European Cooperation in Higher Education Information Systems

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Grenoble, France, 9-11 September 1997

Have a look at the Congress participants

EUNIS 1997

Each reference starts with the letter:

- I for invited talks
- O for oral presentation
- P for poster presentation

Prospective

I/000000 H. Curien, Former Minister of Research, France, "European Cooperation and the role

of the networks"

- I/042501 S. Foster, Chairperson of the board, CAUSE, USA, "Managing the Crisis in Information Technology Support in US Higher Education: Higher Education Associations and Institutional Approaches"
- I052201/0 P. Mederly, EUNIS, Slovakia, "Annual EUNIS report on University Information Systems in Europe"
- I/051501 D. Oblinger, IBM, USA, "The future Compatible Campus"
- I/050701 M. Zastrocky, Gartner Group, USA, "Technology Strategies for Higher Education: A
- Vision for the 21st Century"

1 - From teaching to learning

- I/031101 J. Knop, Germany, "Multimedia Technologies in University Education"
- I/000000 J.M. Laborde, France "Cabri-Geomètre, logiciel d'apprentissage de la geomètrie (Cabri-Geomètre, a teaching tool for geometry learning)"
- I/022501 J. Viteli, Finland, "The Web as an Effective Learning Environment for Universities"
- I/100297 F. Thibault, MTNES, Ministery of Education, France, "La situation des Etablissements d'Enseignement Supérieur en matière de technologies de l'information appliquées à l'Enseignement. Une analyse à partir des contrats d'établissements" (State of the art for
- Information technologies in Higher Education in France. An analysis from the State contracts)
- O/022503 E. Burianova, Czech Republic, "The Forms of Further Teachers' Education at University of Ostrava in the Czech Republic"
- O/032101 J-F. Eritzpokhoff, J. Bourel, P. Wegbrands, France, "Architecture Intranet/Internet au service de la gestion de la scolarité et de la pédagogie" (Intranet/Internet architecture for student management and teaching)
- O/032403 A. Koutoumanos, N. S. Papaspyrou, S. Retalis, C. Sgouropoulou, I. Sgourovassilakis, E. Skordalakis, Greece, "Distance Learning Applications in Banking: The D-Lab Project"
- O/031901 M. P. Lenn, USA, "The Global Alliance for Transnational Education: Transnational Education and the Quality Imperative"
- O/022502 A. Lifshits, Russia "The Scandinavian - Russian partnership in networking and distance learning: next steps"
- O030701 E. Rubio-Royo, A. Ocón-Carreras, M. J. Galán Moreno, Spain, "INNOVA Project:A proposal for fostering electronic teaching and learning based on the WWW"
- O/060501 V. I. Trukhin, A. N. Sandalov, N. A. Sukhareva, Russia "Hypermedia Technology for Lecture Courses: Selection Strategy, Development and Realization"
- P/030501 V.A.Aleschkevitch, N.A.Suhareva, Russia, "Hypermedia-Technology in General Physics lecture courses"
- P030102 C. Froissart, M. Patouillard, France, "Distribution de l'information dans un centre d'informatique pédagogique" (Information distribution in a student computing center)
- P/022807 I.Mirtcheva, Bulgaria, "An approach to teaching Medical Informatics to students in Medicine"

2 - Network information services

- I/000000 J-P. Le Guigner, CRU, France, " Higher Education networking initiative in France"
- I/000000 M. Uzé, RENATER, France "RENATER 2: high performance network (RENATER 2: un réseau à hautes performances)"
- I/062001 Y. Maillaux, G. Tudo, R. Wiest,
- I/062002 G. Young "Table ronde logiciels" (Discussion session: software)
- O/030703 J-M. Adam, G. Coquelle, France, "Administrer un réseau pédagogique sans informaticien : l'expérience "Alta&idiaer;r" (Management of a teaching network without computer specialist: the "Alta&idiaer;r" experience)
- O/031701 A. Binczewski, C. Mazurek, N. Meyer, J. Nabrzyski, S. Niwiñski, M. Stroiñski, Poland, "Information Infrastructure of the Poznañ Science Society"
- O/022701 W R Chisnall, UK. "Applying Risk Analysis Methods to University Systems"
- O/020101 F. Collin, K.B. Su, France "Du DOS à Windows NT : émergence d'une nouvelle génération de stations de travail et de serveurs" (From DOS to Windows NT: the rise of a new generation of workstations and servers)
- O/031401 W. Fitzner, Germany, "Erfahrungen beim Einsatz einer Breitband-Richtfunkverbindung zwischen dem Collegium Polonicum und der Europa-Universit&adiaer;t Viadrina Frankfurt (Oder)"
- O/022804 F. Telbisz, L. Daruhazi, G. Gyori, Z. Onder, O. Pinter, Hungary, "Integrated information infrastructure at the Eotvos Lorand University, Budapest"
- P030304 N. Andronaty, I. Andronaty, Moldova, "The problems of MOLDNET"
- P/022806 N.V.Borisov, Russia, "Regional academic neetwork in St Petersburg: ROKSON NW project"
- P/030104 P. Erdõsi, G. Terdik, Hungary, "An analysis of the e-mail traffic by a server called TIGRIS.KLTE.HU"
- P/022810 C.Gaindric, G.Secrieru, Moldova, "AMNET: experience of utilization for investigation and training in Moldova"
- P/032402 L. Matyska, Czech Republic "TEN-34 CZ-- High Speed ATM Network at Czech Republic"
- P/022805 V. Sidorenco, Moldova, "TUM-Net: an Internet/Intranet Project"

3 - Delivery of information

- I/032102 G. Dulac, France, "Grenoble Network Initiative (GNI): an environment for the development of Information Technologies and Communication"
- I/091501 H. Flack, Switzerland, "The Electronic PublicationPolicy at the International Union of Crystallography"
- I/031002 P. Kytomaki, Finland, "The electronic Library"
- I/102302 R. Rivoire, AMEU, France, "Uniweb : un système d'information national pour les étudiants sur le Web (Uniweb : National information system on the Web for students)"
- I/091701 J. Voiron, France, "La bibliothéque virtuelle de l'IMAG" (IMAG virtual library)"
- O/030101 T. Sonkkila, Finland, "SGML-based publishing as a joint effort"
- O030302 D. Keraite, Lithuania, "Vilnius University Library Automated System - Change to modern technology. General situation"
- O/042101 M.J. Clark, UK, "Information delivery - the convergence agenda"

4 - Management Information Systems

- I/102301 A. Abecassis, AMUE, France, "Politique de mutualisation de l'informatique de gestion et modernisation : l'expérience des universités françaises (Joint venture for management
- information systems: the french experience)"
- I/021801 S. Berglund, E. Lauritzen, Sweden "Computer based functions for advanced student services"
- I/000000 J. Bielec, USA, "Issues in College and University Information Technology"
- O/022811 Irmantas Aleliunas, Lithuania, "System Development for Higher Education and Research Assessors Selection"
- O/031001 U. Kammerer, Germany, "i3vreg. - education. An approach for an integrated university information system"
- O/022813 P. Lundberg, S. Gustafsson, Sweden, "Ping - an electronic interface for the Swedish universities"
- O/022808 R. Marty, J. Xech, France, "Vers un management assisté par réseau " (Towards a network assisted managment)
- O/052202 T. A. Reid, UK, "Preservation of the Electronic Assets of a University"
- O/022802 D. Stevenson, Australia, "Data Warehouses and Executive Information Systems - Ignoring the Hype"
- O/050601 J. Towsend, UK, "Managing Information for Management"
- O030303 I. Vrana, Czech Republic, "Implementation of University Information Systems"
- O/022812 L. Wilkin,J. Moriau, Belgium, "Construire les usages: dynamiques d'usages des applications télématiques dans les unités de recherche scientifiques" (Dynamics of use of network applications in scientific Research Units)
- P/022809 R. Rupnik, M. Bajec, M. Krisper Slovenia, "Information System for Application Procedure for Registration in Higher Education in Slovenia"
- P/022702 S. Martisius, Lithuania "Computer based system for students admission and student records information system at the Lithuanian University of Agriculture"

5 - Changing role of computer centres

- I/071501 V. Alessandrini, IDRIS, CNRS, France, "Trendsin High Performance Computing"
- O/022303 H. Bondars, M. Treimanis, Latvia, "Development of Information Technology in University of Latvia, (State of the Art and Projects)"
- O/022304 A.Cote, P.Gris, JJ.Pansiot, P.Guterl, France "Les divers aspects de l'administration de réseau, exemple du réseau OSIRIS" (The different faces of the administration of a network: the example of OSIRIS network)
- O/022302 P.Guterl, S.Behr, R.Biechel, I.Combes, A.Cote, S.Gillmeth, P.Gris, S.Ley, M.Mayer, F.Ostre, JJ.Pansiot, France "Organisation d'un centre de réseau pour le support technique aux utilisateurs" (Organisation of the service for users technical support)
- O/022101 G. Jean-François, France, "Les CRIs face aux nouveaux moyens de traitement de l'informations (Information services and new technologies"
- O/022703 V. Mahnic, Slovenia, "Towards the re-integration of the University of Ljubljana information system"
- O/032401 L. Matyska, E. Hladká, Czech Republic, "META Center, a distributed computing center of the future?"
- O/043001 A. Rothery, A. Hughes, UK "Information strategy - a tool for institutional change"
- P/030103 Z. Gál, I. Rápolti, K. Rutkovszky, G, Terdik, Hungary, "Role of the computer center in migration to Information Society: A case study at Kossuth University of Debrecen"
- P/040101 L. M. Ribeiro, G. David, A. Azevedo, J. C. Marques dos Santos, Portugal, "Developing an Information System at the Engineering Faculty of Porto University"

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

EUNIS97, Grenoble (France) 9-11 September 1997 (Ref: 042501)

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Managing the Crisis in Information Technology Support in US Higher Education

Susan J. Foster

Environmental screening is essential to strategic planning. It is incumbent upon information resource professionals, particularly those in management and leadership positions, to scan their environment regularly. Part of the CAUSE mission--and the deliberations of the Board of Directors--is to aid that process.

It is instructive to look at the environmental factors identified by the Board last year and set out in the November 1996 CAUSE Strategic Plan, and compare them to the factors that were discussed by the Board in March. Less than a year ago there were six:

- information technology organizations in a state of siege;pressures to reflect an increasingly diverse society;
- survival through institutional cooperation;
- extra-institutional pressures for accountability and for access to affordable, quality education;
- burgeoning ethical and legal issues raised by networked information publication and use, as well as the behavior of network users;
- and the effects on and influences on scholarly communication using electronic media.

Another essential ingredient of strategic planning is awareness and acknowledgment of the emotional climate in which we do our scanning. When we looked a year ago, we were overwhelmed by what we saw and what we were experiencing. I am especially struck by the use of words such as "survival" and "siege." It tells us that a year ago, and perhaps for longer, many of us felt besieged: threatened, defensive, possibly even frozen in place, only just coping, not very hopeful, out of control. As a result, our view was profession centric.

Newly Identified Environmental Factors

This year, in March, the CAUSE Board looked again and this time identified four factors:

(1) It is higher education that is under pressure for accountability, affordability, access, diversity, productivity, service (especially to K-12 educational reform), and seeking shared solutions. These are not the sole province of information resources management. We have allies, both within our institutions and among them, who are also searching for partners with whom to share the load and the solutions.

(2) We recognize that our traditional technology support infrastructure is no longer adequate nor scaleable to meet expectations for change. Scalability requires partnering, inclusiveness, malleability of boundaries.

(3) The barriers to making full use of information resources have shifted. Technology is no longer the limiting factor. Now, more often than not, institutional culture and practice are the inhibitors or catalysts for change.

(4) The last factor is the cycle of infusion and diffusion of information resources that, at the national level, has led associations whose focus has been on discrete constituencies to discover their common agendas and seek greater coherence. On our campuses, various constituencies are discovering issues related to information, with varying levels of understanding of their complexity and common elements.

Clearly our outlook has changed. A year ago we saw ourselves potentially at the mercy of our environment. Now we know that not only can we be actors upon it, but we are an integral part of the whole from which strength and progress can emerge.

There is no one path forward. Institutions will find or adopt those ways that use their strengths and valued attributes. Collaboration will provide for those needs that only scale can achieve.

We are on the threshold of unprecedented diversity in institutions and educational models for which information technologies are a diverse and strategic resource.

Vice President for Information Technologies,
University of Delaware, USA
Current Chair of the CAUSE Board of Directors
E-mail: sfoster@UDel.Edu

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Annual EUNIS Report on University Information Systems in Europe

Peter Mederly

1. Introduction

At EUNIS'96 Conference in Manchester we made an attempt to characterize the state of university information systems in Central and Eastern Europe. Because there were no statistics available in this area, we made a questionnaire containing questions asking for basic information about the state of computing equipment for education, research and management as well as about the state of information system. We sent this questionnaire to deans of 40 faculties of science, mathematics&physics, and electrical engineering of 40 universities in 14 countries of Central and Eastern Europe. We received answers from 15 faculties of 15 universities in 7 countries. We processed the answers and presented them in Manchester. The complete results can be found in [1].

After the presentation we were asked to try to extend this overview by adding data from more universities. To accomplish this, we chose again the form of inquiry. This time we did not limit ourselves to universities in Central and Eastern Europe but we sent the questionnaires to some Western European universities too. We used three channels: the listserver EUNIS, the list of academic officials that took part at the annual conference of deans of science in Paris in 1996, and we turned also to contact persons at Central European universities taking part in the world-wide ACM International Collegiate Programming Contest. The reason why we took just these channels was simple: we wanted to address people that we had already some contacts with before and in this way to increase the probability that we would get the questionnaires back.

Using experiences from the previous inquiry, to make answering of the questionnaire easier we left out some questions more demanding for collecting of data (e.g. questions about number of computers and operating systems used for education and research as well as the questions about technicalities of the network infrastructure). In spite of their importance, we did not included, similarly as before, the sensitive questions about financial issues and we also promised that we would not present the names of single universities in connection with the presented data. On the other hand, this time we left the liberty to answer for the whole university or for a single faculty (last time we concentrated on faculties).

So the questionnaire was a subset of the questionnaire used in the inquiry for Manchester conference. Our main goal now was to concentrate on applications used in the university information systems.

The questionnaires were sent by e-mail and we got back 18 ones from 11 countries. 17 questionnaires contained data at the university level and 1 contained data at the faculty level. 8 of these questionnaires came from 5 Western European countries and the remaining 10 came from 6 countries of Central and Eastern Europe. We did not send again the questionnaires to the universities we successfully addressed with questionnaires for Manchester because we considered the time interval 6 months as being not so essential from the point of view followed in this contribution (except Slovak universities where we completed data from faculty to university level).

After summarizing answers to both inquiries and after omitting some very poorly filled up questionnaires we can state that we have data from 29 universities in 15 countries. The majority of data about information system concerns the university level (24), the rest concerns the faculty level (5).

2. Results of the Inquiry

We will now successively present an overview of the collected results with some comments. According to what we have promised in the inquiry, we will not present the names of single universities.

The questionnaire contained 3 parts:

1. Basic information about the university.
2. A short characterization of the university network.
3. Basic information about the applications used within the information system of the university.

In the first part we asked about the name of the university, number of its students, the name of the organization unit(s) responsible at the university for academic and/or administrative computing services, and the number of full-time staff positions in this organization unit(s).

In the second part we were interested in the accessibility of the university network (options: A - the university network is accessible (installed) in almost each room, B - the network does not cover the whole university but almost each organizational unit has at least one computer connected to the network, C - the network does not exist), the number of computers connected to the university network, and whether there is an Internet connection at the university.

The main results of the first two parts of the questionnaire are summarized in Table 1. Individual columns of the table contain: a symbolic name of the university (we have promised not to disclose the full names), country, number of students. In the fourth column, there is the number of full-time positions in the organization unit(s) responsible at the university for academic and/or administrative computing services. If the university declared just one such unit, one number is presented. If it declared separate units for academic computing and administrative computing, two numbers marked by (Ac/Ad) are presented. In two cases universities declared just the unit for administrative computing - in these cases the number of positions of these units is followed by an (Ad) remark. The fifth column contains the characterization of the university computer network in terms of above options. The number of computers connected to the network is in the last column. If a position in the table is blank, it means we have not got corresponding data. The data marked with * concerns faculty level.

All universities that responded to the questionnaire have Internet access.

Some remarks about the data presented in Table 1:

- Universities of different size - from 2 500 to 60 000 students - took part in the inquiry.
- Each university has a central unit(s) taking care about academic and/or administrative computing services. But the numbers of full-time positions in these units are considerably different. Also the organization differs. 6 universities (21%) have separate units for academic and for administrative computing. The rest has at university level one computing center for both types of services with number of positions ranging from 3 to 100. This fact alone may considerably influence the situation in the use of information technologies at the universities.

Table 1

Basic information about universities and their networks

University	***Country***	***Number of students***	***Number of positions in CS unit(s)***	***Network accessibility***	***Number of computers***
U1	Austria	23 000	56/10 (Ac/Ad)		2 500
U2	Finland	6 000	15/7 (Ac/Ad)		2 500
U3	France	60 000	40		10 000
U4	GB	12 700	75		3 900
U5	GB	17 000	12 (Ad)		
U6	GB	18 000	20 (Ad)		
U7	Ireland	11 000	53		2 500
U8	Ireland	8 500	25		1 350
U9	Czech	6 000			1 500
U10	Czech	15 000	45/5 (Ac/Ad)		2 000
U11	Croatia	50 000; 1 000 *	60	A *	70 *
U12	Estonia	8 100	25		1 000
U13	Hungary	6 000; 2 500 *	30	A *	220 *
U14	Lithuania	10 000	125/13 (Ac/Ad)		500
U15	Lithuania	10 000	100		300
U16	Lithuania	4 500			200
U17	Poland	45 000	79		
U18	Poland	20 000;1 300 *	5 *	A *	480 *
U19	Slovakia	8 300	68		1 000
U20	Slovakia	20 000	20		2 000
U21	Slovakia	5 500	11		200

U22	Slovakia	2 500	18		170
U23	Slovakia	3 500	26		600
U24	Slovakia	11 500	43		750
U25	Slovakia	4 000	11		500
U26	Slovakia	15 000	63		2 500
U27	Slovenia	14 000	17		2 000
U28	Slovenia	2 450 *	3 *	A *	700 *
U29	Slovenia	30 000; 700 *	3 *	A *	120 *

** data concerns faculty level*

- At 21 universities (72%), the university network is accessible in almost each room. At the remaining 8 universities (28%) the network does not cover the whole university but almost each organizational unit has at least one computer connected to the network.
- The biggest university network has 10 000 computers connected, the smallest has 170. The rough ratio number of students / number of computers in university network varies from 2,4 to 33.

The third part of the questionnaire dealt with university information systems. With regard to EUNIS mission, we can consider this part the most important.

The first question of this part was whether the university has centrally maintained WWW system. All but one responses were YES.

Further we listed most common applications usually used at universities. The applications were divided into several areas:

- Financial and personal information: Accounting, Operative financial records (orders, invoices ...), Equipment records (inventory), Personal records, Salaries.
- Student information: Personal records of students, Admission process, Study records, Dormitories, Financial aid, Schedules.
- Library: On-line catalogue, Acquisition, Catalogue, Loan services.
- Science, research and international relations: Publications, Research projects, Visits abroad, Foreign guests.

There was also place for presentation of other applications used at the university. For each application we asked for the following information:

- Operation environment: hardware and operating system.
- Network operating system if the application runs in network environment.
- The source of application. Options: I - developed in-house, S - bought as a standard application, D - developed by an external partner, O - other.
- Implementation environment.

We were aware that the structure of applications at different universities need not be exactly as presented in the questionnaire but we expected that people would look at the list more from the functional point of view. It turned out that in general this assumption was satisfied.

An overview of responses to this part of the questionnaire is in Table 2. The first three columns of the table contain the name of the area, the name of the application, and the total number of applications that appeared in the questionnaires. Next five columns contain data about operating systems used for the application. The headers of columns are self-explaining, O stands for "other". Next two columns say how many implementations of the application are running is network environment (N) and how many as standalone (S/A). Unfortunately, incompleteness of the answers has not enabled us to make a more detailed classification of the network operating systems used. Columns headed I, S, D, O (which stand for single options described above) contain figures about the source of the application. The last section of the table is devoted to implementation environment. Individual column headers have the meaning as follows: DBF - implemented in Clipper, FoxPro, or DBase. Or - implemented in Oracle. 3GL - implemented in a 3GL language such as COBOL, C, FORTRAN, Pascal. IIP - implemented in Informix, Ingres or Progress. Off - implemented in MS Office. O - implemented in other environments. U - implementation environment unreported.

Table 2
Overview of information about applications

Area	*Application*	*# of*	*Operation environment*					*Network*		*Source*				*Implementation environment*						
		Appl.	*DOS*	*UNIX*	*VMS*	*Win*	*O*	*N*	*S/A*	*I*	*S*	*D*	*O*	*DBF*	*Or*	*3GL*	*IIP*	*Off*	*O*	*U*
Financial	*Accounting*	29	16	5	4	3	1	20	9	10	13	5	1	14	4	5	2	1	1	2
and	*Operative Financial Records*	24	14	4	2	3	1	16	8	12	6	5	1	14	2	3	2	2	0	1

Personal	*Inventory*	22	15	4	2	1	0	11	11	14	4	4	0	15	3	2	1	1	0	0
Information	*Personal Records*	27	17	4	5	1	0	21	6	14	8	5	0	14	5	2	2	0	3	1
	Salaries	27	16	4	3	1	3	21	6	9	10	7	1	15	4	2	3	0	1	2
	Total for the area	***129***	***78***	***21***	***16***	***9***	***5***	***89***	***40***	***59***	***41***	***26***	***3***	***72***	***18***	***14***	***10***	***4***	***5***	***6***
Student	*Personal Records of Students*	28	14	8	3	2	1	22	6	22	1	5	0	15	6	2	2	0	2	1
Information	*Admission Process*	24	14	5	2	2	1	19	5	21	0	3	0	16	4	1	1	0	2	0
	Study Records	22	11	6	1	3	1	18	4	19	0	3	0	12	5	1	1	1	2	0
	Dormitories	15	8	3	3	1	0	11	4	12	1	2	0	7	4	1	1	1	1	0
	Financial Aid	13	8	2	1	1	1	8	5	10	1	2	0	9	2	0	0	0	1	1
	Schedules	16	11	1	2	2	0	5	11	13	2	1	0	8	2	4	0	0	0	2
	Total for the area	***118***	***66***	***25***	***12***	***11***	***4***	***83***	***35***	***97***	***5***	***16***	***0***	***67***	***23***	***9***	***5***	***2***	***8***	***4***

Table 2 (cont'd)
Overview of information about applications

Area	***Application***	***# of***	***Operation environment***					***Network***		***Source***				***Implementation environment***						
		Appl.	***DOS***	***UNIX***	***VMS***	***Win***	***O***	***N***	***S/A***	***I***	***S***	***D***	***O***	***DBF***	***Or***	***3GL***	***IIP***	***Off***	***O***	***U***
Library	*On-line Catalogue*	20	1	9	4	1	5	20	0	4	8	5	3	0	1	2	2	0	8	7
Information	*Acquisition*	16	4	7	2	1	2	15	1	5	6	3	2	3	0	0	2	0	5	6
	Catalogue	25	6	10	3	1	5	23	2	8	9	5	3	3	1	1	3	0	10	7
	Loan Services	16	2	8	3	1	2	16	0	2	8	4	2	2	0	1	2	0	6	5
	Total for the area	***77***	***13***	***34***	***12***	***4***	***14***	***74***	***3***	***19***	***31***	***17***	***10***	***8***	***2***	***4***	***9***	***0***	***29***	***25***
Science,	*Publications*	13	6	4	3	0	0	10	3	8	3	2	0	4	2	1	0	0	4	2
Research,	*Research Projects*	8	4	2	2	0	0	5	3	5	0	3	0	4	2	1	0	0	0	1
International	*Visits Abroad*	7	6	1	0	0	0	3	4	6	0	1	0	5	1	1	0	0	0	0
Relations	*Foreign Guests*	4	3	1	0	0	0	2	2	3	0	1	0	3	1	0	0	0	0	0
	Total for the area	***32***	***19***	***8***	***5***	***0***	***0***	***20***	***12***	***22***	***3***	***7***	***0***	***16***	***6***	***3***	***0***	***0***	***4***	***3***
	Total for all applications	***356***	***176***	***88***	***45***	***24***	***23***	***266***	***90***	***197***	***80***	***66***	***13***	***163***	***49***	***30***	***24***	***6***	***46***	***38***

Some remarks on the data in Table 2

- We have got information about 356 implementations of applications in total. If we look at the data collected in the individual areas we can see that the most numerous are applications in the financial and personal area (124) and in the student information area (118). The smallest number of applications is in the area of science, research, and international relations (32). As for libraries, 77 application were presented but it turned out again that library systems form relatively independent part of university information systems. It is clear that almost all universities have some software for libraries but in several questionnaires people presented no information about library software and even if they presented, they were not able to provide complete information.
- Let's concentrate now on the most important areas, i.e. financial and personal information area and student information area. As for operation environment, network, and implementation environment, there are no considerable differences between them. In operation environment we can still see the clearly leading position of MS-DOS (61% and 57%, respectively) followed by UNIX (16% and 21%) and OpenVMS (12% and 10%). Windows systems (7% and 9%) are still relatively behind. Concerning network vs. standalone environment, about 3/4 of implementations are networked (terminal-host implementations we also considered as networked). As for implementation environment, the most frequent implementation tools are Clipper, FoxPro, and still also some DBase (55% and 57%), second place is for Oracle (14% and 19%), then there are 3GL (mainly COBOL) applications (11% and 8%). Other well-known database systems Informix, Ingres and Progress have together the next place (8% and 4%). After other (4% and 7%) and unknown (5% and 3%) implementation environment at the very end there is MS-Office (3% and 2%).
- The equilibrium between the two areas is broken when we compare where the universities got their application from. While for financial and personal information area the figures are the following: developed in-house 46%, purchased as standard products 32%, and developed for the university by external company 20%, for student information as much as 82% of implementations have been developed in-house. 14% come from external companies and just 4% have been purchased as standard applications. The visualization of these facts is in Fig. 1 - 4.
- It would be interesting to compare the situation between western and eastern universities. Unfortunately we have just 8 western universities participating in the inquiry so we cannot make deeper conclusions. Nevertheless, if we take the data from these universities and compare them with the data from eastern universities we can see some clear differences. At western universities, there is:
  - much less applications in DOS environment,
  - much less standalone applications,
  - much more applications in Oracle and in COBOL,
  - relatively less in-house developed applications and more applications bought as standard products,

  comparing with eastern universities.

In the third part of the questionnaire we also asked which applications do share common data and whether the sharing is on-line or off-line. Next question was about the methodology used for in-house application development and the last question was: what is the expected development in the area of university information system at the university in the next three years. Options: A - IS will be maintained mostly at the current level with inevitable changes of existing applications, B - IS will be enhanced by adding further applications. Existing applications will be maintained and inevitable changes of them will be made, C - A development of a new IS will be started.

Fig.1 - Operating environment

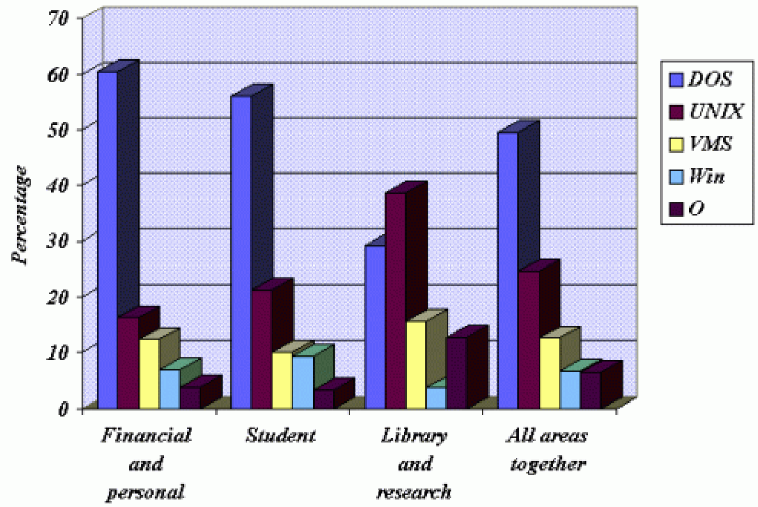


Fig. 2 - Network environment

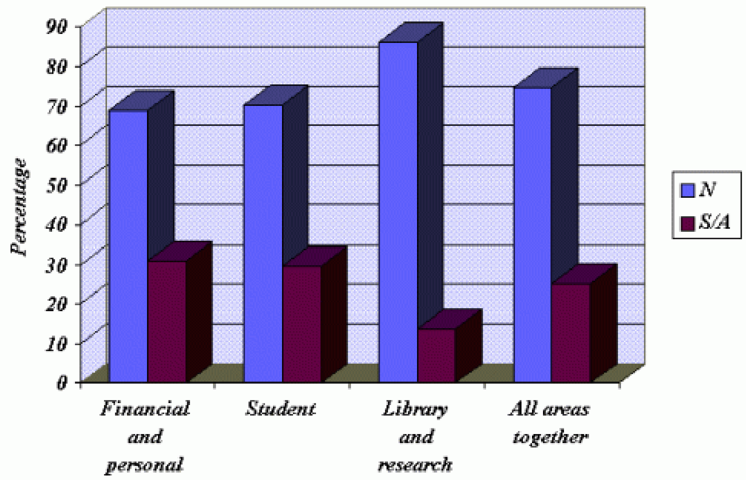
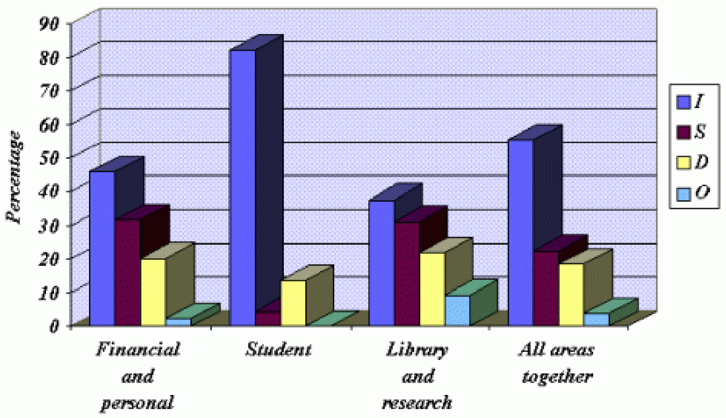
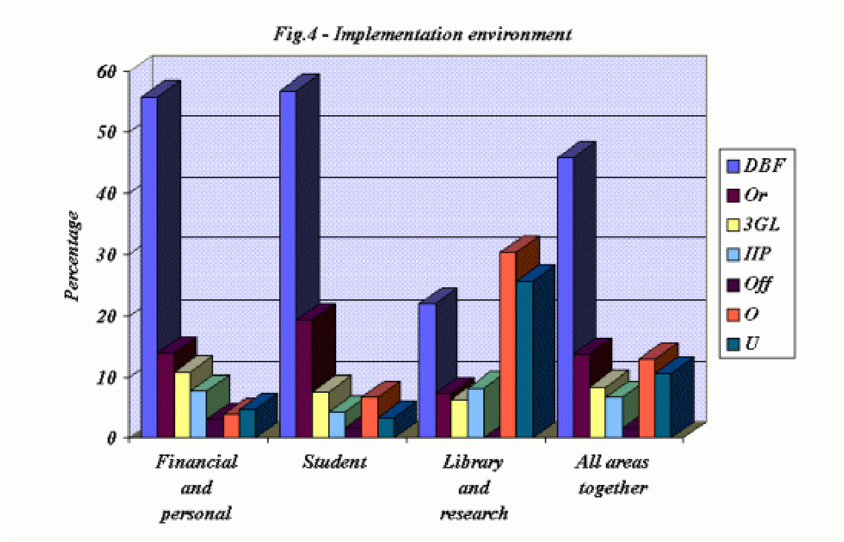


Fig.3 - Source of applications





The results of this part of the inquiry could be summarized as follows:

- The question about the sharing of data was formulated rather freely. From the answers we can estimatethat at 8 universities (28%) the data among applications are shared to large extent, at 10 universities (34%) we can speak about some sharing of data (typically within individual areas of applications), at 4 universities (14%) there is no sharing of data and the remaining 7 universities (24%) did not answer the question.
- Although all but two universities (94%) developed at least one of their applications in-house, only 7 universities (24%) declared the use of a development methodology. 4 of these 7 universities are western ones.
- As for the expected development of the university information system within the next three years, 17 universities (59%) suppose that the development of the new IS will be started (option C), 11 universities (38%) expect that their current IS will just be enhanced by adding further applications (option B), and just 1 university is satisfied with its information system and expects that its IS will be maintained mostly at the current level with inevitable changes of existing applications (option A). At western universities, option B prevails over C (5 and 3), at eastern universities option B has much smaller frequency than C (6 and 14).

3. Closing remarks

In the end of this contribution we want to accent our awareness of the fact that the inquiry we have obtained data from cannot be considered large and representative enough, and therefore we cannot make very deep and indisputable conclusions from it. Nevertheless, it has confirmed some facts and problems known to people working in university information systems area, the facts and problems that led to the establishment of national and international organizations for co-operation among universities in this area. If we had to say more concretely what could be a real contribution of this inquiry, we would formulate it perhaps like this:

1. The inquiry has brought the first, although incomplete, picture of the state of university information systems around Eastern and partly Western Europe (at least in EUNIS environment).
2. The inquiry has shown that many universities want to start the development of new information system for themselves in near future.
3. At the same time it turned out that in spite of the fact that many applications are developed in-house, this development is done without any standard or nonstandard methodology.
4. The inquiry has also shown that it has already appeared examples of good integrated university information systems.
5. Two rounds of the inquiry brought first experiences with such kind of activities. It would be worth to think over whether EUNIS should not make such an inquiry, properly modified, a regular part of its activity. This activity could lead to a permanent database of information about university information systems in Europe.

4. References

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Comenius University,
Bratislava, Slovakia
E-mail: mederly(at)fmph.uniba.sk

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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The Future Compatible Campus: Global Education in the 21st Century

Diana Oblinger

The year 2000 is less than 1,000 days away. How will we create the future compatible campus when the 21st century is almost upon us? Change seems to be occurring at an ever increasing rate.

Many of the reasons for this rapid pace of change relate to information technology. The volume of new information is increasing at such a rapid pace that the class of 2000 will be exposed to more new data in a year than their grandparents encountered in a lifetime. The evidence of the information explosion is all around us.

- Ten thousand scientific articles are published every day (Forman, 1995).
- Ninety percent of all scientists who have ever lived are alive today (Prusak, unpublished).
- Beginning in 1907, the Chemical Abstracts Society took 31 years to accumulate its first million abstracts; the next million took 18 years, and the most recent took 1.75. More articles have been published on chemistry in the last two years than all of recorded history before 1900. (Noam, 1995)
- As of May 1996, there were more than 33 million articles and web pages. It would take over five years to read just the new listings added each month (Van Alstyne, 1996). Even so, only 1% of the world's recorded knowledge is available on the Internet.
- Predictions are that by the year 2020, knowledge will double every 73 days.

One of the defining trends of the future will be the rate of change. In fact, for the first time in the history of higher education, the ability to manage change is becoming a competitive differentiator.

"Many feel that traditional self-contained, time-delimited "degree" programs may have increasingly limited use in a world where information and skills become quickly obsolete. Education has already become a lifetime process and with the advent of a "virtual" university comes the possibility of providing the learning people need, when they need it, wherever they happen to be.

"We must move beyond the idea that any particular model of education is sacrosanct and concentrate on the content and results of that education. Success as a "lifetime" university will mean the creation of a much more flexible and adaptive education. `Just-in-time' courses will need to respond to the diverse and shifting needs of emerging careers, developing social problems, and opening areas of knowledge. Some classes may need to be available in modules so that students can choose the parts they need to know." (Duderstadt, 1996).

There are other indicators of the rate of change. Microprocessor performance has been increasing at a relatively constant rate, doubling approximately every 18 months. This trend is expected to continue. Its impact, however, is a perceived time compression which will cause changes in business, education, entertainment and daily life.

A steady rate of growth (2x per period of time, as in 2, 4, 8, 16, 32....) will yield progressively larger increments of growth as the rate continues. The result is that it takes less time to cover the same increment of technological improvement as time goes on. This is perceived as less time; it stresses our established models.

The result is that we sense a breathless pace of change. The impact is felt on organizations, as well. Asset volatility is high. Neither organizations or individuals can purchase the "right" machine. As soon as it is bought, it is out of date. No one can keep up with the current version of the software. Organizations are spending enormous energy, time and money churning hardware and software in an attempt to stay current. In spite of large investments, institutions find themselves with two or three levels of technology that are now obsolete, but which they cannot afford to discard.

Add to this scenario the fact that these changes are dwarfed by what we believe will happen in network bandwidth. Expect changes on the order of 800 to 1,000 times in bandwidth (Tuller, 1997). To put this into perspective, it is possible to transmit close to 1.2 GB (gigabits) of information over a network with current capabilities. This is roughly equivalent to 85 books or 39,000 pages of text per second. Such transmission speeds also support scientific visualization. Compare this to the capabilities available in 1989 when transmission speeds enabled a mere two pages per second to be sent across a network (Hulser, 1997).

SCENARIOS

Most of us predict the future based on the past. Instead, let's begin our glimpse of the future with scenarios of what is really represents the present and what will be the probable future.

Age 15. The term papers in this course are web-based. The students have grown up thinking and composing in hypertext. "Technology" is as natural to them as a household appliance. A student has an aunt who lives in Ireland. She just began a job processing insurance forms for a US company. The firm moved its operation from America to Ireland to take advantage of the high literacy rate and competitive wages.

Age 16. A student is preparing for college entry. He/she uses CollegeNet to browse information on colleges of interest and receives periodic "counseling" updates such as reminders to begin preparing for college entrance exams and to develop a savings plan for college. These same students routinely correspond with pen pals from around the world. Getting connected and staying connected is taken for granted. This is the first generation for which the world is their "neighborhood."

Age 17. Students participate in Project FeederWatch on the World Wide Web. Not only are they able to research questions using the online database, but they contribute to a research which spans North America. The project from Cornell University's Laboratory of Ornithology is founded on the concept that scientific literacy can be improved by involving the public and school children in scientific research. A student later learns that a Korean firm has bought out his father's company. Mergers and acquisitions are changing the face of business.

Age 18. Students are taking a college course--at a distance--to get an early start on college credits. One 12th grader has a pen pal in India. Her father is working on a global software project--the project moves across three continents (where each one is a work shift) every 24 hours.

Freshman year. A college freshman uses information technology for a history course, utilizing historic archives that are in digital format on the Internet. At the same time that the student hears FDR's radio broadcast declaring war on Japan, he/she is able to read along from his notes. Access to the original material is more motivating and memorable than just reading from a textbook.

Sophomore year. A sophomore is studying music appreciation. However, instead of all the content being provided by the professor, students learn the fundamentals then are provided with a music analysis tool. Their assignment is to select a piece of music, analyze it and present it to the class. The students must teach each other.

Junior year. A junior is working on a team, selecting problems in a kinematics class. Applying principles from engineering and physics, the team collects data, analyzes the problem and reports the results on the web. The students find it motivating to be able to select their own problems and for their work to be shared with others.

Senior year. A senior is solving a microbiology problem. There has been an outbreak of food poisoning. The assignment is to identify the pathogen, find its origin and recommend corrective action. Lab tests are performed and analyses are made. Feedback is instantaneous. Information from multiple courses must be integrated.

Adult learner. An adult is studying for a new career in auto mechanics. Prior learning is assessed using a pre-test. Content for the course is delivered using video, text and audio in an integrated environment where tools such as a glossary are easily accessed. The learner is able to study on a flexible schedule.

There is an increasing body of evidence that technology, when well utilized, will lead to improved student achievement. More important than improving current educational practices, technology provides an opportunity to achieve results that have not previously been possible; to find entirely new approaches to teaching and learning; to reach students who have been immune to current strategies; to teach new, higher order skills; and to reinvent education (Verville, 1997).

THE LEARNING ENVIRONMENT

Whether describing the present or the future, information technology will play a role. One of the great values of technology is that it expands our options. Hundreds of years ago, the lecture was designed as a surrogate to direct access to scholarly information. When books were a rare commodity, the closest students were able to come to authentic information was the lecture. Today our options range from original archives to digital books to three-dimensional representations which move about the world at the speed of light. If you ask the question, "Why do we teach the way we do?" the answer is often that we didn't know there were other options. This no longer needs to be true. With what we know about cognition, technology and communication, we now have the richest collection of educational options available in centuries.

It is not just the medium that is changing. We are in the process of shifting what it means to be literate from the memory base of knowledge acquisition to knowing how to find and use channels of information. Knowing how to learn is more important than the facts accumulated (Adams, Carlson and Hamm, 1990).

The brief scenarios on the previous pages provide a glimpse of education as we approach the 21st century. The learning environment of the future will continue to incorporate information technology (IT). The functional characteristics of IT, coupled with a better understanding of cognition, will lead to the development of learning environments that are authentic, interactive, equitable, sensory, modular, global and network-based.

- Authentic: Information technology allows us to bring students as close to the real experience as possible. Students can travel back in time to FDR's "Day in Infamy" speech. They can experience the pain and struggle of Dax Cowart. This access to authentic information--the original source material of scholars--brings students closer to the level of scholarship that faculty experience. It is through working with authentic material, coupled with learning the "way of thinking" of a particular scholarly community, that students enhance their learning.
- Interactive: Passivity has given way to interactivity. It is well recognized that the greater the interaction--student-to-student, student-to-professor or student-to-information--the greater the learning. The value of technology to education is partially encapsulated in the phrase "getting connected." "Connections are not just to information, but to other students, instructors and experts. Networks offer learners and teachers access to new ideas, perspectives, cultures and information--enriching locally available resources" (Harasim et al, 1995).

Students can easily interact with their fellow classmates, regardless of the fact that they may be spread across the country or the world. Although the face-to-face method may be the most efficient form of communication, such meetings do not occur very often (or at all when classmates span the globe). Said another way, the communication bandwidth peaks during face-to-face sessions and falls to zero in between traditional class sessions. Networked communications allows students to communicate 24 hours a day, seven days a week (i.e., asynchronously). The result is that, averaged over several hours, the effective bandwidth for asynchronous communication can be much higher than face-to face communication (Mayadas, 1997).

Another element that is different for students in on-line classes is the opportunity to learn from each other--to see the work of others and to compare their ideas with those of their classmates. Students learn not only from their own work, but they can learn from everyone else. By its very nature, this kind of on-line environment encourages collaboration and group interaction (Kearlsey et al, 1995).

- Equitable. Delivery of education through a collaborative, computer-mediated environment alters the relationship of the instructor, the students, and the course content. The many-to-many, asynchronous nature of the medium "democratizes" access and encourages student input (Harasim, 1991). In fact, studies are showing that students feel they have more access to the professor than they did in traditional, lecture courses as well as more interaction with other students.
- Sensory: Digitization has allowed us to effectively create a common, worldwide "language" with which to communicate. Virtually everything can be translated into a common currency of bits and bytes. The significance of digitized information is that the conversion of text, graphics, images and video into bits provides information with a digital passport to travel across global networks. Powerful new communications technologies are giving networks the bandwidth needed to handle rich but space-consuming content like video, MRI scans or great works of art. Networks are developing the speed to support interaction, enabling two-way communication and collaboration. Together, digital content and high-speed networks allow us to create "microworlds" that create sensory experiences that are much most motivating and memorable than text alone.
- Modular: It will become increasingly common for institutions to share courses, modules and curricula. The expectation that every faculty member create his or her own unique course will be replaced by a model of mass customization. Courses will be built of modules that can be "snapped" together to create unique combinations, individualizing and personalizing instruction. Few faculty will develop their own digital course materials from scratch; most will use component material directly or tailor it. This will facilitate more rapid response to the needs of learners whether the goal is completing a standard degree program or acquiring a skill related to a specific job or career.
- Global: Knowledge knows no boundaries. Education without a cultural frame of reference limits its value. The ability to use language ,interact and work productively with people from other cultures are skills that will be embedded in courses. Global systems are represented in the 21st century curriculum. These systems affect the quality of life as exchange rates raise and lower the price of goods and as pollution and public health problems trascend national boundaries (ACE, 1995).
- Network-based: The network--the global information infrastructure--allows learners to access resources anywhere at any time. Both students and instructors can share ideas, concerns and solutions with peers--no matter where they are--as easily as if they were in the next room. It also allows for nearly instantaneous updating of information. Because knowledge is distributed, communities of learners come together and disperse based on needs and interests, not solely on geography.

Technology is helping higher education execute the social obligation with which it is invested. Education is seen as the key to social and economic progress. Network technology is allowing us to establish education as the centerpiece of community and global networks. This extension of the benefits of education to the community-- to women, minorities, the elderly as well as underprivileged children-- will enable us to facilitate the development of learning communities that transcend the traditional boundaries of education.

In the 21st century university, our options will be expanded. Communication, computing and networking technologies extend the reach and range of traditional residential colleges and universities, enabling students to synthesize on-campus with on-line experiences. Some learners seek a mixture of face-to-face experiences and network-based education. For example, the on-campus student who wishes a more individualized, self-paced, self-directed learning experience can achieve that desire through technology. With a goal of reducing the time to degree, students may choose to complete courses in residence while simultaneously fulfilling other graduation requirements on-line. The network expands options for interaction among faculty and students. External experts are more easily accessed; opportunities for faculty to individualize and personalize contact with students is increased (Oblinger, 1997).

We see an immense opportunity to establish forms of electronic-based collaboration--from the student level to the institutional level--that can bring about major improvements in both access and learning, while meeting the legitimate public and institutional concerns about cost and quality. This is not to suggest that technology-based learning should replace traditional pedagogy; this is not an either/or proposition. Computer-assisted, self-directed, electronically-mediated learning will work for some institutions but not for others, for students in some fields, but not for all students in all fields (Mingle, 1995). As institutions move toward the creation of their campus of the future and a learning continuum that spans birth to death, it will be important to understand the nuances of where networked learning is the most appropriate alternative or supplement to traditional residential education, and how it can best be implemented.

TRENDS TO WATCH

Although no one can accurately predict the future, identifying the trends to watch is critical as we anticipate the form and function of our future institutions. We believe the defining trends of the 21st century will be:

- Technology
- Globalization
- Complexity
- Demographics
- Linkage between education and economics

Technology

To put information technology into perspective, consider a few facts.

- In 1995, Americans spent more on PCs than on televisions
- If you drive a Ford Taurus (or a Mondeo) today, it has more computing power than the first lunar landing module
- In 1985, the most expensive car in the US was the Cadillac. It cost $17,000, got 12 miles to the gallon and weighed over one ton. If the auto industry operated on the same technology trajectory as the computer industry, today's Cadillac would cost $12,63, get 5,900 miles per gallon, weight 14 pounds and be 3 feet long.

Our purpose is not to belabor the technology itself. Of more importance are the changes that it stimulates. In fact, our view is that information technology is a transformation agent that will change every institution, every business and every individual in profound ways. We are moving rapidly towards global connectivity which is changing access to content, services and communication. The likely consequences include:

- Everyone will become a technology user because costs will be low enough and compatibility will be high. New software will allow the broader population of users to easily deal with ever more complex systems.
- Inter-enterprise integration will become pervasive. We already see this in the form of electronic links among suppliers, distributors, students and faculty.
- We will process and transport bits, instead of things and people; information will displace the physical. Working this way will be faster and less costly, as well as less harmful to the environment.

As a tool, technology enables the transmission of information. However, the critical process is people interacting with other people. Technology enables us to develop a much more participatory and collaborative society. The societal implications of participation and collaboration could be immensely powerful. Drawing on research in collaborative learning, we know that there are significant, positive cognitive and non-cognitive effects of collaboration.

Information technology also places pressure on the "middleman." Computer networks offer the possibility of learners accessing services and information directly rather than through an intermediary. We have seen service delivery change in business (e.g., automatic teller machines) as a result of this "middleman" phenomenon. One of the challenges to higher education will be to identify those "transactions" where humans are "in the middle," redesigning them so that they add value.

When confronted by skeptics who question whether technology will have an impact on higher education, the response is that it already has. Information technology has opened new, fundamentally different options for higher education, both in how to run "the business" of higher education as well as in teaching and learning. History demonstrates that fundamental technological change ultimately begets significant structural change, regardless of whether the affected participants choose to join or resist the movement. The changes that universities have weathered over the centuries did not upend their basic technology. Information technology does (Massy, 1997).

Globalization

In the global marketplace, companies, industries, products, technologies and even jobs no longer depend upon the strengths and weaknesses of any one nation's economy or industrial base. Jobs lost at home reappear abroad. Goods and services flow freely across borders and among trading blocks. Graduates must compete with their peers from overseas (ACE, 1995).

Global competition is one of the most significant forces of change in the last five years for business. This is the environment in which graduates will work. It is tempting to assume that much of this global pressure stems from "sweat shops" or exploitative labor practices. However, global competition no longer means a low wage unskilled labor pool. Increasingly, competition is coming from a high quality, highly productive work force.

The strategy of many countries is to skip over being an industrial power and move directly to being a powerbroker in the information age. It is a savvy approach. For those with massive populations, their raw power is in people. If they are educated, have a strong work ethic and are motivated to become middle class consumers, they will become fierce competitors with the US and Western Europe. "Industrialized" nations cannot afford to stand still.

Globalization is not just about competition, it is also about interdependence. As an example of international interdependence, consider the nations involved in manufacturing and selling my Honda Civic. The engine was assembled in Japan with some US parts. That engine was likely shipped on a Liberian-flagged freighter with a Greek crew, manufactured in Ohio, distributed by a trucking firm and sold to me in North Carolina. Where once we were in competition, we are now bound by mutual dependence.

Globalization represents a structural change. When a structural change occurs, things never go back to the way they were. We will never be able to recreate the time when the US or the UK was the dominant economic and cultural force. Globalization is inexorable. It will not be reversed; it cannot be legislated away. One of our educational challenges is to integrate globalization into the curriculum in a meaningful way so that we can capitalize, rather than be constrained, by globalization.

Complexity

Everything appears to be getting more complex. More technology is used in the workplace. More technology is involved in home products. More technology is used in education. By the year 2000, 95% of the US workforce will use some type of information technology in their jobs. In addition, almost all workers are asked to make decisions and solve problems. With this increasing level of complexity it is not surprising that 75% of our workforce needs retraining just to keep up.

In the workplace, the people with whom we interact are more diverse in terms of culture, gender, ethnicity and age, making interpersonal communication more complicated. As layers of middle management are removed for the sake of efficiency, different tasks are being required of workers. All these add to the complexity of work.

The more complex a process or an event, the less likely it is that a single individual knows enough to master it. Complexity also compounds the likelihood that something will "go wrong" and specialized knowledge will be required to correct it. In both of these cases, the knowledge needed will most likely be found through others. As the nature of work itself changes, there is much greater emphasis on workplace knowledge--the knowledge that is embedded within the routines, processes, and norms of the organization. To be efficient, organizations must gain access to this non-articulated knowledge that resides within groups of professionals. (Prusak, 1997).

Demographics

When we begin thinking in global terms, it does not take long to realize that most of the world's population is elsewhere. Many of us grew up with the assumption that the US or the UK "dominated" the world. The truth is that we no longer dominate; we are one among many. Not only do 95% of the world's consumers reside someplace other than the United States, but economic growth is more rapid outside the US than it is here. As other countries experience economic growth, they behave similar to us. The availability of more disposable income makes them better consumers. It increases the size of the middle class.

Another dominant demographic trend in our countries is aging. The "graying" of our population is likely to produce a variety of changes in society at large and in higher education, as well. This aging labor force will require new investments by the public and private sectors in education and training in order to facilitate American economic growth and productivity. For example, as older adults work longer and postpone retirement, many seek continuing education in order to stay abreast of new technologies and developments with professional disciplines. For those who do retire, many pursue learning for enrichment and enjoyment.

At the other end of the age continuum, consider "Generation Y," those children who will reach their teen years as the next century begins. They will be the first generation to take the Internet for granted. Generation Y's orientation in space and time will be different from its predecessors. Some are growing up with online pen pals on other continents. Far more than today, their world will be global, connected and around-the-clock. Their neighborhoods will not be the street where they live, but the people with whom they interact, electronically (Graham, 1997).

Generation Y will never know a world without computers. Global conversations over the Internet will bring distant cultures close. What's more, they won't even realize how remarkable that is. This generation views computers as basic equipment, like pencil and paper, not something to be feared. Technologically, this generation is going to make the Generation Xers look like fuddy -duddies (Beck, 1997).

Link between education and economics

Throughout the world, a highly educated population is seen as the key to economic growth and a stable society. Higher education's importance will continue to grow as the world's economic strength is increasingly based on an information age model. Economic prosperity is linked to an educated workforce which can compete in a global economy where information technology sets the pace of change. All things being equal, countries with higher levels of education and training will be the least affected by employment dislocation and other problems associated with global competitiveness.

It is no wonder that the demand for education has never been greater. For a large proportion of its clientele, education is an investment--a down payment--on a career, social status or more immediately, a job. Most students take the degrees they do to get the jobs they want, knowing or hoping that these jobs will repay the investment (Brown and Duguid, 1996). In 1992, a worker with a bachelor's degree earned 1.74 times as much as a worker with a high school diploma (Bureau of the Census, 1994).

No surprisingly, the single most important factor in determining level of income is level of education (CFAE, 1997). This poses a troublesome future in the US. I assume it is similar in the UK. If current trends are extrapolated for 20 years, by 2015, male workers with a high school education will have lost 38% of what comparable male workers earned in 1976. And those without a high school diploma will have lost 52% in real earnings over the same period. Only college graduates will be able to hold their own out to 2015. This economic polarization is even more alarming when linked to demographic statistics; African Americans and Hispanics have lower college-going rates than other ethnic groups.

It is in the interest of all to promote higher levels of education and training for those who are rapidly losing earning power in society. Low levels of education are powerful predictors of welfare dependency, unemployment and incarceration, all of which are very costly. Moreover, by 2015 the numbers of workers for every retiree on Social Security will be one-fifth what it was 50 years ago. This means a shrinking proportion of

American workers will not only have to maintain US economic competitiveness in the global marketplace, but will also have to support the economic base of the rest of the nation at the same time (CFAE, 1997). Will the trends be noticeably different in the UK or Western Europe?

Figures involving education, income and social services help illustrate the importance of education. In Indiana, the break-even point for state services is $38,000. The average Indiana worker who earns less than $38,000 per year uses more services than he or she pays for through taxes. Someone who earns more than $38,000 contributes to the general tax revenue. The average high school graduate in Indiana earns $34,000 and the average college graduate earns $55,000 per year. Thus, the average college graduate is likely to be a net contributor to the public welfare; someone without a college degree is apt to be a net user of services. It is to the benefit of the state to increase the proportion of the population obtaining college degrees (Brand, 1997).

Education has broad economic returns that go beyond the individual. For example, for every dollar Illinois invests in undergraduates at the University of Illinois, returned to the state are $4.31 in taxes over time (Anonymous, 1996). Colleges and universities stimulate economic growth through the creation of new jobs, as well. A study found that the 4,000 companies founded by the Massachusetts Institute of Technology (MIT) graduates or faculty as of 1994 employed 1.1 million people and generated $232 billion in world sales. In the US, MIT-related companies employed 733,000 people or one out of every 170 jobs in the country (Kindleberger, 1997).

Perhaps because of all of the positive effects of higher education, the demand is great. Unfortunately, population growth is outpacing the world's capacity to give people access to universities. A sizable new university would now be needed every week merely to sustain current participation rates in higher education. A crisis of access lies ahead (Daniel, 1996). Half of the world's population is now under 20--three-quarters in countries like South Africa and Palestine. Our traditional concept of the campus university will deny higher education to all these young people. Without vigorous action, many of them will grow up to be unemployed, unconnected, and unstable. In a global world, that is a global problem. We require mass training and employability and mass education to inspire the human spirit (Daniel, 1997).

ORIGINS OF THE FUTURE COMPATIBLE CAMPUS

With the demand for higher education worldwide expected to exceed 100 million by the year 2007, education is a growth industry. Large opportunities often attract many rivals. The most aggressive competition facing traditional institutions today is not from within higher education but from new providers of post-secondary educational services. Will their more nimble structures and market-oriented cultures allow them to dominate non-traditional, post-secondary education? (Twigg and Oblinger, 1997)

The inertia in our systems of higher education is immense. Many point to an exemplary record and ask why there is any need for change. How does the Future Compatible Campus begin? More often than not, its origins stem from fear--fear of moving ahead or fear of being left behind. Although all institutions are unique, there are some common philosophies that are emerging among campuses which are "future compatible."

FUTURE COMPATIBLE PHILOSOPHIES

Learning-centered

Future compatible campuses are consumer oriented--they put the learner at the center of their philosophy of service. These institutions are concerned with ensuring value for the learner, not just the organization. Access to information is more open. Centers of competency are created, where generalists are often empowered to help students without long waiting lines or shuffling students from office to office.

Historically, undergraduate education has operated on the premise that the student spends four years living on a campus, insulated from home, work, and the social environments outside the campus. Consequently, it is a campus-centric system that is both place-constrained (the campus or the classroom) and time-constrained (delivered according to an academic calendar and a specific course schedule that is controlled by the provider). The campus-centric model assumes that students will choose from a campus-established set of courses and curricula. Control over the content is in the hands of the provider--the faculty or the institution. Administrative functions such as admissions, financial aid and registration are designed for the convenience of the institution, with minimal regard for the needs of the consumer.

The combination of new communications technologies, changing student demographics, the rising costs of a residential experience, and the need for continuing education throughout a lifetime is eroding this centuries-old system. The modus operandi of the campus should be changing. Relationships among learners, instructors, and information resources are shifting, as well. The rapid proliferation of information and communications technologies is making it possible for the control of delivery to move out of the hands of traditional providers--higher education institutions and faculty --and into the hands of consumers.

One indication of the rising power of learners is the trend for students to learn independent of time and place. The assumption that higher education takes place in the classroom or on the campus is being shifted to the workplace, the home, the library, or even the network. Communications technologies enable a shift toward asynchronous (at different times) rather than synchronous (at the same time) learning experiences, which makes learning available seven days a week, 24-hours a day. Increasingly learners use networks to interact with their peers, their instructors, external experts, as well as information resources; they do it when it is convenient, not just during scheduled class times.

The change from a campus-centric to a learner-centric learning model is accelerating. By expanding the number of potential providers--for content, courses and curricula--learner choice is expanded. The days of a campus-centric model are fading (Twigg and Oblinger, 1997).

This is not to imply that students are without responsibility. In a learner-centered environment, students will be accountable--for updating their mailing address or seeking out external experts for course projects. Institutions can make the processes simpler, but will not assume the in loco parentis burden. Learning is hard work. Although information technology can make learning more motivating, engaging and enjoyable, it will always require exertion. The new learning environments and skills that will be required of students are likely to require additional effort. For all involved, becoming learner-centered will require some adjustment.

Learning organizations

Future compatible campuses believe in the value of on-going learning for everyone. Training is provided for faculty, staff and students. This training focuses heavily on problem solving and sharing. The view is that the collective wisdom of the organization is greater than that of any single individual. Only by sharing does everyone benefit.

To create a sophisticated and continually improving workforce, we need to create and nurture learning organizations. "How institutions of higher education engage their workforces in learning activities is one of our sadder ironies. Colleges and universities are, of course, learning organizations by definition. If we are to develop sophisticated problem solvers in our organizations, we will need to increase our commitments to the formal training agenda. In addition, we will need to discover, uncover, empower and replicate that complex informal system of successful mentorships, peer networks, informal collaborations and grapevines that exist already in the organization" (Ernst et al., 1996).

Becoming a learning organization mirrors the individual's commitment to learning. For singular workers, brains, know-how, broad skills and the willingness to learn throughout life have become the essential tools for building a career (ACE, 1997). Job skills are more important than a job, alone. In the university of the 21st century, employees will recognize that their job and security depends more on their own competence and work skills than on the hierarchy. Assessing skills, finding good teachers and making time for self-improvement will become part of the university culture. The goal will be to ensure that employees have skills that are valuable and transferable--from one department to another or from one institution to another.

Redefine learning

Future compatible campuses have redefined learning. All too often, the operative definition of learning is teaching. The emerging philosophy recognizes that learning is not always dependent on teaching. It also stresses that learning is a social process and interactivity is closely linked to learning achieved.

Access to information technology can enhance learning in several ways. When compared to traditional classes, student satisfaction with online courses is higher; GPA and other measures of student achievement are the same of better; a higher level of critical thinking and problem solving is reported; and there is often more discussion among students and instructors in a course. Instructors are able to track the progress of their students in a detailed way and have a better understanding of what students are/are not learning. Computer networking provides a more authentic learning environment in the sense that students can easily communicate with other educational professionals outside of the class if they desire (Kearsley et al., 1995).

Concomitant with an emphasis on learning vs. teaching is the focus on learning productivity vs. teaching load. Learning productivity (Johnstone, 1992) describes a concept that will allow higher education to attain significant and sustainable productivity increases through greater attention to the learner. "Learning productivity relates the input of faculty and staff not to enrollment or to courses taught or to credit or classroom hours assigned, but to learning, i.e., to the demonstrated mastery of a defined body of knowledge or skills."

One way to make learning more productive is for students to master a body of knowledge in less time. Learning that takes less time can cut the traditional costs carried by the institution, but also the opportunity costs (lost earnings) of the student. Another way to make learning more productive is to make it possible for students to get the courses when they need them (Johnstone, 1992). The way we will achieve sustainable productivity gains in higher education is by facilitating more learning from students, not just increasing the workloads for faculty. If we are serious about learning, the learner should be our focus.

There are many ways in which information technology might be used to leverage learning if the bars of convention were dropped. Massy (1997) illustrates some important benefits from reengineering such as relaxing traditional constraints on the economics of the educational process. For example, faculty labor is applied at the times and in the circumstances needed rather than in fixed quanta defined inflexibly as courses per semester. Technology substitutes for some of what has traditionally been viewed as faculty work, but faculty labor is redeployed to tasks that professors can do best. Support staff and graduate student time may be used to a greater extent than in some kinds of institutions currently, but it is concentrated in areas where faculty do not have a comparative advantage--not in places, like small group discussion sections, where a professor's wisdom can confer important benefits.

Another critical component in redefining learning is to think in terms of learner needs rather than teaching franchises. Currently, most teaching, course credits and degrees are bundled together seamlessly in accredited institutions, with credentialed faculty, controlled by various combinations of accrediting associations and government agencies. A learning franchise, on the other hand, provides access to powerful learning systems, information and knowledge bases, scholarly exchange networks with customizable learning modules and systems open to anyone who needs them and can compensate the provider. Measurement and certification are important for many but not all learners. Students can pay for as little or as much mentoring as they choose (HEIRA, 1996).

Reinterpret administration

Future compatible campuses have redefined administration. New definitions eliminate unnecessary work, dismantle unproductive policies and reengineer policies to achieve efficiencies and make a more learner-centered environment.

Organizations evolve not just because they change but because we change our point of view in looking at the work of an organization. When this occurs, we need to redefine the work. In the future, work will be directed mainly by cross-functional and self-governing teams. The effectiveness of such teams will depend on their members' access to one another, to cross-functional information, and occasionally, to elements of the campus leadership. Such work practices will demand enhanced integration of data across functional systems, robust networking and technical interfaces that lower the cultural barriers between diverse work cultures (Ernst et al., 1996). Administration will be redefined.

Consider organization charts as an example. Although they are useful guides, they are outmoded. Institutions do not manage through structures anymore, they manage through processes. The emergent organizational paradigms succeed by empowering people and horizontal processes in ways that are supplemental to--or independent of--the "formal" vertical organization.

To enable organizational transformation, we need to shift our attention away from the organization chart and towards the creation of an information-rich infrastructure. We will need to (1) eliminate the technical, cultural, hierarchical, and procedural boundaries that divide or isolate intelligent and motivated people; (2) create a policy environment that stimulates and rewards collaboration; (3) promote easy access to the kinds of information people need for making sound decisions; and (4) specify, measure and reward the achievement of defined and customer-centric objectives (Ernst et al., 1996).

Leverage partnerships

Future compatible campuses realize that new kinds of strategic alliances will be required to remain viable. Outmoded notions (e.g., philanthropy equals partnership) are disappearing. Business, industry, alumni and parents can make positive contributions to education. However, before they can, partnerships and strategic alliances must be redefined.

There are also many lessons that business and industry have learned that could provide guidance for higher education. Although the enterprises are not alike in terms of governance, structure, etc., all involve people, cultures and change. Business has wrestled with massive changes for the last decade. Many of these changes are beginning in higher education. Why not learn from the experience of others?

With those philosophies, the future compatible campus will be different. It will be:

- Mission-driven, not rule driven
- Results-oriented: outputs and outcomes will matter more than inputs
- Customer-driven rather than driven by the needs of the bureaucracy
- Decentralized: decisions will be made at lower levels in the organization--employees will be empowered
- Competitive: the status quo will no longer be good enough. There will be rewards for those individuals and institutions who are more competitive.

PREREQUISITES TO A FUTURE COMPATIBLE CAMPUS

Although there is no formula to create a future compatible campus, there are some prerequisites that must be addressed. Our institutions have inherited traditions and organizational structures that may limit the future of some. Just as the needs of our society have continued to evolve, so too must our institutions.

Information Technology Infrastructure

Much of the future compatible campus involves empowering individual and institutional learning. The development of new instructional models is facilitated by the availability of a reliable and ubiquitous network infrastructure as well as access to computers, anyplace and any time. The framework of the learning environment is changing; the emerging model places the student at the center with more flexible access to people and information. These distributed learning environments exist among a dispersed student population where the educational experience is based on learner needs and integrates traditional institutional functions (e.g., classroom and library). Students and faculty may enter the learning environment at different times and from different locations.

The IT infrastructure is also important in supporting organizational learning. Information gains value as it moves around the institution and is used by many people in many contexts. This exchange of information is facilitated by networking technologies and groupware. However, the IT infrastructure is more that wires, hubs and routers. In addition to optimizing machine efficiency we must enhance human productivity.

New Learning and Interactivity Models

Higher education, as a growing, multi-billion dollar industry, will attract aggressive competition--both within higher education and external to it. To remain competitive as a 21st century university, institutions will develop more individualized curricula. In part, this will be accomplished by pooling the resources of multiple institutions. The brokering of courses from multiple institutions will allow students to choose from a broader array of courses to create a unique program of study.

Tate (1996) described a future where higher education would evolve toward production, delivery and certification organizations (PDCs). PDCs would operate on a national basis, using the most efficient and effective communications media available. Courses and programs would be designed and produced to commercial standards. These organizations would purchase subject-matter expertise from many sources, depending upon the degree of expertise and the quality of the content. In addition, PDCs would provide competence-based testing and certification services. Students could participate in interactive testing at any time or at a place of their choosing--and pay a fee to receive certification upon successful completion.

Another model focuses on electronic commerce and education brokerages. Proposed by Hamalainen, Whinston and Vishik (1996), education brokerages would provide product marketing and advertising. They would also process customer applications. Able to match customer needs with existing and prospective courses available from any number of educational suppliers, they could also accommodate requests outside the mainstream by bringing in educators with special expertise or through customized combinations of course elements.

Within courses, cognition, collaboration and communication will modify both what is taught as well as how. Problem solving skills will receive significant emphasis. The focus will be on process more than on memorization. Components of "successful intelligence," (Sternberg, 1996) will be woven into the curriculum: analytical, creative and practical intelligence. Traditionally, only analytical intelligence has been valued on tests and in the classroom. Yet all three are needed. Analytical thinking is required to solve problems and to judge the quality of ideas. Creative intelligence is necessary to formulate good problems and ideas in the first place. Practical intelligence is essential in order to use the ideas and their analysis in an effective way.

Many subjects and skills can be approached through apprentice-like learning. Going beyond the traditional libraries, laboratories and studios, newer technologies can enrich and expand options. Technology can be used to support apprentice-like activities in fields that themselves require the use of technology as a tools, such as statistical research and computer-based music, or the use of the Internet to gather information not available in the local library. Some simulations require computers. Other tools help students gain insight. For example, students can be asked to design a radio antenna. Simulation software displays not only their design but the oridinarily invisible electromagnetic waves the antenna would emit. Students change their design and instantly see resulting changes in the waves. The aim is not to design antennae but to build deeper understanding of electromagnetism (Chickering and Ehrmann, 1996).

New Financial Paradigms

To become a future compatible campus, the existing financial structure of higher education will need to be modified. The funding patterns of higher education are archaic when considering the need to change. Institutions each raise all the money they can, spend all they get, and spend it in ways that relate closely to the way they spent the money the previous year (Ehrmann, 1995).

A second financial problem is due to a funding strategy based on inputs rather than results achieved. "The higher education system as currently financed is not adequately serving the public interest. As long as payments are made to colleges and universities on the basis of intent and not results (for example, graduation rates or the demonstrated competence of graduates), inefficiency is built into the financial structure. As long as the higher education financial structure also includes a faculty reward system that encourages them to pay less attention to public need and more to professional demands, research will continue to be valued over teaching and teaching less over teaching more." (Eaton, 1993).

"One of the absurdities of current funding formulas is that an institution could utterly fail its educational mission and yet its revenue would remain unaffected. Nothing could facilitate a shift to the learning paradigm more swiftly than funding learning and learning-related institutional outcomes rather than hours of instruction." (Barr & Tagg, 1995).

Measurement and Accountability

Measurements help people understand what is happening better. They help people communicate that insight to each other, to legislators, to parents and to students (a form of accountability). Measurements help us gain insight into what really needs to change and how well we are doing (Cortada, 1997). Few institutions will become future compatible by chance. Those with well articulated objectives that are linked to appropriate measures are more likely to excel than those without them.

Over the past decade, demands for accountability have begun forcing institutions to measure their performance and communicate it effectively to stakeholders. Even though many have begun, more needs to be done to measure outcomes and the "value-added" by the educational process. Demands for increased productivity arise from the common perception that faculty do not teach enough, students do not learn the right things, and that administrators are reactive "fire-fighters" instead of effective managers. And, the high fixed costs of doing business (e.g., aging, decaying infrastructures and massive deferred maintenance) give institutions a hefty bill to pay regardless of the number of students they attract and retain (Hafner and Oblinger, 1997).

One of the most effective tools to address measurement and accountability is the balanced scorecard (Kaplan and Norton, 1996) which integrates vision, goals, measures and controls to provide a more holistic view of the institution. Performance indicators take into account the customer perspective (e.g., how students or legislators regard the institution), an internal business process perspective (e.g., cycle time, use of resources), a financial perspective (e.g., revenue, expenditures) and innovation and learning perspective (e.g., asking how well the institution is improving and creating value).

Customer Focus

As a colleague said, we spend too much time looking in the mirror when we should be looking out the window (Father Dietrich Reinhardt, President, St. John's University). In many ways, our institutions are too internally focused. The intended beneficiaries of university work are students and society. The 21st century university will excel because it understands and focuses on its customers.

As "customers" of higher education institutions, students are interested in a smooth, integrated process which will produce the results they need. They hope to go seamlessly from admissions to registration, file their financial aid application and receive their awards, pay their fees, attend classes, receive advising and grades, and graduate, with the least possible disruption to their learning experience. They expect to initiate these tasks themselves via technology from their homes and dorm rooms. Like customers of any successful service delivery operation, they count on the institution to make their interactions with it easy, fast and painless.

To transform an institution, the focus must be on what its customers want and need. Many tasks that employees perform have nothing to do with meeting customer needs; they are done simply to satisfy the internal demands of the organization, hence the world of multiple reviews, four part forms and complex certification stamps and approval signatures. Often things are done simply because they have always been done that way. Guardianship, gatekeeping, controlling and regulating must give way to collaboration and sharing in the future compatible campus.

Students are not the only customers of higher education, of course. Others include business, government, and society. As higher education expands its focus on customers, we anticipate that network-based, university-organized virtual communities will become more prevalent, playing a very positive role in society.

Strategic Alliances

Just as no one person has all the skills needed for their job, no single institution has all the skills it requires. Strategic alliances among higher education institutions and partnerships with business and industry will become increasingly common in the 21st century university.

In some cases, strategic alliances will be created so that key personnel may remain focused on the core competencies of the institution. Although operating a mailroom, the bookstore or a legacy system are part of running the university, none represents the university's core business. Instruction and research are the core businesses. Choosing from a sliding scale, ranging from "insourcing" to "outsourcing," universities will select which activities to "own" and which to contract out to another provider.

A more important step for the 21st century university, however, is the refinement of the notion of partnership. All too often, "partnership" is synonymous with philanthropy. The premise of a partnership suggests that performance can be significantly improved through joint, mutually dependent action. The requirements include risk sharing, the need to view the relationship as a series of exchanges without a definite endpoint, as well as the need to establish a range of mechanisms to monitor and execute the operations of the partnership. Because of the high degree of mutual dependency that evolves, these partnerships become strategic alliances.

As higher education and business become more adept at partnerships and strategic alliances, both parties must develop trust that they share similar goals. Trust and confidence are built up through a working relationship. As trust and confidence are built, mutual dependencies will evolve. This is reinforced by each partner understanding how the other works. Although it takes time to educate each other, the key is sharing knowledge. Of course, effective partners bring distinctive resources to the relationship to build something greater than either could have done alone. Skills are brought by each party. Interdependence may replace autonomy as a characteristic of the 21st century university.

Culture of Change

What we know about cognition, collaboration and communication should allow us to change higher education--to redesign the learning environment. Initiating and sustaining the redesign of education, institution-wide, will require strong executive leadership and a viable process model. The redesign of education entails a fundamental rethinking of instructional strategies. The critical questions to ask are:

Why do we do what we do?

Why do we do it the way we do?

What must we do? (What is critical to our success and our students?)

What should we do? (without regard to what is currently done)

(Hammer and Champy, 1993)

Why do we do what we do? Why do we do it the way we do? Among the answers are because that is how we were taught and because the culture of higher education emphasizes autonomy. The tradition, the existing infrastructure, the lecture-based experience of faculty and the fact that it is more comfortable to preserve the status quo than to change it all contribute to higher education's lecture-based approach to learning. The tough questions are: What must we do? What should we do?

"Resistance to change is a hallmark of higher education. It has been said that changing a college is a lot like moving a cemetery--you don't get a lot of help from the residents. In this case the residents include the education bureaucrats, the faculty, the administrators, the students and the parents--all stakeholders in the status quo." (O'Banion, 1997).

The challenge for higher education will be to create a culture where change is accepted--even welcomed. Seen in a positive light, higher education is entering one of the most challenging and potentially creative periods in its history. Although to change will require enormous acts of potentially career limiting leadership (Rush, 1995), changes will be required if higher education is to thrive in the 21st century. If higher education is not the architect of change, it may be its victim.

Common Sense

There is no single blueprint for creating the future compatible campus. The university of the 21st century will be created with vision, planning, execution and common sense. Our institutions have strengths we would not want to abandon. In addition, we must consider human nature--we are rational as well as emotional beings. Changes in one aspect of the institution can have a "ripple effect" throughout other parts of the institution. Even the finest plans may fail without ample application of common sense.

CONCLUSION

"We are engaged in a battle. The world's universities are in crisis, assailed by challenges of access, cost and flexibility. The traditional classroom of the campus university has had a long run as the preferred means for achieving the ultimate goals of the university. But the classroom model is approaching its "sell-by" date. It is not the means that are important, but the ends to which the university aspires." (Daniel, 1997)

The dilemma is that the future is always becoming the present and the present becomes the past. Our real challenge is to inculcate a culture of change in our institutions. The rate of change in our disciplines, our lives and our society will probably never diminish. Only by making change a part of the academic culture will we be able to continually create our future.

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Diana G. Oblinger, Manager, Academic Programs and Strategy,
Global Education Businesses ,IBM Corporation,
PO Box 12195, 3039 Cornwallis Rd, RTP, NC 27709,
USA

E-mail: doblinger(at)vnet.ibm.com

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Technology Strategies for Higher Education: A Vision for the 21st Century

M. Zastrocky

How does an institution plan for and manage information resources when the world is the classroom and exponential change in technology is a given? Are there solutions and strategies for dealing with the problems facing higher education, and can we work together to redefine relationships and resources necessary to support tomorrow's campus? This presentation will look at problems and issues facing traditional colleges and universities in a global marketplace. Participants will be challenged to push their thinking into the twenty-first century as they explore the systems and resources campuses will need to make the world a classroom.

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- Join Eunis
- Application form for institutions/organizations
- Application form for Corporate membership
- Application form for personal members
- Member's data change

RESOURCES

- Distribution lists
- Publications
- Newsletters
- Information Network
- Archives

ORGANIZATION

- Statutes
- Board of Directors
- Executive Secretary
- Past Presidents
- Members

EVENTS

- EUNIS Congresses
- Rectors' Conferences
- Elite Award
- Jens Dørup Award

ACTIVITIES

- Task Forces
- Groningen Declaration
- International Exchange Programme
- Partnership
- Best Practices

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Multimedia Technologies in Universities

M. Heydthausen, J. Knop, K. Vehlhaber

Introduction

Multimedia as one of the key technologies of the ending century will influence and challenge our universities to a high degree.

New technologies in higher education will change teaching and learning: Computer based training, computer assisted learning and teaching will be no longer slogans but will become common like other techniques as videoconferencing, lecture on demand or self-instructing courseware. But we think that there will be no real revolution in teaching and learning techniques. More likely there will be a (sometimes slowly) evolution, because not only techniques have to change but also teachers and students have to adopt themselves to that changes.

But not only education is challenged by the new techniques. University research and development and even administration will be influenced by multimedia. A broad variety of information that is now traditionally handled will be performed by multimedia information systems.

In this paper we will sketch some multimedia techniques and their application in academic teaching and learning on the one hand and their application on a special example in university medicine on the other hand. We will discuss the possible benefits and will not hide the difficulties that arise in the context of their implementation.

Multimedia in teaching and learning

Besides few critical voices the majority of authors in scientific journals dealing with questions of multimedia in teaching and learning share the opinion that multimedia techniques can be successfully used in university education. The nowadays used terms ,,Computer Aided Teaching (CAT)" and ,,Computer Aided Learning (CAL)" point out that these techniques influence both teachers and learners.

In the following section we will deal with three main questions:

1. What actions must be taken to establish multimedia techniques?
2. How does the technical scenario look like to provide an adequate technical infrastructure for multimedia?
3. What organizational infrastructure can support multimedia in teaching and learning?

The scenario which we have in mind is that of the Duesseldorf University. Thus, the following statements and sections can not be valid for every university in every country. Some might step ahead others may lagging behind.

Actions for establishing multimedia techniques in teaching and learning

Acquisition and evaluation of available CAT- and CAL-programs

There are some sources for relevant products: publishers, research associations, previously made self-developments, public-domain-programs. The commercial conditions are quite different and vary from free of charge to very expensive.

There is also no correlation between price and quality.

However, deciding to use these products depends on the evaluation by the lecturers.

Design and programming of own CAT- and CAL-programs

The design and programming of own CAT- and CAL-programs includes the construction of lecture materials (e.g. projection of multimedia - worked up foils) as well as the construction of individual education- or simulation programs. For the production of CAL-products for video processing should be set up a well equipped multimedia lab. Apart from tools for recording and digitalising pictures and sound there should exist workstations for a digital rework of multimedia material. The equipment of the multimedia lab must include author systems for construction of CAT- or CAL-products.

Distribution of CAT- and CAL-programs

Through license restrictions some commercial available multimedia products could only be distributed by original CD-ROM. Thus, CD-ROM players will be necessary for distributing these products. The technical limitations are obvious. Frequently used products without license restrictions should be made available to users by an appropriate server because of the easier technical handling and higher access-speed. Uncleared is the problem how such products could be used by students at their homes.

Electronic lecture-halls

On the university campus should be set up electronic lecture-halls and electronic seminar-rooms available for multimedia-supported lectures. They offer the following services:

- Online-access to computers for calculations, simulations, graphical representations. The computer monitor can be projected by a beamer to a screen in the lecture-hall.
- Online-access to central servers holding videos, CBT-software, ...
- The lecturer has an interactive white board at his disposal.
- There is a video-conference-system available in order to have live-conversations with external round of talks transmitting it into the lecture-hall.

Video conferences

The technology of the video-conference can be used in university education for the realization of the so-called teleteaching. Several applications are possible.

- Transfer of lectures to another place within the same university.
- Cooperation between universities by transfer of lectures.
- Real-time video conference between two lectures on the same subject in different universities.

Evaluation and integration of new multimedia techniques

Through the dramatic development of multimedia techniques there are always new technologies that could be adopted for teaching and learning in universities. Some current keywords are Computer Supported Cooperative Work (CSCW) or Electronic White board. Further on a digital video-library is a very important service of education in the university. Such a video-library supported by a powerful video server can be used to set up a service called ,,lecture-on-demand".

Technical infrastructure

An adequate technical infrastructure can be developed from the activities pointed out in the previous section.

Most important parts of the technical infrastructure are:

- A high speed network with a big bandwidth.
- Multimedia labs for the design of own CAT- and CAL-products.
- Video servers keeping lectures, parts of it or other video information for supporting university education.
- Electronic lecture-halls.

Organizational infrastructure

In addition to technical infrastructure an organizational infrastructure is needed for efficient support of multimedia techniques. Part of this infrastructure is any university institution dealing with media in a wide sense: library, computing center, media centers (if existent) and every potential user of media.

To keep the organizational structure easy to survey it is planned to have a permanent multimedia working group in Duesseldorf consisting of:

- representatives of the different faculties,
- library,
- computing center and
- administration.

This working group is responsible for:

- progression of the multimedia concept for Duesseldorf university,
- planning, implementation and integration of new multimedia techniques,
- survey of the technical realization,
- coordination of all tasks concerning multimedia aspects in university.

Multimedia in Medicine

Not only aspects of teaching and learning are challenged by new techniques. University research and even administration will be influenced by multimedia. Our next examples for multimedia techniques are taken from medicine. Medicine combines various aspects for multimedia support: research, patient administration and the wide field of hospital information and communication systems.

Health care has lagged for a long time behind other domains supporting work by efficient computerized techniques. One exception are systems for financial transactions in hospitals and for patient admission, as related topics. These were the first systems supporting data processing in hospitals. Information systems for patient-related medical information came up later. Information in these systems is mainly handled in a traditional -non multimedia- manner.

The next section will sketch some aspects of changing traditional patient records to multimedia records and the benefits connected with this change.

Patient records

A patient record for a given patient contains all information concerning anamnesis, findings, treatment, and more of this given patient. It forms the basis for the continuity of the patient`s treatment and influences hereby the quality of health care substantially.

Patient records, however, are often found to be handled on a traditional manner. That means: a lot of paper, more or less exact and readable or complete, possibly referring to further data in X-ray archives, ECG departments, labs, ...

During the last years a lot of efforts have been pushed into computerizing patient records 1). The term EPR (electronic patient record) describes and summarizes these efforts. In Europe a pre standard has been defined by the European Committee for Standardization (CEN).

Patient records in principle are multimedial constructs in an almost natural sense: The information stored in and ordered by an patient record consists of written material, pictures, graphics. The associated information can enclose for example film sequences (heart catheterisation), curve diagrams (ECG, EEG). Voice information is stored rarely in a traditional patient record by lack of an adequate medium. But a lot of information during the patient`s examination is acoustic information. Additionally, an EPR is handled very interactively. With these details an EPR-system is qualified as a multimedia system.

For the user (doctors) of an multimedia EPR-system arise a lot of advantages:

- Reduction of written materials. Representation of information by means of a graphical patient record.
- Direct access even to time dependent media like X-ray films.
- Possibilities to integrate other media like videos or voice information to the patient record.

Visual Information Retrieval

For searching information in an EPR-system the user needs an effective tool. An information retrieval system is expected to help a user specify an expressive query to locate relevant information. The role of the emerging field of visual information retrieval (VIR)2) systems is to go far beyond text-based descriptors to store, and retrieve this ,,imagery-based" information content in visual media.

Visual information

There are two kinds of information associated with a visual object (image or video): information about the object, called its metadata, and secondly information contained within the object, called visual features. Metadata is alphanumeric and generally expressible as a schema of relational or object-oriented database. Visual features are derived through computational processes - typically image processing, computer vision, and computational geometric routines - executed on the visual object.

The simplest visual features that can be computed and retrieved are based on pixel values of raw data, and several early image database systems used pixels as the basis of their data models. A pixel-based model suffers from several drawbacks. One is, that variations in illumination and other imaging conditions affect pixel values drastically, leading to incorrect query results, but significant video segmentation results can be obtained by measuring pixel differences over time.

Most applications for VIR fall between automated pixel-oriented information models and fully human-assisted database schemes. They do not require pixel-level queries; nor are they constrained to only a few object classes. For this middle-of-the-spectrum applications, visual information can be defined in terms of image-processing transformations computed on the visual object. In most of these middle-of-the-spectrum applications even the system's designer needed training to perform effective retrieval. In medical-image databases, fully automatic feature extraction is still a research problem. The general experience is that completely automated image analysis works well only for small, controlled domains and it is very computation intensive.

Moving from images to videos in VIR adds several orders of complexity. Most research and commercial efforts take the following approach: Consider a video clip as a large number of image frames with progressively varying image content. Videos contain three kinds of motion information: one due to movement of the objects within the scene, second due to motion of the camera, and third due to special post-processing effects, like image warping. Ideally, a video information system integrates motion and frame information into a single computational framework, but current research is not there yet.

Summarizing we can say that many aspects of VIR systems are important for the application of multimedia techniques im medicine but they are not yet properly understood. Especially for the retrieval of multimedia databases there are still a lot of research problems.

Assessment of Cost / Benefit Relation

An estimation of a cost/benefit relation for a given technique has two faces: First the specification of costs and secondly an understandable description of what could be the benefits of this specific technique.

The question of the costs for the technical implementation is easy to solve. In contrast to this, the description of benefits is a hard job. What is the benefit of the multimedia support for teaching and learning? What amount (in ECU e.g.) is it worth? Being not able to answer these questions we will choose another way to describe benefit. We will try to answer the following question: what could be the obstacles, what are the difficulties for multimedia techniques to produce benefits?

Costs

The following table gives some details of necessary expenses (in ECU) building up the multimedia infrastructure for Düsseldorf university.

Estimated costs for:	Amount (in ECU):
Investments	
Electronic lecture-hall (per piece)	110.000
Multimedia-lab (per installation)	90.000
Video server	125.000
Future costs for investments (5%, per year)	9.000
Man power (per year)	
Multimedia-lab	100.000
Video server	25.000

This table does not contain costs for network infrastructure which is a condition sine qua non for any multimedia technique and it does not contain costs for further extensions of the underlying network.

These few examples show that the costs are enormous: one electronic lecture-hall is not enough for a large university no more than the installation of one multimedia lab. Thus, the respective costs in the table have to multiplied by an adequate factor. Over the years the costs for investments still stay relatively small. The real financial problem are the costs for the supporting man-power.

Obstacles and difficulties

For efficient support of teaching and learning by multimedia techniques it is important to integrate these techniques as normal tools in preparing and offering lectures and as a normal way to achieve knowledge. A lot of possible obstacles must be overcome:

1. Old habits.
2. Change in self-understandig: the professor is not a teacher but a learning facilitator.
3. Preparing multimedia for teaching requires a lot of time.
4. Support of teachers in preparing multimedia requires a lot of man-power and for that reason a lot of money.
5. ...

Points 3 and 4 are only technical obstacles that could be solved by means of time, man-power and/or money. Real problems are old habits or necessary changes in self-understanding of teaching persons. The ,,real" integration of multimedia techniques means a fundamental change of teaching methods also.

For multimedia support in other areas of interest (like administration or medicine) we have the same technical and financial restrictions like in teaching and learning. Specific for these areas is -as pointed out already in the section about visual information retrieval- the need for further research. Often there is a great uncertainty how multimedia techniques could support a given area of interest.

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Computer Center , Heinrich-Heine-University,
Universitaesstr. 1, D-40225, Düsseldorf, Germany
E-mail: knop(at)uni-duesseldorf.de, heydth(at)uni-duesseldorf.de

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The Web as an Effective Learning Environment for Universities

Jarmo Viteli

The Association of European Universities has published a report (CRE DOC: November 1996) "Restructuring the University: University and the Challenge of New Technologies". The message, as you can see below, of report is clear: The world is not the same tomorrow. Universities have to rethink they aims and objectives. New Technologies is one of the main strategic issue for universities. The time to act is now.

The rapid development of new technologies has implications for the provision of higher education. The new possibilities of Digital Technology like Internet and World Wide Web are already and will be largely applied the traditional markets of universities, that is, regular students. In addition opportunities in Open and Distance Learning (ODL) create new markets, while the principle of lifelong learning extends the age groups to which the university can offer education. Thus, the potential created by new technologies for teaching and learning requires a considerable rethinking of the universities aim and objectives, and a fundamental restructuring of the ways in which it delivers those objectives.

The development of new technologies does not bring with it a miracle solution to the range of problems most universities are now confronting. Multimedia and Networks should not be a diversion for universities from other questions that will determine their future. Technological progress should be exploited by higher education institutions to further their strategic objectives.

This presentation will offer models, examples and research results of how different universities have utilised WWW as an effective learning environment. As we know, today will be history of tomorrow. That is why I will also look ahead to those research projects which are creating tomorrow - like digital paper, agents and immersive environments on the Net - to get a hint of the future.

Senior Research Scientist, Director of Hypermedialaboratory, University of Tampere, Finland

email: jarmo.viteli(at)uta.fi URL: http://www.uta.fi/hyper/

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La situation des Etablissements d'Enseignement Supérieur en matière de technologies de l'information appliquées à l'Enseignement. Une analyse à partir des contrats d'établissements

State of the art for Information technologies in Higher Education in France. An analysis from the State contracts

F. Thibault

- Technologies d 'information

  et enseignement supérieur

  - La situation des établissements français
  - à partir des contrats signés avec l 'Etat

- Les contrats

  - Passés avec les universités à partir de 1989, par tranche et pour une durée de 4 ans
  - objectifs majeurs du ministère :
  - impliquer un nouveau mode de pilotage des établissements
  - modifier les relations entre la « tutelle » et ses « services extérieurs »

- La contractualisation

  - Pensée comme une solution à l 'augmentation du nombre d 'étudiants et à l 'amélioration parallèle de la qualité de l 'enseignement
  - devait donc accélérer la modernisation des établissements et déclencher des innovations

- La contractualisation : une rupture

  - Mettre fin à la politique des guichets
  - Mettre fin au fréquent morcellement des établissements en favorisant, en leur sein, l 'émergence d 'une approche globale par grands secteurs de développement

- Les technologies d 'info. avant la contractualisation

  - A partir des années 80, des guichets particulièrement bien dotés (entre 300 et 400 MF par an)
  - Une succession d 'opérations reposant sur l 'achat d 'équipements (audiovisuel, laboratoires de langues, matériels informatiques)
  - Pas de réelle politique de production de ressources ou de dispositifs, quelques aides ponctuelles.

- Typologie des établissements à partir des contrats 95-97

  - 4 types d 'établissement :
  - les anciens : des actions vivantes dans des composantes sans projet global
  - les débutants : 1 ou 2 actions initiées et un début de réflexion sur le projet global
  - les progressistes : en cours d 'élaboration du projet global
  - l 'avant-garde : projet global en action

- Les indicateurs d 'existence d 'un projet global

  - connaissance de l 'existant
  - portage politique (vice-président, chargé de mission, commission de concertation...)
  - définition de cibles et d 'objectifs intégrés aux objectifs globaux de l 'établissement
  - organisation des infrastructures techniques
  - arbitrages financiers
  - communication autour du projet

- Répartition des établissements

  - « anciens » : 20%
  - « débutants » : 45%
  - « progressistes » : 25%
  - « l 'avant-garde » : 10%
  - La forte proportion, en1996, des anciens et des débutants témoigne de la difficulté à contractualiser. pour les T.I on assiste cependant depuis un an à de réels changements.

- Les différentes demandes honorées dans les contrats

  - Equipements : langues, informatiques, visioconférence, multimédia (40MF, en 95)
  - fonctionnement et mise en oeuvre de dispositifs de formation (EAD, autoformation, centres de ressources en langues..., 35 MF, en 95)

- Les problèmes posés par ces demandes

  - Absence de codes communs et difficulté de rendre lisibles les projets

- Peu de demandes pour la production de ressources ou de dispositifs
- Difficulté d 'appréhender les équipements dédiés à la pédagogie (même situation pour la recherche)
- Pas de demande pour des actions interuniversitaires

- Les stratégies de changement en oeuvre depuis 96
  - Aide au changement : existence de Renater (très importante pour l 'utilisation pédagogique), des CRI, du CSIESR, de GEMME
  - Pour la tutelle : renforcement de l 'accompagnement du projet (à l 'étude indicateurs de suivi), prise en compte de l 'interuniversitaire (contrats et hors contrat pour la production)
  - Dans les établissements : - mise en place d 'une instance forte de coordination en préservant les services existants - création de nouveaux services à partir de l 'éclatement des anciens
- Impacts du changement
  - Mise en oeuvre de la contractualisation, (nouveaux modes de gestion : appels d 'offres internes -prélèvement à la source sur la DGF- parfois décharges de service, heures spécifiques pour les personnels)
  - Dépassement de la procédure avec la nécessité, pour les grands projets nationaux (PCSM, EAD) d 'une aide directe de la tutelle.
- « La cohérence globale doit primer sur la juxtaposition. »

MENESR, Ministery of Education, 1 rue Descartes, 75231 Paris Cedex 05, France
thibault(at)dgrt.mesr.fr

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The Forms of Further Teachers' Education at University of Ostrava in the Czech Republic

Eva Burianova

The development of information technology has begun to influence teaching information technology and general knowledge subjects at primary and secondary schools in the Czech republic since 1990. Schools are equipped with computers, but only few teachers have been able to use the new technology in an active or effective way in teaching so far.

The teachers who finished their studies before 1990 had had no opportunity to work with the computers and information technology during their university education.

There are a lot of various opinions among our teachers saying that computer knowledge is not necessary for teaching and they manage without it. The answer to this attitude is the development of information technology, which enables teachers and students access not only to the new information but also to the co-operation among themselves on various levels.

There are the reasons for which our Department of Computer Science wants to deal with further education of teachers.

It is a very important thing for the teachers, headteachers and headmasters to be acquainted with the possible ways of utilising the computers and information technology. Only then they will be willing to introduce them at schools.

1. The teacher's training centre

We set up The Teacher's Training Centre at University of Ostrava designed for Information technology at primary and secondary schools.

We have these aims :

- information technology will be used in education at the primary and secondary schools,
- schools will use the services of the Internet for the communication between themselves and with our university,
- schools will be communicating with schools in other countries.

There are 69 primary schools in Ostrava. At present some schools are equipped with various types of computers in laboratories but in others there have not been any computer laboratories so far.

Computer facilities at primary schools in Ostrava

Computer type	The number of schools equipped with a laboratory
PC	25
Macintosh	2
Consul	16
None	26
Total	69

2. The education courses for teachers

We have divided our work into several stages in order to reach our aims. In the first stage our department has offered the education courses for teachers teaching the subjects of general education.

We are offering these courses:

- Basic Work with Computer and Operating System
- Education Software
- Word Processing Systems
- Database and its Application
- Using Spreadsheets
- Algorithms and Programming Languages
- Using Internet
-

BECOME A MEMBER
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2.1 Basic work with Computer and Operating System

Teachers attending to this course have never worked with computers yet. They start learning how to operate the computers, they get acquainted with MS DOS operation system, system of files and directories, Windows.

2.2 Education Software

This course intents on the Czech education software, which teachers use in mathematics, physics and chemistry. They work with multimedia programs for history, geography, biology and Czech or foreign languages as well.

2.3 Word Processing Systems, Database and its Application, Using Spreadsheets

These courses acquaint teachers with the application software of Czech and foreign firms (Microsoft, Software T602, Lotus) and their using in education.

2.4 Algorithms and Programming Languages

The course is aiming at interesting algorithms for children and Pascal programming language.

2.5 Using Internet

We offer this course, but teachers have no interest in it. Unfortunately, only few schools are connected to Internet now. But Education authorities in Ostrava have opened a project called “The Information System in Ostrava Education“. One of its aims of this project is to connect schools to Internet. Therefore we are expecting a great interest in this course next year.

2.6 SGP Baltazar - Czech programming language for children

Teachers learn “Soukup Graphic Processor (SGP). It is a program for children (4-16 years old) and it is very popular in the Czech Republic.

Interest teachers in offer course

The teachers are interested in the courses very much. 148 teachers participated in 12 courses in Autumn 1996 and Spring 1997.

The number of graduates in the realised courses

Basic work with Computer and Operating System	62
Education Software	14
Word Processing Systems	25
Database and its Application	14
Using Spreadsheets	10
Algorithms and Programming Languages	12
Using Internet	0
SGP Baltazar	11
Total	148

3. Distant education

In the second stage we are going to offer distant education for in-service school teachers. It is expected that schools will be connected to Internet. We are going to prepare study materials and textbooks in electronic forms. We would like to exchange experience with foreign universities as well.

Now our department offers Lifelong Education in Computer Science - Postgraduate study of computer science for in-service teachers :

- the study for three years
- tuition - 84 hours per a semester
- curriculum is the same as in regular study and there are these parts:
- theory of informatics

- information technology and application
- programming and computers
- educational software and didactics
- study finishes with extended diploma

4. Organise a project

In the third stage we are going to organise some project for primary or secondary schools. This project will intent on transporting experience with multimedia, Internet and the Web in teaching between these schools.

At present we are contacting several primary schools in Ostrava's area that would like to participate in “Using Information Technology at Primary and Secondary Schools“ project.

Our help to these schools:

- to work out the presentation of their schools and put it on WWW pages in Web server in our university,
- we will enable the teachers of these schools to have access to the computer laboratory at our faculty in order that they can be acquainted with the latest information technology and work with Internet,
- the preparation of competition called “Utilising Internet at our school“ for primary and secondary pupils and teachers.

We and the teachers together are going to prepare a conference. The teachers will present their work with their pupils and acquaint the participants present at the conference with the utilising information technology at their schools.

Department of Computer Science
University of Ostrava
Bráfova 7
702 00 Ostrava 1
Czech Republic
E-mail: buriano(at)osu.cz

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Architecture Intranet/Internet au service de la gestion de la scolarité

1 Jean-François Eritzpokhoff,

2Peter Wegbrands,

3Jacques Bourel

Une nouvelle génération d'applications client/serveur basées sur l'architecture Intranet/Internet émerge. Ces techniques apportent de nouvelles réponses aux besoins et aux problËmes généralement rencontrés dans la gestion de la scolarité et de la pédagogie.

1. Gestion de la scolarité pour quel public et pour quels besoins ?

La gestion de la scolarité et de la pédagogie est l'une des principales préoccupations des établissements d'enseignement. Elle concerne un large public, depuis les futurs élèves de l'établissement, jusqu'aux responsables des services administratifs. Nous pouvons distinguer cinq groupes d'individus en fonction de leurs activités socioprofessionnelles : les personnes susceptibles de devenir les futurs étudiants de l'établissement, les étudiants qui suivent des enseignements sanctionnés ou non par un diplôme, les enseignants qui dispensent un ou plusieurs enseignements, le personnel administratif qui assure le fonctionnement des services de scolarité et de pédagogie, et les personnes en charge de la direction de l'établissement. Les besoins de chacun de ces groupes sont différents et cette diversité entraîne un élargissement du champ d'activité de la gestion de la scolarité, depuis la gestion administrative des dossiers, en passant par la comptabilité, la pédagogie, l'enseignement, jusqu'à la mise en place d'actions de communication internes et extérieures à l'établissement. Le personnel administratif joue un rôle pivot dans le fonctionnement de la scolarité. Il doit non seulement gérer les dossiers au quotidien, mais diffuser l'information en fonction des demandes. Il est en contact avec l'ensemble des usagers, depuis les futurs étudiants jusqu'aux directeurs de l'établissement. Outre le travail classique de gestion, la scolarité a de plus en plus une fonction de communication et de diffusion de l'information.

Sur ces aspects fonctionnels de la gestion de la scolarité viennent se greffer des contraintes liées à l'organisation structurelle de l'établissement. Plusieurs facteurs peuvent rendre difficile l'intégration d'un logiciel de gestion et doivent être pris en compte : une organisation hétéroclite de la scolarité, l'existence de sites d'enseignements distants et délocalisés, l'insuffisance de personnels techniques qualifiés, un nombre important d'utilisateurs, l'hétérogénéité du matériel informatique en place ou l'existence d'applications locales. Les services informatiques des établissements d'enseignements doivent faire face à une demande des utilisateurs et doivent avec des moyens limités améliorer l'accès à l'information à l'ensemble des acteurs de la scolarité. L'un des objectifs est de rechercher des solutions techniques qui permettent non seulement de limiter les coûts, mais également d'améliorer l'adaptabilité des outils à l'environnement technique et humain.

2. Architecture Intranet/Internet

Conçu à l'origine pour diffuser de l'information, le World Wide Web permet aujourd'hui de concevoir des applications pour interroger et mettre à jour des bases de données. Le concept du Web appliqué à la gestion de base de données créé un nouveau type d'architecture client/serveur qui se situe à la croisée des chemins des solutions gros systèmes (Mainframe) et du client/serveur classique. Les avantages techniques et aussi l'ouverture d'accès à un large public suscitent un engouement de la part des principaux éditeurs de solution logicielle. La mise en oeuvre d'application Intranet/Internet est aujourd'hui possible, même s'il subsiste encore certaines limitations techniques. D'abord ressenti comme une évolution, voir une révolution informatique à la lecture des médias, l'architecture Intranet/Internet trouve peu à peu sa place au sein des systèmes d'information des grandes organisations.

Le succès du Web vient essentiellement de l'introduction du concept de recherche hyper texte et du protocole utilisé. Chaque document Web possède un lien avec un ou plusieurs autres documents. Ce lien permet aux utilisateurs de "naviguer" de document en document et d'effectuer ainsi des recherches plus ou moins complexes. Les documents sont formatés et balisés à l'aide de marques définies dans le protocole "HyperText Markup Language" (HTML). Il permet de définir un format de présentation des pages Web et des liens hyper-textes. Pour lire les documents Web, l'utilisateur utilise un navigateur Internet (Browser). Ce navigateur est un logiciel capable d'interpréter les balises HTML d'un document. Ainsi, le même document Web peut être lu depuis différents navigateurs, indépendamment du système d'exploitation et du processeur du poste de travail utilisé. Cette propriété permet d'envisager la création de documents multi plates-formes pouvant être diffusés à l'ensemble des machines connectées à l'Internet. Les éditeurs de logiciels ont d'ailleurs tendance à considérer le navigateur Internet comme une sur-couche au système d'exploitation dans laquelle s'exécutent des applications. Le navigateur Internet tend ainsi à banaliser le système d'exploitation des stations de travail.

L'évolution du protocole HTML a permis de rendre les documents Web plus interactifs, notamment avec l'adjonction de fonctions multimédias et de la programmation en langage de script (JavaScript, VBScript,...) ou en code semi-interprété (Java, ActiveX). La possibilité de programmer à l'intérieur d'un document Web permet de réaliser des applications indépendantes de la plate-forme cliente. Les programmes Web peuvent être exécutés soit du coté du serveur Web, soit à l'intérieur du navigateur client. Les programmes exécutés côté client sont chargés depuis un serveur Web et sont exécutés à l'intérieur du navigateur. Plus ces programmes sont complexes et plus ils font appel à des caractéristiques du navigateur client. En revanche, les programmes exécutés côté serveur sont totalement indépendants du client, puisque le serveur Web les exécute avant de retourner le résultat sous la forme de code HTML. L'une de leur principale fonction et de servir de passerelle entre le serveur Web et le serveur de base de données. Ils permettent d'interroger des bases de données et de retourner le résultat sous la forme de pages HTML. La charge de travail étant répartie entre le poste client, le serveur de Web et le serveur de base de données, on parle d'architecture client/serveur trois tiers. Ce type d'architecture s'applique aussi bien à des accès publics (Internet) qu'à des accès réservés (Intranet). Dans le cas d'un Intranet, le processus d'authentification est la clé de voûte de la sécurité du système et doit donc être protégé.

L'architecture Intranet/Internet apporte des avantages techniques notamment en terme de déploiements des applications. L'application est installée sur une seule et même machine : le serveur Web. La livraison de nouvelle version de l'application est ainsi grandement simplifiée. Il n'est plus nécessaire, comme c'est le cas dans une architecture client/serveur classique, d'installer l'application et les pilotes (ODBC, SQL*Net,...) sur chacun des postes clients, il suffit seulement d'installer un navigateur Internet sur les postes clients et l'application sur le serveur Web. Certains constructeurs d'ordinateur proposent d'ailleurs des postes de travail allégés (Network Computer) dédiés aux applications Intranet/Internet. Cette facilité de distribution de l'application permet non seulement de faciliter le travail des équipes de développements, mais également de réduire les coûts de gestion de parc informatique. En outre, cette architecture permet de délocaliser et de nomadiser le travail des utilisateurs.

Il existe toutefois des limites techniques inhérentes aux outils Intranet/Internet. Le protocole réseau du Web (Hyper Text Transfert Protocol) n'a pas été conçu pour le mode transactionnel des applications client/serveur. Lorsqu'un utilisateur a émis une requête, il n'a alors plus le moyen de reprendre le contrôle sur sa propre demande. Le serveur n'a pas non plus les moyens de contrôler le déroulement des transactions. Dans un environnement multi utilisateurs, cette lacune peut notamment poser des problèmes pour gérer les verrouillages d'enregistrement (Lock row). Les éditeurs de logiciel de base de données ont pris consciences de la faiblesse du protocole HTTP et proposent déjà des solutions pour gérer des connexions Web persistantes. Les applications Intranet/Internet sont limitées en terme de fonctionnalité. Par exemple, le navigateur Internet permet d'imprimer la page HTML telle qu'elle est affichée à l'écran, mais cette fonction n'est pas toujours suffisante. Il serait souhaitable qu'à terme des balises dédiées au formatage d'impression des documents soient intégrées dans le HTML. Encore récentes, les techniques de développement d'application Intranet/internet doivent être améliorées et être adaptées aux besoins des applications de gestion.

3. Mise en oeuvre d'un Intranet pour la gestion administrative de la scolarité à l'ENSAM

L'Ecole Nationale Supérieure d'Arts et Métiers (ENSAM) a mené une expérience innovante en réalisant une application Intranet pour la gestion administrative de sa scolarité. Développée par une petite équipe d'informaticiens et d'enseignants de l'école, cette application a montré non seulement que l'architecture Intranet permet d'apporter des nouvelles réponses à un certain nombre de contraintes techniques, mais qu'elle est également capable de s'adapter à l'organisation particulière de la scolarité de l'ENSAM.

Le modèle informatique retenu donne aux services de scolarité les moyens de gérer de manière autonome les dossiers administratifs. Les informations sont mises à jour dans une base centrale accessible en mode client/serveur à partir d'une application Intranet. A partir de la base centrale, les services de scolarité peuvent extraire à tout moment une sous base locale contenant les informations sur les dossiers administratifs de leurs élèves. Une deuxième application permet de répondre à des besoins particuliers et locaux tels que des impressions (carte d'étudiant, certificat administratif,...) ou des statistiques. Les données des sous bases peuvent également être utilisées pour alimenter d'autres applications locales antérieures au nouveau modèle. Ainsi, les centres ENSAM peuvent exploiter comme ils l'entendent les données extraites et conservent une autonomie par rapport à la gestion générale de la scolarité de l'école.

Les choix techniques de ce modèle s'appuient sur le système d'exploitation Microsoft Windows NT. L'un des avantages de ce système d'exploitation propriétaire est qu'il apporte une solution pour protéger l'accès à l'application Intranet. Le système d'authentification sécurisé (Challenge/Response) de Windows NT permet en effet d'éviter que le mot de passe des utilisateurs circule en clair sur le réseau public. Toute demande de connexion à une ressource gérée par un service de IIS ouvre une session sur le serveur Windows NT. Le serveur envoie une clé (un chiffre calculé de manière aléatoire) au navigateur client. Ce dernier exécute une fonction de chiffrement basée sur cette clé et sur le mot de passe de l'utilisateur, puis retourne au serveur la valeur ainsi calculée. Le serveur décode cette valeur avec sa propre clé et compare le résultat avec les informations stockées dans sa base utilisateur (SAM). L'authentification NT contrôle non seulement l'identité de l'utilisateur, mais également le domaine NT du compte utilisateur. Ainsi, le mot de passe de l'utilisateur ne circule jamais en clair sur le réseau. Ce système d'authentification spécifique ne fonctionne qu'avec le navigateur Internet de Microsoft (Internet Explorer) et ne peut donc être utilisé que dans le cadre d'une application Intranet. Par ailleurs, ce modèle permet d'utiliser les fonctions de sécurité (réseau et fichier) et les outils d'administration de Windows NT pour administrer et surveiller l'application Intranet.

Aucun utilisateur ne peut accéder directement à la base. Un utilisateur doit d'abord avoir été authentifié par le serveur d'application Intranet, avant de pouvoir ouvrir une session dans la base de données. Le noyau de la base de données vérifie seulement que l'utilisateur a été authentifié au niveau du système d'exploitation du serveur Intranet et qu'il est autorisé à ouvrir une connexion dans la base de données. Un système de gestion de base de données se compose de plusieurs objets dont les principaux sont des Tables, des Vues, des Fonctions et des Procédures stockées. Il contrôle systématiquement l'accès aux objets de la base en fonction des privilèges de chacun des utilisateurs. Si un utilisateur ne possède aucun privilège sur l'objet, alors il ne peut ni "voir" ni "atteindre" cet objet.

Dans la base centrale de la scolarité, un utilisateur n'accède jamais directement aux données de la base. Il doit toujours passer par des objets filtrants. L'utilisateur accède à ces objets filtrants en fonction de ses privilèges. Il ne possède aucun privilège sur les informations brutes contenues dans les Tables de la base. Les objets filtrants sont des Vues, des Procédures ou des Fonctions stockées dans la base de données. Ils accèdent aux données contenues dans les Tables de la base, en fonction de l'identifiant unique du centre ENSAM de rattachement de l'utilisateur.

4. Conclusion : l'Intranet au service de la scolarité

Conçu à l'origine comme un outil de diffusion de l'information, le Web apporte une nouvelle approche dans la conception des applications informatiques de gestion. Une application basée sur une architecture Intranet/Internet permet d'étendre le champ d'action de la scolarité, notamment en améliorant l'aspect de diffusion de l'information et de gestion des flux des étudiants. Elle contribue à améliorer l'accès aux informations non seulement aux principaux acteurs de la gestion de la scolarité, mais également à un plus large public, depuis les futurs étudiants jusqu'aux enseignants et anciens élèves. Avec le Web, la scolarité prend une dimension nationale et internationale. Les services de scolarité des différents établissements peuvent échanger et partager des informations. Au coeur de l'activité des établissements d'enseignement, la scolarité dispose d'un outil qui lui permette d'anticiper les besoins en cours et à venir.

La force des applications Intranet/Internet réside dans les propriétés du navigateur Internet. Ce navigateur est capable de communiquer avec un serveur Web et de fonctionner sur la majorité des systèmes d'exploitation du marché. Dès les débuts de l'informatique, les informaticiens ont été confrontés aux problèmes d'intéropérabilité de leurs applications. Aujourd'hui, ils disposent d'un outil simple, basé sur le HTML, pour réaliser des applications multi plates-formes. L'architecture client/serveur trois tiers répartit le travail entre le poste client, le serveur d'application et le serveur de base de données. Les principales briques logiques de cette architecture sont ainsi dissociées et indépendantes les unes des autres, qu'il s'agisse de la couche réseau, cliente, ou d'accès à la base de données. Si cette architecture demande un effort d'analyse et d'étude lors de la conception d'une application, elle apporte par la suite un gain en terme de maintenance des applications et une plus grande adaptabilité aux évolutions des outils informatiques.

L'architecture Intranet/Internet apporte des avantages techniques importants, mais il existe aujourd'hui des contraintes dues à la jeunesses des outils. Les informaticiens n'ont pas encore eu le temps d'intégrer ces nouvelles techniques. La conception d'une application Intranet/Internet ressemble davantage à un projet expérimental. Il faut du temps pour apprendre à concevoir de telles applications. D'autre part, il existe encore peu d'outils de développement rapide adaptés aux applications Intranet/Internet tels que ceux que les informaticiens de gestion ont l'habitude d'utiliser. Le Web évolue vite et chaque jour de nouvelles solutions apparaissent aux problèmes d'hier. Les grands éditeurs de logiciels rivalisent entre eux pour détenir le monopole sur les outils de développement Intranet/Internet. Petit à petit, il est nécessaire de programmer différentes versions d'application Intranet/Internet non plus en fonction du type d'ordinateur ou du système d'exploitation client, mais du navigateur Internet utilisé. Si ces applications sont toujours multi plates-formes. L'architecture client/serveur trois tiers répartit le travail entre le poste client, le serveur d'application et le serveur de base de données. Les principales briques logiques de cette architecture sont ainsi dissociées et indépendantes les unes des autres, qu'il s'agisse de la couche réseau, cliente, ou d'accès à la base de données. Si cette architecture demande un effort d'analyse et d'étude lors de la conception d'une application, elle apporte par la suite un gain en terme de maintenance des applications et une plus grande adaptabilité aux évolutions des outils informatiques.

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1Direction Générale de l'Ecole Nationale Supérieure d'Arts et Métiers (ENSAM)
151, Bd de l'Hôpital, 75013 Paris, France
E-mail: jfe@Paris.ensam.fr
2Faculté de Mathématiques et d'Informatique,
Université de Delft, Pays-Bas
3Institut de Chambéry,
Ecole Nationale Supérieure d'Arts et Métiers (ENSAM) E-mail: Jacques.Bourel@Chambery.ensam.fr

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Distance Learning Applications in Banking: The D-LAB Project

1 Anastassios Koutoumanos, 2Nikolaos Papaspyrou, Symeon Retalis, Cleo Sgouropoulou, Ioannis Sgourovassilakis, Emmanuel Skordalakis

1. Introduction

The rapid developments in the European monetary market, emanating mostly from the forthcoming currency coupling of European countries and the intense competition, render the need for vocational training of bank employees essential and urgent. In order to fulfill their duties, bank employees must be up-to-date with recent developments, current laws, practices, etc. Furthermore, the speed and effectiveness with which employees are trained is critical for a bank's activities, for its competence in the market and therefore for its viability. These reasons have urged Greek banks and their managers to change their traditional unfavourable point of view towards training, so that nowadays training is considered a significant part of a bank's strategic plan.

Distance learning, as a training method, seems to have the potential of overcoming constraints in time and place that the traditional face-to-face teacher-centered training method imposes, and thus to contribute in the improvement of the offered training. However, the success of the distance training approach is hindered by a number of factors, such as poor communication between the actors of the training process, troublesome updating of course material, etc. The use of new technologies, supported by the computer networks that banks already have, seems to be in the right direction because it facilitates the frequent updating of the learning material and guarantees homogeneity and a high level of interaction among the participants in the training process [Coll96, Kout96].

A project with the title “D-LAB: Distance Learning Applications in Banking” is underway by a consortium led by the Union of Greek Banks (UGB). The main objective of this project is to design, implement, evaluate and experimentally use a modern distance training system for delivering on-the-job training to bank employees. This system will be based on the new technologies, namely computer networks and networked hypermedia systems, as well as on current pedagogical trends. It is intended to cover the training needs of the Greek banks that participate in the project's consortium and also to demonstrate the technical and economical viability of such an approach. A team from the National Technical University of Athens (NTUA) takes part as a technology expertise provider.

For the development of such a distance training system, the NTUA team has proposed three solutions, based on its experience from participating in two related projects, EONT [URL1] and MECPOL [URL2], within the SOCRATES programme [URL3]. The third solution is particularly interesting from the development point of view and for this reason is more elaborated in the sequel.

The paper is structured as follows. In section 2, a brief account of the current situation and trends in training in Greece, as far as training in the banking sector is concerned. In section 3, a brief description of the D-LAB project is made. In section 4, the three solutions for a distance training system for banks are presented. In section 5 the third solution is described in detail. The paper concludes with some brief remarks in section 6.

2. Current situation and trends in Greece

The current situation of education and training in Greek banks could be undoubtedly described as mediocre. There are no higher education institutes offering courses in banking, whereas only recently a couple of highest education institutes have formed departments offering related courses. The training needs of approximately 54,000 Greek bank employees are currently covered mostly by intra-bank training and some times by training delivered by specialized private companies.

Between 1982 and 1986, administrative Units for Education and Training were created in almost every bank of the public and private sector. These units have planned and organized a lot of intra-bank training seminars, most of which were organized in Athens. In parallel to this activity, since 1985 the UGB has organized a number of inter-bank training seminars in an effort to cover the training needs of banks with little or no training facilities. The methods that have been adopted for training are based on the oral presentation of the material, in form of lectures, and use exercises and written assignments as a supplement.

Distance learning has been used as a training method in other fields with great success. During the last few years, the UGB has organized a number of distance training seminars that were attended by approximately 1,000 bank employees. Although these seminars were delivered with the conventional method of distance training, based on printed training material and the telephone as the only means of communication between the trainees and the trainers, they have had considerable success. This has raised the interest of UGB for experimenting with modern distance training systems.

3. The project D-LAB

The project D-LAB is partially funded by the Greek General Secretariat for Research and Technology, under the research programme . The aim of this programme is the application of technologies and processes that are new to the Greek standards but have been successfully applied abroad. A long-term aim is the creation of an infrastructure for the development and demonstration of innovative products and methodologies of wide economic interest.

D-LAB is a partnership project between several actors of the Greek banking sector and the NTUA, which participates as a technology expertise provider. The project's consortium was formed on the basis of the partners' common interest in experimenting with the distance training method using the new technologies. The project is coordinated by the UGB. The complete list of partners is shown in Table 1.

Table 1. Participants in the project D-LAB.

PARTICIPANTS	ROLE
Union of Greek Banks (UGB)	Coordinator
National Bank of Greece (NBG)	Partner
Agricultural Bank of Greece (ABG)	Partner
Mortgage Bank of Greece (MBG)	Partner
Educational Center of MBG	Partner
INE - OTOE	Partner
National Technical University of Athens (NTUA)	Technology expertise provider

The main objective of the project D-LAB is the development of a modern distance training system for bank employees, based on the new technologies and pedagogical methods. The new technologies that will be used in the implementation of this system are computer networks and hypermedia systems. The project also aims at demonstrating the technical and economical viability of such an approach. The distance training system that will be developed must meet the following requirements:

- It must be equipped with efficient authoring tools to facilitate the development of training material and provide an easy way to manage and regularly update this material.
- It must facilitate the automation of administrative tasks, specify access and update rights for all users and have a friendly user interface.
- It must implement a communication channel, in which all trainees and trainers will participate and discuss electronically matters related to specific courses. The content of these discussions that take place, as well as all questions and answers, must be reusable.
- It must facilitate the users in their attempts to locate and access course related material that is distributed in the Internet.
- The training material must be widely available and accessible at the same time from many different locations. It must also be hierarchically structured and use hypertext links in such a way as to facilitate and guide the users.

4. Proposed solutions

Since the beginning of the project, the most important problem has been to specify the modern distance training system that will be used. The NTUA team has proposed three alternative solutions after investigating related research.

The first solution advocates the selection and adoption of a system similar to the ones used today by banks outside Greece for their training needs. Unfortunately, our experience in this area is very limited and this solution should be realized through investigation of the current situation world-wide. It might lead nowhere if such systems are not available today.

The second solution advocates the adoption of a commercial system for distance education, such as the ones used today in academic institutions world-wide. Web-based distance education systems, for example TopClass [URL4] or WebCT [URL5], are particularly suitable for the needs of this project, since they meet many of the requirements that were stated in the previous section.

The third solution advocates the development of a distance training system specially designed for the needs of banks. This solution will be further elaborated in the rest of the paper, as it is particularly interesting from the development point of view.

5. Implementation approach -- the DDTS solution

According to the third proposed solution, a distributed system structured in three layers as shown in Figure 1 is envisaged for the needs of the project D-LAB. This system will be referred to in the sequel as “Distributed Distance Training System” (DDTS). Each layer will contain a number of nodes which will act as the system's servers. These servers will host the training material and provide other educational or administrative services.

The first layer will consist of a single central node, located at the educational center of the UGB, hosting the training material that is common to all banks. The second layer will consist of several primary nodes, one for each bank participating in the consortium. In each primary node the material of the central node will be mirrored, in order to improve access time and reduce the network load. In addition, primary nodes will host material specific to the needs of the particular bank or supplementary to the common material. The third layer will consist of several secondary nodes for each bank, distributed over the country. These will mirror parts of the training material and provide access to trainers and trainees.

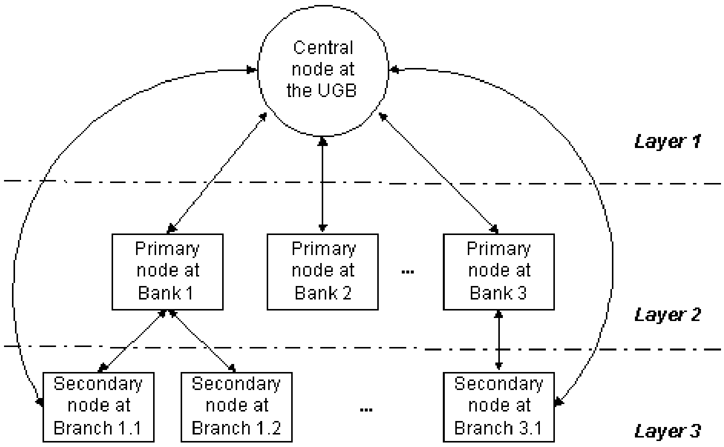

Figure 1 *Layered structure of DDTS.*

DDTS will be based on the client-server architecture. Each node will contain a powerful server computer, which will host the training material and make it available to the users, who will operate a number of client computers. Such client computers will be connected to DTTS through LANs or modem lines, as shown in Figure 2.

The development of the required training material, its management and updating will be performed only in nodes of the first two layers. Subsequently, updates will be propagated to other nodes through the network. Such an architecture has the advantage of avoiding duplication of effort in preparing, maintaining and managing the training material. Additionally, it makes the access to this material very flexible.

DDTS can be implemented using as infrastructure the Internet and the second-generation networked hypermedia system HyperWave [Maur96, URL6]. Internet offers a large number of services, contains a real treasure of information and is widely used and available today [Hesslop 1994]. HyperWave possesses characteristics that facilitate the development of distance training systems. Specifically:

- It is a scaleable distributed system, in which the stored data can be placed at a variety of sites. There is no need for a central, dedicated server with huge amounts of disk storage.
- It is interoperable with other first generation hypermedia systems, such as WWW and Gopher, and with other popular Internet services, such as Telnet and FTP. Browsing, authoring and administration can be performed using standard HTTP clients or custom application development tools.
- Objects can be added to the system piecemeal as they are constructed. The system is based on an object-oriented database containing documents, links and object information.
- Hyperlinks are stored separately from documents, allowing users to attach links to otherwise read-only documents. In addition, hyperlinks are automatically checked for consistency.
- It is a multi-user system, allowing people with an organization to work together simultaneously and collaboratively. It utilizes access rights for every collection of hyper-documents.
- It supports integrated search engines for full text and object attributes.
- It supports Java and JavaScript, which can be used in order to create applications that extend a server's functionality and improve user-friendliness.
- It is multilingual.

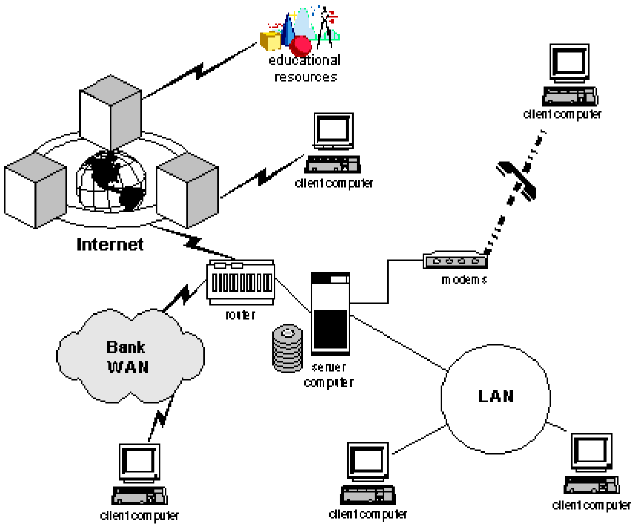

Figure 2 *Schematic view of DDTS.*

DDTS will support various modern pedagogical methods, such as collaborative, conversational (student-student and student-teacher) and student-centered learning. Apart from hosting and electronically transferring the educational material, the network will also allow the exchange of asynchronous hypermedia messages, as well as synchronous live communication (chatting and teleconference) between trainees and trainers.

6. Discussion

Distance training based on systems utilizing the new technologies of computer networks and networked hypermedia systems will undoubtedly modernize the way in which training is offered in banks today. The problem is how to build systems that will exploit the great potentiality of these technologies in combination with current pedagogical trends.

Of the three proposed solutions towards a modern distance training system for banks within the D-LAB project, the first is by far the easiest. The second solution seems easier than the third, but the adaptation effort that is needed, in order to make it suit the banks' requirements is hard to be estimated without a thorough investigation. The third solution is the hardest but the most promising, given that the proposed system will be specially developed for the banks' needs.

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[1] National Technical University of Athens,
Department of Electrical and Computer Engineering,
Division of Computer Science, Software Engineering Laboratory,
Polytechnioupoli, 15780 Zografou, Athens, Greece.
E-mail: tkout(at)softlab.ntua.gr

[2] National Mortgage Bank of Greece, Center for Education,
41-43 Vassileos Georgiou A' Ave., 16675 Glyfada,
Athens, Greece
E-mail: nickie(at)softlab.ntua.gr, retal(at)softlab.ntua.gr, csgouro(at)softlab.ntua.gr, ekkt(at)mail.hol.gr, skordala(at)softlab.ntua.gr

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The Global Alliance for Transnational Education: Transnational Education and the Quality Imperative

Marjorie Peace Lenn

The global marketplace and new technology are contributing to the rapid globalization of higher education. Today's business environment draws its professional work force from all corners of the globe. Human resource development divisions of multinational corporations face the increasing challenge of evaluating courses and degrees from other countries when identifying personnel. Further, higher education is no longer provided solely within national borders. Available through both the higher education and corporate sectors, transnational education can be found in multiple forms, including both electronically and through traditional on-site instruction and training programs. Issues of quality, purpose and responsibility abound in this new borderless educational arena and the time is ripe for a new international alliance of business, higher education and government dedicated to principled advocacy for transnational educational programs. This new alliance is GATE - the Global Alliance for Transnational Education (GATE Brochure, 1996).

It is the purpose of this paper is to provide a brief global context for the new organization and discuss its organization and services as envisioned by its founders.

The Global Context

Institutions globally are seeking new frontiers for growth and recognition. A part of their motivation is spurred by a need for additional resources as developed countries become less capable of subsidizing higher education. But the loftier among motivations lies in the rapid globalization of the marketplace and the needs envisioned by the higher education community to prepare a new generation for this inevitability.

Economic growth is at the heart of this change. For 1992, the United Nations Economic, Scientific and Cultural Organization (UNESCO) estimated the “world market” for international students as slightly in excess of 1.2 million (UNESCO Statistical Yearbook, 1992). However, this world market is measured by the number of students enrolled in educational institutions outside their country of origin as counted by receiving countries. This figure, therefore, does not take into account the unknown but perhaps even larger number of students who are receiving their education in their own country but from international sources. Whereas the United States, France, Germany, the United Kingdom and Canada import the largest number of international students (63 percent in 1990 - UNESCO), the United States, Britain and Australia are touted to be the primary exporters of higher education. The Office of the U.S. Trade Representative reports that since 1992, education has ranked fifth in U.S. cross border sale of services. In 1994, the United States earned about $7 billion (US) for educational services (Ascher, New Trade Agreements: Implications for Education and the Professions, Office of the U.S. Trade Representative, 1996) while Australia earned about $1 billion (US) in the year prior (Department of Employment, Education and Training, Australia, 1993).

These figures not only do not count the number of students who are receiving a “foreign” education in their own countries, they also do not include corporate education. As business globalizes, the multi-nationals are finding it necessary to conduct their own educational programs for their personnel. There are a number of reasons why the corporations feel that this is necessary, such as low quality higher education in certain countries where their enterprises are located, or the lack of educational facilities or expertise in highly technical areas. In some cases, the provision for an educational program is contracted out to higher education institutions in countries other than where the enterprise is located (e.g. the National Technological University, a distance education consortium of U.S. institutions for graduate level degree programs in engineering). But in a growing number of cases, the human resource divisions of corporations are providing their own (e.g. Ericsson Telecom, United Technologies, Motorola and others).

The increasing export market in higher education and new corporate educational programs, accelerated by the new technologies which make distance education a primary medium are but indicative of a larger activity: regional and global economic growth and the subsequent increased academic and professional mobility. Indeed, the multiple accreditation phenomenon already taking place in Europe and North America may barely become normal activity before it is replaced by regional and eventually global accreditation, motivated by the trade agreements. These forms of quality assurance may provide a system of standards and evaluation applied commonly among institutions and their educational programs on a regional or global basis. Although the question, “what is a quality institution of higher education,” is at the heart of regional activity in the developing world, it is the globalization of the professions and the need to provide common professional preparation which is the fastest moving pretense for regional and global standards setting and accreditation.

There are recent global initiatives which also recognize the rapid internationalization of higher education and the need to assess its effectiveness. In the professions, a recent example of international accreditation is the 1989 agreement among the engineering accreditation bodies of Australia, Canada, Ireland, New Zealand, United Kingdom and the United States. Known as the “Washington Accord”, the accrediting bodies agreed to recognize the substantial equivalence or comparability of their respective processes for accrediting engineering programs. The accrediting bodies can make recommendations to licensing authorities in their home countries that engineering programs in the other member countries be treated as equivalent (Ascher, Ibid., 1996). The General Agreement on Trade in Services (GATS) of the World Trade Organization has begun to affect business as usual by encouraging the development of common educational standards, mutual recognition and the liberalization of the processes by which professionals are allowed to practice. Traditional nationalistic modes of quality assurance, including institutional and programmatic, will inevitably work in conjunction and/or give way to global forms of public protection and educational quality, beginning with professional education. Countries which have not established their educational systems based on rigorous standards of literally “world class” quality further risk the replacement of their professional labor force by those who have anticipates global mobility and have fine-tuned their quality assurance systems accordingly.

The Global Alliance for Transnational Education: Formation, Organization and Services

GATE was envisioned by the corporate sector and founded in 1995 by Jones International, Ltd., a multinational telecommunications corporation. Jones has since been joined by a number of multinational corporations including Coca-Cola, Ericsson Telecom and others. The first invitational forum of GATE was held in October, 1995, co-hosted by the Center for Quality Assurance in International Education and Jones International, Ltd. GATE's founding affiliates are individuals drawn from:

National Quality Assurance Bodies: Committee of University Principals, Republic of South Africa; Commission d'evaluation de l'enseignement collegial, Canada; Chilean Accreditation Council; Secretaria de Educacion Publica, Mexico; National Council for Education Awards, Ireland; Academic Degrees Committee of the State Council, People's Republic of China; and the New Zealand Academic Audit Unit.

National Higher Education Associations: Hungarian Rectors' Conference; American Association of Collegiate Registrars and Admissions Officers; The Laurasian Institution (Asia and U.S.); the Australian Education Office; and the American Council on Education.

Institutions with Major Off-Shore Offerings: Open University (United Kingdom) and Monash University (Australia).

International Organizations: The United Nations Educational, Scientific and Cultural Organization; the International Network of Quality Assurance Agencies in Higher Education; and the Organisation for Economic Co-operation and Development.

The founding affiliates identified three primary needs at the heart of establishing a new organization:

I. The need for a reliable and current data base of transnational educational programs globally

A major service of GATE is a global data base. For a list of “accredited” institutions of higher education and their programs, human resource divisions of corporations, qualifications authorities, admissions offices of educational institutions and prospective students (among other users) currently rely on multiple and expensive publications of various national and international bodies which are typically outdated by the time they are printed. These publications further generally list institutions which operate within national borders but do not usually list: a) the transnational educational programs of these institutions in other countries; b) the degree programs produced by the private/corporate sector; or c) the growing number of distance education programs which are “beamed” across borders to foreign national student bodies. The data base, being developed with the assistance of the American Association of Collegiate Registrars and Admissions Officers, will be in accessible printed as well as electronic form.

II. The need to develop cooperatively principles of good practice

Key to GATE's purposes are Principles of Good Practice in the provision of transnational programs. The Principles assist institutions and organizations in the development and evaluation of quality education which crosses national borders. They are adopted by national systems for application to transnational programs provided by their institutions of higher education, and/or they are applied directly by GATE in a centrally administered, international peer review process for quality assurance and improvement, requested on a voluntary basis. The latter use has made it necessary for GATE to develop a system of quality review, including the identification of qualified external reviewers and the establishment of an evaluative process which promotes and maintains educational improvement. At its first conference, participating countries envisioned using GATE as a process of external review for foreign programs wishing to enter their country.

III. The need for an international forum to coordinate quality assurance and other activities related to principled advocacy of transnational programs

GATE's founding affiliates envisioned a global organization of institutions of higher education, national higher education and quality assurance associations, intergovernmental organizations and national ministries of education, and major corporations dedicated to principled advocacy of transnational educational programs. Further, although higher education is key to GATE's purposes, the organization concerns itself with the full range of education including postsecondary, higher and post-graduate and professional continuing education and training. The participants of GATE will come from both industrialized and developing countries.

GATE's inaugural global conference took place in London in September, 1996 at which: the three needs and sets of activities above were endorsed by the participants; an international Board of Directors was appointed; a Secretariat was named, administered by the Center for Quality Assurance in International Education in Washington, D.C. Over time, GATE's operational centers are envisioned to be located throughout the globe. Membership for higher education institutions and organizations and governmental agencies is without charge as the funding resources for GATE is borne by the corporate membership.

GATE is a global organization which operates like many organizations with newsletters, access to data bases, invitations to global forums on specific topics of interest and an annual meeting. GATE's second annual meeting is scheduled for October 8-11, 1997 at the Ritz Carlton Pentagon City in Metropolitan Washington, D.C., USA. This meeting will be co-sponsored by the Programme on Institutional Management in Higher Education and the Centre for Educational Research and Innovation of the Organisation for Economic Co-operation and Development. GATE's time is right and those who have envisioned this new organization look forward to corporate, higher education and governmental communities joining in this much needed and timely partnership.

Executive Director,
The Center for Quality Assurance in International Education and The Global Alliance for Transnational Education (GATE)
Suite 370, Washington, DC 20036 USA
E-mail: millerb_gate(at)aacrao.nche.edu

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The Scandinavian - Russian partnership in networking and distance learning: next steps

Anatoly Lifshits

Introduction

At EUNIS'95 Congress in Dusseldorf the author has stressed the great importance of distance learning and networking for Russian enormous territory. Being the representative of one of educational institutions of Russian North West author has made a call for collaboration to the Scandinavian countries (EUNIS'95 congress, pp 55-71).

This call to collaboration was heard by Finnish colleagues in 1996 and now we have prepared a common Finnish-Swedish-Norway-Russian project in networking and distance learning. The target sectors are business and management for SME's -Small and Middle Enterprises.

The time of organising such common project in 1997-1998 was a good period due to European commission had decided at that time to develop several projects in the field of Cross-Border Co-operation (CBC) and gave special grants for such projects.

The Euro-Arctic Region - the ìNorth-Topî of Europe where are gathered the borders of the northern parts of Norway, Sweden, Finland and Russia is one of the most suitable region for CBC both from the geographical point of view and from the economical one. Therefore there was organised special CBC project called Interreg Project. One of its part is targeted to the development of telecommunications. The paper describes the under-mentioned project concerning to this part of CBC.

Scope

National and regional Chambers of Commerce and Industry (CCI) and surrounding them SME's of the above-mentioned four countries form the common virtual Euro-Arctic Chamber of Commerce. Naturally to serve this Chamber there is necessary to organise the integrated telecommunication network that gives the possibility for their collaborative economical activities. So described project is aimed at organising of such international telecommunication network and to use it in business and trade.

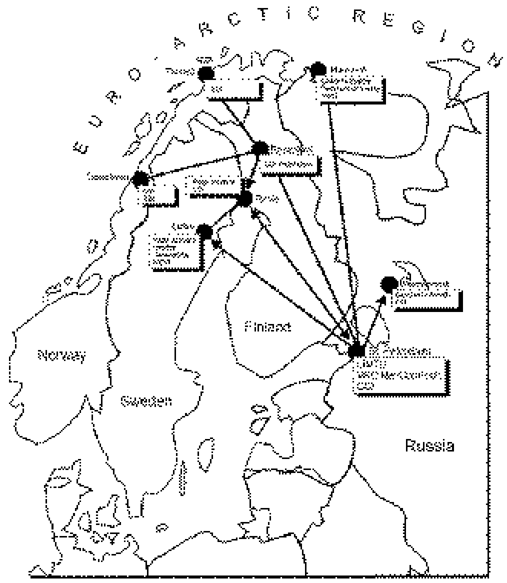
The main participants are: Kemi-Tornio Polytechnic (Finland), Rovaniemi Polytechnic (Finland), Telia Nera and Interbiz (research and project companies in Sweden), Murmansk Technical University (Russia), Murmansk research company in computer science ìComplex Systemsî (Russia), Karelian University (Petrozavodsk, Russia), Vocational Renewal Centre ìManagement and Computer Technologiesî (St.Petersburg, Russia) and Chambers of Commerce and Industry in above-mention sites. This project is financed by CBC (Interreg) program of European Union concerning Euro-Arctic Region. Sweden and Finland financed their parts as the members of European Community, the Russian part is financed by TACIS but from special CBC fond, Norway should pay their part from their own budget.

The ultimate goal of this project is to increase the exchange of information and international marketing of enterprises' activities and business opportunities in the Barents Euro-Arctic region for SME's by telecommunications.

The special goals of this scientific, teaching and business oriented project are:

- to establish telecommunication system (including Internet) in Euro-Artic region;
- to provide the information communications with information transformation of the national commerce and industry databases using Internet and Russian RBC-NET;
- to provide the distance learning courses for managing target groups in above-mentioned countries in Euro-Arctic region.

The main difficulties in research part of this project deal with developing of suitable telecommunication system for information exchange regarding that Russia and EU countries use different standards and formats of databases and information exchange systems. The CCI's and SME's in western countries use Internet wherever the Russian customers mainly had only E-mail in the best case. Big cities as St. Petersburg and Petrozavodsk are the exceptions. These difficulties will be overcome due to establishing special information analytical center in Russian institute ìComplex Systemî in Murmansk. The educational distance learning process for all participated countries will be managed by Vocational Renewal Centre in St. Petersburg through auxiliary groups in Tornio (Finland), Murmansk and Petrozavodsk (Russia). (See fig. 1)



Euro-Arctic Russian-Scandinavian Distance Learning NETWORK

Fig. 1

Work packages

The project includes several work-packages. Each work-package has one responsible partner and several active partners involved.

The following work packages are thoroughly prepared now:

- User-need analysis
- Specification
- Developing
- Education
- Verification
- Demonstration
- Exploitation

The brief overview of the main of them is presented.

User-need analysis.

There are two main types of users in this project:

- the end-users from the small and medium enterprises (SME) in each country participated;
- the Chambers of Commerce and Industry (CCI) in the same places.

The CCI's also may be divided into two classes:

- the CCI's, who will be responsible for electronic publications;
- the other CCI's.

User-need analysis was made in several sectors and include the assessment of information, technical (including telecommunications, hard and software) and educational needs. The stress was put on the peculiarities of development of the virtual WWW-site called Euro-Arctic Chamber of Commerce and Industry (EACCI).

Specification. Specification includes three main phases: pilot studies, substance design and solution design.Pilot studies include: present status analysis, objective status analysis and project design.

Substance analysis includes: notion analysis, task flow analysis, inter-actions design, user interface design, form design, access path analysis, data storage analysis, data communications design.

Solution design includes: normalisation, file design, database design, cartage group analysis, design of processing regulations, design of integration of Russian databases to EACCI.

Developing. The main part of this phase of project includes the establishment of the Analytical - Informational Centre in Murmansk and development of computerising technologies for electronic exchange of information in Barents Euro-Arctic region via Internet. The objectives are to design, to develop and to create communications and exchange of documents between the Chambers in EACCI, to create common site for electronic publications, to develop informational data bases for EACCI and to develop infrastructure of EACCI, in order to serve SME's in EACCI.

Education. The educational part of the project was done under leadership of the Vocational Renewal Centre (VRC) ìManagement and Computer Technologiesî from St. Petersburg due to its experience in distance learning.

The educational target groups are:

- personnel of the active CCI in EACCI, who will be responsible for electronic publications and the future system of EACCI;
- personnel of the other CCI in EACCI;
- personnel of other regional SME's;
- technicians and other persons to be involved in project developing (on the consultation level).

The main educational objectives of the project are:

1. To develop the educational methodology and training methods and to prepare the following materials:

- the training programme;
- the course modules for the above-mentioned target groups;
- the training materials;
- the business game;
- the appropriate CD ROM containing the above mentioned courseware and issues.

2. To provide the training of trainers (face to face and telematic workshops, seminars, consultations).

3. To provide the pilot course for the above-mentioned target groups in each participated country.

Before the beginning of the preparing the training materials it was necessary to analyse:

- the peculiarities of how to use telematic services and how to organise both in-country and international business for SME's in Russian part of Arctic region to be covered;
- hardware, software and information solutions to be provided for the East-West communications for SME in EACC project;
- previous similar educational projects;
- the possibilities of using the results of pervious similar educational projects (using INTERNET etc.)

The economical and geographical peculiarities of the project, the composition and disposition of the users' main principal role of telecommunications defines the distance learning as the main learning technology in this project.

Training courseware

The training materials to be done will include work-book for students, the trainer's guide, the business game documentation and the CD ROM.

The work-book should be done in modular form and should include the necessary basic information, learning materials and exercises for the activities in most useful topics for target groups: accessing the market; preparing the product for the electronic market; electronic publication in progress; looking for necessary information in electronic data base; in-country business through electronic communications; international business throughout electronic communications; information retrieval; security; billing etc. In every module the most appropriate telematic application should be chosen and practical exercises should be included.

The business game will be an important part of learning process. It will be prepared in order to give hand-on practice in using of different telematic applications in the CCI's and SME's business. The appropriate modern software and information solutions should be taken into account within different project activities.

All necessary documents are to be prepared: the games project, scenario, time plan, game's programs, participant's guide etc.

The target group in the business game are:

- personnel of CCI's;
- personnel of SME's
- personnel of Murmansk information analytical centre.

The CD ROM has to include all essential information in electronic form to provide training process of upper-minded target groups and also to self-study. The CD ROM will detail the contents, the material and structure, as well as the technical aspects such as the media (text, video, animation, still images etc.), hardware and software platforms to be used.

The CD ROM should contain training support tools during the standard course and also a self-training stand-alone tool for users of upper-mind target groups who either will not attend the EACC courses, or who will repeat the learning material.

The trainer's guide includes the methodology, programme and techniques of training process. It will also include in details the training instructions to all lessons, practical works and business game.

As to language - the course materials and CD ROM will be prepared firstly in English and after verification will be adapted upon the nationals needs and translated by partners into the national languages if necessary.

Distance learning activity

The learning process will be distributed in space and time. The central control class is planned to be organised in VRC in St. Petersburg, where all necessary educational and telematic equipment will be installed.

In each national or regional district there will be established smaller local classes also equipped with all the necessary but not so sophisticated tools. Each SME to be participated in pilot course should be at least equipped with computer, modem, telephone with loudspeaker and fax. Each CCI should have necessary networking and computer equipment.

After preparing the training materials, technical and software telecommunication the educational process envisages the following parts:

- selection pilot trainers national and regional pilot trainers;
- providing the first international face to face workshop to the trainers;
- selection the national and regional training groups;
- preparing the regional classes to the pilot groups;
- delivering the training materials for both trainers and trainees;
- providing the international and regional telematic workshop to the trainers;
- providing the pilot course for the target groups;
- providing the final face to face international, national and regional seminar after pilot course;
- preparing necessary updating in the learning materials;
- preparing the educational training programme for the follow up period after the project will be finished.

Discussion

As numerous research groups around the world are refining the art of creating telematic-based co-operation, and several have proven to be quite effective, there is a growing consensus among researchers and practitioners that more should be done in the form of international collaboration and joint innovative projects. Especially it is important for distance learning.

But there are many difficult problems on this way. Russian specific economical, historical and cultural features and traditions contribute also into the complexity of the research and development scope. Also educational theorists are in need of tools for evaluating new educational strategies and alternative curriculum models. But the successful maintenance and finishing of the described will help to develop coherent educational experience.

Telematic itself has now rather poor methodological level. Current, "information base" models of information access, particularly for the evolving Global Information Network and World Wide Web are limited. To be organised effectively telematic projects must has access to, and facility with, modern specialised systems, software and interfaces. The project will work to take advantage of - and drive - the technological collaboration in the Euro-Arctic region and evolution of the Global networking. We propose the development and dissemination of educational programs that are rich in use of media and easy to use, adopting a more familiar, television -like `look and feel'. Moreover, these programs will teach: they can provide coherent and comprehensive information about new forms and ways of international business, assist the learner in information retrieval and provide a basis for further learning.

Now there is a growing demand for co-operation in life long and open learning. This project is a first step to wider and closer collaboration in this field. We do hope it will help to analyse the problems embedded in such a radical change of the role of telematic and the obstacles for such change.

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Vocational Renewal Centre ìManagement and Computer Technologiesî
Gastello12, St. Petersburg, 196135, Russia
E-mail: alif(at)limtu.spb.su

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INNOVA Project:a Proposal for Fostering Electronic Teaching and Learning Based on the WWW.

Enrique Rubio-Royo, Antonio Ocón-Carreras, Manuel J. Galán Moreno

Towards New Paradigms in Teaching and Research; Academic Computation Challenges

Nowadays, any organisation (specially universities) faces an scenario characterized by the consolidation of a new paradigm (evolution towards Information Society or Economy) which requires a modification both in its structures and behaviors, in as much a new definition regarding its mission and goals, a new strategy of competitiveness based upon technologic innovation and information.

The evolution of Information Technologies and its introduction in the scope of teaching and research, give arise a wide spectrum of new possibilities (most of them not yet explored), which not only promise an improvement in the productivity of learning process, but also a qualitative change in its nature. At the same time, the consideration of knowledge as a fundamental resource in the economy of information, and the substantive changes in society, enterprises, and labor, are fostering an increasing demand of formation and learning to suit the needs of new professional qualifications and its rapid changes, which makes more evident the obsolescence of existing qualifications and formation, and the lack of relationship between the productive system and curricula, and low proficiency of the traditional model of teaching (expensive and slow).

So, at this moment, the environmental conditions are becoming optimal to put on the foundations, with a certain warranty of success, a new model of creation and transference of knowledge. In fact, due an increasing demand of a more productive and cost-adequate formation, best suited to socioeconomic environment; requires a research activity which should not be divorced to lecturing and vice-versa. In this sense, the Information Technologies are providing great expectations in the field of formation regarding two new formative contexts and new forms of interaction.

Besides, those aspects of Information Technologies make possible the elaboration of several proposals that come from Education Theory (Jean Piaget, Seymour Papert, Vygotsky, ...) based on teaching techniques which emphasize in bi-directionality, participation, collaboration and inter-disciplinarity, instead of traditional approach based upon passivity, individuality, uniformness and unidirectionality.

In this context, a new foundation for the creation and diffusion of knowledge is proposed, which should be well suited to the Economy of Information, considering the organization as a shared information network; and as a result of a integration and synthesis of different aspects and several considerations as:

The proposal of a prototype of an architectural model of formation and learning based on a shared network of formation and information, the convergence of Library services and Academic computation, the definition of scholar information services based on the design of the organisational information cartography, and the convergence of the different models of teaching (Ocon, 1.995), as shown in fig. 1.

Under these circumstances; which are going to be the new challenges for academic computation (lecturing and research), in this new times of revolution in scholarship and knowledge concepts?

During the eighties, there was, generally speaking, a massive introduction of distributed computing in higher education environments. During the nineties, after the initial explosion of the eighties, we can say that academic computing is reaching its teenage. Indeed, we are shifting from a fast and chaotic growing to a development of ways that involve an institutional dimension, new paradigms in teaching and research, and new models of information services management.

By this way, academic computing should provide the creative basement of an increasing academic population in a rich information environment (through the use of Internet).

So, one of the most important aspects which modern academic computing is facing right now, deals, more than technology itself, with the need of warrant the access to a living information environment, and from this the needs of developing new media for this goal and, at the same time, reduce the interval of time between the creation and diffusion of knowledge.

Another aspect which should be considered is to provide an adequate management of academic computing, considering the great differences relative to the eighties point of view: from mainframe to desktop computing (due to the increasing power and decreasing price of personal computers and workstations). This trend produced a shift from computation and programming languages, devoted to calculations, to personal productivity tools and applications; from reduced technological environments to a widespread community of users; etc.

In this circumstances, which new technologies and which new learning and reearching applications will be the key for innovation in academic computing?. Which new challenges will they bring to the supporting groups these new applications and technologies?.

We consider that academic computing will be characterized at least by this three new classes of computation:

1. An increasingly rich information environment, which will require the access and processing of great amounts of data.
2. Visualization and post-processing tools (that transform raw data into 3-D presentations and animations), which are able to show the temporal evolution of a given process.
3. Composition and management of hyper-media and hyper-text documentation (web publishing).

Starting with this considerations, the ULPGC is developing institutionally a Plan for Innovation Technologies whose goals are, fundamentally:

1. The deployment of an infrastructure of global information - ATM Corporate Network - (http://www.ulpgc.es/ulpnet/index.html) which permits an all-with-all connection.
2. The development of an electronic edition and publishing environment, based on WWW techniques, which simplifies and improves electronic teaching and learning - INNOVA Project (http://www.ulpgc.es/cicei/innnova/index.html).

In the following paragraphs, we will describe these two plans in more detail.

The Voice Integrated Network, "ATM" Data of the University of Las Palmas de Gran Canaria (ULPNET)

The first action proposed by the earlier mentioned Plan of Technological Innovation of the ULPGC, was developing its own infrastructure for information (INFOestructura) that would permit a universal access to the resources and services of information.

On the basis of technological homogenicity and unity of the network and after a deep analysis, we though convenient to adopt the ATM technology (Asynchronous Transfer Mode) rather than SDH (Syncronous Digital Hieranchy) for the integration under a single network of the transmision of any type of information (voice, data, video, etc.). The next step forward was negociating the metropolitan infrastructure to allow communication between the different units of our university. In August, 1996, we signed an agreement with the Spanish National Telephone Company for implanting the Corporative Network of the ULPGC. its scheme is shown in figure 1 and its main features are the following:

1. ATM switches are used (initially, 10 FORE units whose models are ASX-1000 and ASX 200), placed along the different departments of the university and connected by means of multimode (in the university grounds) or monomode (in the metropolitan areas) fiberoptics. These switches have a capacity of 155 Mbps, with the capacity of migration to 640 Mbps
2. The data transport is carried out by direct connection between the main servers and the ATM switches (ten of them, initially) and the costumer servers or stations through a total of 45 Ethernet commuters with access to ATM (FORE 3810 equipment, which will be called from now on LanSwitches), providing nearly 2200 ethernet points. In any case, the commuters installed initially represent the trunk (Backbone) of the network, considering the use of of ATM commuters to facilitate direct access to work groups over ATM as long as this technology is more economic and readily accessible.
3. The voice transfer is dealt with the acquisition of IBERCOM switch boards, as well as by substituting MIC circuits (E1 at 2 Mbps, supplied by the Telephone Company) in these switch boards by links of the same speed, supplied by cards addapted to the ATM commuters
4. The video transfer will be carried out, in due course, throug codificator-decodificator equipment (CODECs), connected to the ATM switches.
5. University delegations in the other islands (Tenerife, Fuerteventura and Lanzarote) will have digital switch boards using added RDSI channels, separatinf the data traffic by means of a router.
6. As added values to the network, we contemplate a 128 Kbps connection to IBERNET (the TCP/IP network of the Telephonic Company), with access to the Internet and to InfoVia, as well as the creation of 4 Videoconference rooms in different departments of the university.

Obviously, this network must proggressively substitute in a non traumatic manner previous infrastructures of voice (IBERCOM network, supported by MIC links) and data (FDDI ring at the campus of Tafira, with links to the other buildings).

This network project requires the existence of adequate wiring in all buildings, in such a manner they can be distributed with the 10BaseT Ethernet standard connections to the LanSwitches. Since the location of the buildings is variable we will implement wiring in the 23 buildings that lacked this infrastructure. We expect this to be completed and operative in about 2 years time.

External connections have developed in a similar manner as internal connections, changing in a short period of time from a 9600 bps line (it used to link the ULPGC with the IRIS network, a 2 Mbps line which belongs to the Canarian I+D network (REDIC), connecting the 3 main research and development units of the Canarian Community: the University of La Laguna (ULL), Institute of Astrophysics (IAC) and the ULPGC, with access to this network through both universities, all other units by means of RDSI connections. The backup of the backbone links (the 2 Mbps IAC-ULL and IAC-ULPGC links) is also through RDSI. The IAC maintains the connection between the Canarian Network and the IRIS Network through an ATM link from the GIGACOM service of the Telephonic Company, at a speed of 4 Mbps and backup by primary access of RSDI (at 2 Mbps).

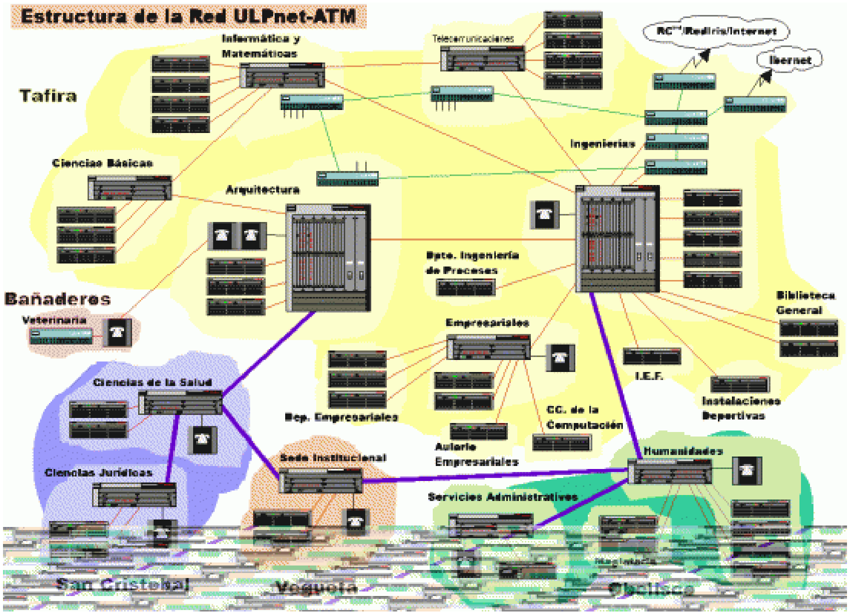

Figure 1

The agreement between the ULPGC and the Telephonic Company introduces a 128 Kbps connection to the IBERNET, with access to the Intenet via InfoVia.

INNOVA Project: Plan for the improvement in the quality of teaching.

As an action inside the Campus Innovation Model, and in the scope of the Plan for the improvement of quality in teaching, a proposal was done in early 1997: the first call for Teaching Innovation Projects of ULPGC. The goal of this call was to stimulate the adaptation to the new paradigms of formation and learning, which implies a new kind of teaching and learning far apart from the traditional models. Inside this Call, the INNOVA Project was presented as a proposal to promote electronic teaching and learning based on WWW technologies, in as much to take advantage of the investments done by the university in the aforementioned Corporate ATM Network (ULPnet).

Before going to a more detailed description of this project, we will try to identify the potential of WWW as an educational tool. Iun this sense, the most important characteristics can be summarized by the following:

- Hypermedia capabilities (Hypertext and Multimedia)
- Information distribution and sharing capabilities, open to Internet
- Free availability of servers, clients (browsers), and auxiliary applications.
- Wide interactive capabilities (forms and cgi-scripts)

Relating to the process of learning, we can see four main actions of web technology:

1. Web as a Tutor: An excellent environment to design hypermedia tutorials and lectures, for local and remote use, in which the student is able to control the speed of learning process
2. Web as publishing supporting tool: Making possible the publication and organization of

student on-line multimedia works and projects, with links to many references and network connections, in opposition to the traditional role of the student as "publisher" associated to conventional Information Technologies: books, papers, classroom presentations, etc.

3. Web as a Forum: The web is an exceptional base for debate and virtual exploration and discovery. It should be note that web is the result of the evolution of Internet in a friendlier environment that enables the interactivity with a complex set of Internet protocols: News, distributions lists, online discussions, etc.

4. Web as a Navigator: The capabilities and simplicity of navigation, exploration and search is another differential characteristic of the WWW. Increasingly, there are appearing searching and indexing tools (Altavista, Yahoo, Lycos, ...) which facilitate the organization of resources, giving "online guides" which are fundamental for the design and development of a "cartography of knowledge".

Under this point of view, INNOVA Project tries to foster the online teaching and learning in an information-rich context, with application to:

1. Common shared subjects of the Scientific and technical curricula
2. An specific curricula (Industrial Engineering School)
3. Standard software productivity tools (WWW software, AutoCAD, etc.) with the counsel of differents services and resources of information (Language Laboratory of ULPGC, Computer Laboratory of Sea Sciences School, publishing and Library services of the Engineering Building, CEANI and CICEI).

The main reasons of this proposal were:

- The need to provide a novel learning environment, according to an rich-information atmosphere, in opposition to the traditional approach
- The technological barriers of this new environment are disappearing as Information Technologies evolves and bandwidth increases, which will give rise to a quantum leap in the nature of learning itself.
- The obvious economical advantages of this approach
- The need for the future labor market of new skills for our students, not provided by traditional curricula.
- The cooperative experience in formation and production, and the research about new pedagogical and methodological criteria inside the aforementioned paradigm shift.

The sought objectives and contents are:

- Promote and develop online learning and teaching based on WWW
- Get returns from the investments made in computing and networking facilities in the ULPGC
- Cooperate in the sought cultural drift, towards learning and teaching skills based on Information Technologies, which is necessary for studenty, faculty and staff of our university.
- Establish the principles and tools for a publishing environment based on WWW, with the following points:
- Formation of the participants
- WWW concepts
- HTML Language
- WWW Edition
- Design and development of a generic prototype of interface (institutionally wise), based on WWW, with application to different subjects involved in the project.
- Development of user interfaces, to facilitate the accessibility and use of standard productivity tools, WWW software and AutoCAD
- Develop utilities and tools to facilitate on-line tutorials authoring
- Propose a methodology for learning projects, based on WWW (style guides, rules and stages)
- Enumerate possible technologies related to electronic learning environment
- Integrate the publishing services into the corporate ATM networks
- Start the Scholarship Information Services in the field of Engineering, with the aim of developing the knowledge cartography.

In relation with this proposal, we have taken as starting point, the prototype of instructional interface devised in "Introduction to Computer Sciences" subject:

http://www.ulpgc.es/etsii/departam/inform/inf_bas/si/index.html

with the following aspects: "General Data, concepts and definitions, objectives, evaluation, contents, recommended practices, tests schedule, bibliography, electronic supporting material, collection of exercises, e-mail distribution lists, etc.".

As a possible initial structure for the lessons of the course, the following scheme is proposed:

"Introduction, objectives of the module, index of contents, summary, conceptual map, proposed activities, advanced exercises, self-evaluation tests, solutions to the exercises, glossary with basic concepts, thematic index"

Among the different tools for the course, to be progressively included in the development environment, we could mention:

"Notice board, real time chat, on-line questionnaires, student self-evaluation, e-mail, images archive, page annotation, shared blackboard, student management, student presentation areas; etc".

We should point out that the particular level of development and complexity of the instructional WWW interface for each subject will depend not only on the development of the production environment, but also on the personal and individual commitment with the improvement of teaching quality.

Finally, with this INNOVA Project we have tried to adequate, inside the field of teaching, to a new context characterized by the intensive use of information. Through the use of "VIRTUAL CONGRESSES" we seek to accomplish the same goals in the field of research and knowledge transference. A first experience on this possibility was performed on the "Primer Congreso Virtual Hispano-Americano de Anatomía Patológica" (First Spanish-American Virtual Congress on Pathologic Anatomy), (May-June 1997, http://www.ulpgc.es/conganat).

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Spain
A E-mail: rubio(at)cicei.ulpgc.es

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Hypermedia Technology for Lecture Courses: Selection Strategy, Development and Realization

Vladimir I. Trukhin, Aleksandr N. Sandalov, Natalia A. Sukhareva

Introduction

The structure of university education expects an unity research and education activities both on the part of professorial teaching composition, and with students. One more distinctive part of university style of education is possible to united education and research from the level of waking students selection to university, the level of unceasing professional improvement a professor teaching and research composition. Naturally that all infrastructure elements, ensuring operation of university as a whole and a department in particular are created and developed according to united " selection rules".

Information components, on the technological level - Information Computer Network (ICN) - are actively increasing elements of infrastructure of the department. At a rate of university tasks network facility, on source ideologies present itself distributed system, oriented on experimental and computing procedures, added by the database with information reference and search subsystems. This concept was taken for the base created and developed on the function system structure of information education process support, oriented on the extension of spectrum of research facilities applicable when studying of general and special physics discipline and humanitarian cycles.

1. ICN of Physics Department at MSU

On the modern stage of integration of Physics Department at MSU in the world scientific community, currently unceasing telecommunication system development, as at a rate of the department ICN infrastructure and its access to global Internet ensuring functioning to the work of the professors and researchers with international information and computing resources. Under developing should understand not only equipping Physics Department with computers and software, as well as literate usage, information filling and active use ICN of the department, introducing the modern information technologies to the education and research activity. Thereby, speech goes not on purely technical problems, but on the essential realignment scientifically methodical style of activity professorial teaching and research personnel, on radical change in organizations of cognition process, technologies of acting the scientific studies and educating the students.

High speed performance computer network are in use on Physics Department since 1992 [1,2]. ICN structure is divided into several local groups to internal network, with output on fiber - optics (100 Mbps) and coaxial - cable (10 Mbps) links to external channels. Internal network of the department comprises of at present time near 400 computers in local network on IP and more than 500 computers on UUCP.

According to the program of ICN development, passes a connection on fiber optics links of the three remote building as a part of the department ICN. Each of the remote buildings creates an own local network, falling into united. Now all 32 subdivisions of the Physics Department have a direct access to global Internet. For raising network reliability in the nearest future provided creation an ring network structure with transition on the topology 10baseT, using twist pair as a transport media, with the realization of speed 100 Mbps. Under given topology is ensured high intolerance, broad possibilities of checking and control of the network condition. Constantly developing architecture of network is accompanied operative on modern technologies of ICN with phased rearranging the most busy traffic segments of network.

Integration with global Internet at present time based on two MSU links to the Europe: through the NPI of MSU to Germany (1 Mbps) and to France (256 kbps) and one link to US through the central MSU node with the connection to Moscow Backbone.

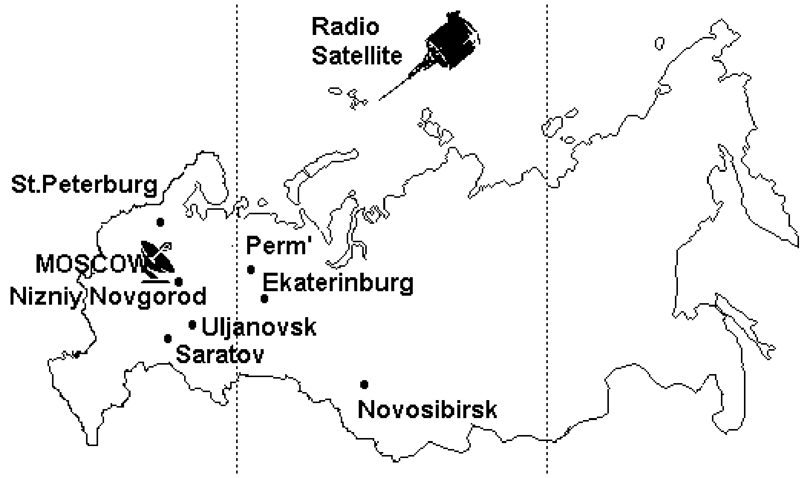

Fig. 1 Universities centers supported by the MSU overland satellite station.

At January 1994 within the framework of the federal program "Universities of Russia" was established the computer network of Russia universities - RUNnet, which primary task is a maintenance of united information space of Universities of Russia and integrate with world science and education community. Federal Moscow region node of RUNnet are located at MSU. Physics Department is an antenna equipment operator of high speed performance (till 2 Mbps) link with such powerful regional education and scientific centers, as Novosibirsk, Ekaterinburg, Nizjni Novgorod, Perm, Ulianovsk and others (Fig. 1) through the overland satellite station, located on the Physics Department building.

On transport characteristics ICN of Physics Department is divided into: local area network, UUCP network and external links. Local network is based on topologies Ethernet 10Base5 with use as a transport media fine coaxial cable and consists of several segments, united through the Central Department Node. Maximum segment length is 200 m under 30 computers in it. For longer segments use repeaters and 4 subnodes with the routers. Exchange protocol is TCP/IP that allows a natural integrate the ICN infrastructure to the global Internet community.

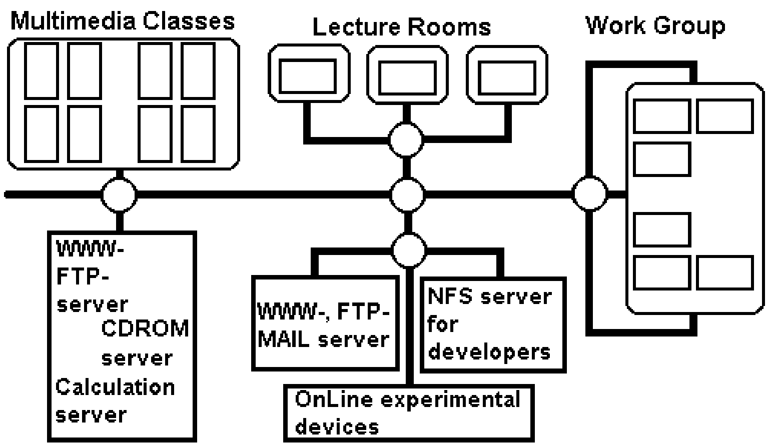

Fig. 2. Block diagram of training support segment of ICN of Physics Department.

Segment, physically realized information training support on logical solution is an independent subnode of ICN, based on three lecture department auditoriums (300 sits each), consist from Server group", Auditorium group", "Working group" and Multimedia computers classes (Fig. 2). In 1996/97 academic years this segment used as transport media the fine coaxial cable and was built on topologies Ethernet 10Base5. How has shown a practice to its usages, forecaster increase of the used information resources and conducted on separate segments of functioning with experimental devices in the on-line mode, transport parameters and level protection inhere are on the upper level of limit. Is it in the nearest future plans is a reconstruction of segment with transition on the single mode fiber optics link together with use in some parts transport media based on twist pair.

Thereby, developed and realized on Physics Department ICN infrastructure allows to realized the whole spectrum of modern information technology for support research and education activities.

2. Information training subsystem: purposes and tasks

According to accepted concepts, ICN is a natural element of scientific activity, seriously changing distribution of the accents in the planning and processing the physics research. Full-fledged entering a information support in the training process can be reached under the simultaneous presentation both forms, and contents of network resources. Here under the form is understood technology of remote access to hardware and software of physics research centers, databases, information search systems. At the selection "contents" of network resources, proposed attention of students, we are intelligently refused from use or development of large number of our own made simulation programs, having shifted accent on adaptation for the concrete training courses research or technologys programs. Such approach allows when functioning on the training material not only to explain strictly essence of fundamental physics phenomenas, as well as preview modern tools of investigations in considered area, ledge-fumes to the culture of data gathering and processing.

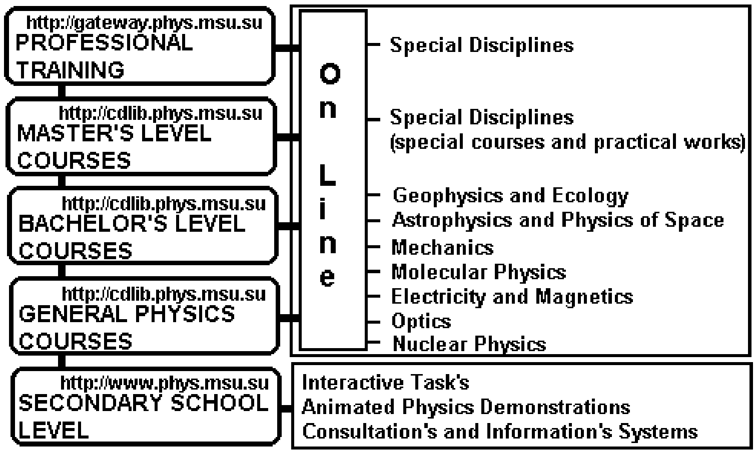

Fig. 3. Courses of physics cycle with introduced by the information support. Physics Department URL servers is shown.

Information providing of education in the auditorium regime processing or under remote access to material now is realized on Physics Department on the whole "educational vertical" - from the system of underuniversity teaching secondary school, students to the system of professional training courses for teaching personnel. On the Fig. 3 is presented realized for 1997/98 academic year "tree" of information support, first of all oriented on the physics courses, technics and technology of modern physics experiment. During 1997/98 academic year on-line mode processing information support consists 32 hours per week for physics profile cycles and 38 hours per week with the account of mathematical and humanitarian cycles.

3. Information lecture cycles support

Introduction of hypermedia support in lecture cycles in the first step of realization the information providing program of education process is connected with the high efficiency of auditorium work, allowing combine a qualify usage hardware part of the information system, ensuring professional explanation of material and broad envelopment of student auditorium (near 200 students).

Hypermedia facilities for lectures we were divided on three classes:

- Interactive;
- Illustrative;
- Informative.

Each of these classes stands out a number of categories.

Interactive class:

- Experiments on remote devices in on-line mode;
- Processing the results of the experiments on remote servers in on-line mode;
- Remote calculations on coordinated algorithms;
- JAVA applications;
- PERL Script interfaces;
- DCR - Shockwave modules.

Illustrative class:

- Slides, prepared with using the sources from common access;
- Connection to systems of global monitoring;
- Video fragments of format QT Movie, MPEG;
- QT Virtual Reality files;
- VRML - modules;

- GIF - animation.

Informative Class:

- Servers of research centers;
- Servers of companies-producers of experimental equipment;
- Measurements and diagnostic systems;
- Thematic journals;
- Lectures collections;
- Thematic reference database.

Selected to each concrete lecture and systematizing material gathered in separate Web directory with the context page and are afforded in common access.

4. Information support out of classes

Continuing an information support of lecture courses is to show - preparing the material, provided to clients (students, schoolboys, teachers) in out-line mode. At the development of formats of presentation of material was taken into account established at present transport media features, typical configurations of computers and modems, which turned to students account. There are in view of not only university links, but, first of all connection from the homes nodes. Addressing to this service client can, depending on parameters its link, use HTTP -, FTP - protocol, or from the September 1997 - mailing-list.

Below is a list of materials for specified a type of service:

- Hypertext version of original textbooks;
- Programs of courses;
- Lectures texts;
- Seminars programs;
- Typical tasks of seminars;
- Programs of practical works;
- Exams material;
- Program and task of entrance exams.

All facility are submitted in Russian language.

5. Realization of program of interactive distant access

Development of elements of interactive distant access system is conducted with the emphasis of experimental physics studies priority, technology of gathering and processing the experimental data, operating with search systems, shaping the databases. At present time following five distant service elements are developed:

- Interactive measurement complex, working in on-line mode. As an example of working element - precision measurement system, created on the base of 24-bit ADC.
- Interactive systems of processing experimental data on special algorithms, requiring computing resources, exceeding standard PCs possibilities.
- Interactive systems of simulation complex physics processes..
- On line consultations.
- Learning to principles of operating with search-information systems and databases.

Thereby, interactive remote service affords for the students full spectrum of exploratory facilities, to which it can appeal both with educational purposes and conducting strictly scientific studies in the laboratory.

6. Unification of presentation of hypermedia resources

As a rule, lecturers developing and selecting their own hypermedia modules. Variety of tasks of different courses, bridge of operative switching between different applications and exhibits has required an entering the coordinated restrictions on types simultaneously (in session of functioning) downloaded applications. These restrictions are basically imposed device features of technical accompanying facilities (LCD- panels and the workstation). Distinctive structure of workstation hardware must have the next configuration:

- Pentium >133 MHz
- Net Card, exchange rate more than 9600 bps
- Operation memory > 32 Mb
- Hard disk >1Gb
- AudioCard 16 bit
- VideoCard STB Powergraph 64V (1 Mb video memory)
- Integrated amplifier and speaker system.

Functioning the lectures workstations goes under Window's NT or Win95 depending on desires of lecturer. In separate events, define connected by resources, provided transition to X-Windows. Browser - Netscape Navigator or Communicator with the additional programs-helpers.

Base operation system for developers of programs resources and interfaces hardware-programs module is installed by UNIX (Free BSD); for the development the modules of video graphic support is recommended system Windows NT, programs packages for data analysis and graphics results presentation - Mathematica, MathCad, programs packages of graphic processing - Adobe Photoshop, Adobe Premier, Adobe Illustrator. System of digitization of video signal is built on the base of card-converter MiroVideo.

Selected standards allow us to use an extensive bank of the exploratory program module, practically exclude a barrier when turning from educational using software programs to strictly scientific studies. Standards debugging exhibits is provided on stage of their making by using the united facilities with NFS server, containing specially selected and testing programs packages.

Summary

Designed and pass an annual experimental usage system of information support an education cycle. Main attention of at the point development and introducing a system spared for adaptation technics and technologies modern experimental and basic research to scholastic tasks of university course general and special physics disciplines, in the first place needing for the modern interactive information support. During 1996/97 academic year in lecture courses were approved following elements of information supports:

- Undertaking the experimental measurements on removed automatic complexes in on-line mode. Executed functioning on installation on studying the electrooptical characteristics of liquid-Crystal samples (Kent University), polarization microscopy.
- Connection to systems of planetary, overland, satellite and interplanetary monitoring.
- Undertaking a processing the results of the experiment with attraction of resources remote calculations servers on coordinated algorithms. Executed experimental data of ellipsometry measuring, calculated series of Fresnels holograms on MIT servers. All procedures were conducted in the mode direct access from the terminal of workstation, located in lecture auditoriums.
- Adapting the exploratory program complexes to problems of educational courses.
- Adapting the measurements system drivers to tasks scholastic demonstration experiment with the translation its in on-line mode and common access on the standard network protocols.
- Using the whole software programs spectrum of net interactive modeling with various multimedia applications: JAVA, JAVA Script, QuickTime, QuickTime Virtual Reality, VRML, PERL Script, Shockwave Flasch, Shock-wave X-Director, MPEG.
- Hypermedia databases for General Physics course: Mechanics, Molecular Physics, Electromagnetism, Optics and Nuclear Physics was developed.
- Hypermedia databases for courses Geophysics and Ecology, Astrophysics and Physics of Space, includes original facts from national and international research centers, operating in on-line mode with planetary monitoring systems was created.
- Practically realized a project of distance education with lectures demonstrations support.

Generalization of developments for lectures courses is presented in the manner of constantly complemented directories global information resources (hypermedia-directories) and with August 25, 97 will be on the common access. Technical and technological aspects of information providing, established during present elaboration, recommended to introduction for physics and research departments at Universities and secondary Schools of Russia.

URLs of MSU Physics Department WWW- and FTP-servers, affording results of present development to common access:

HTTP-protocol	***FTP-protocol***
www.phys.msu.su	cdlib.phys.msu.su
cdlib.phys.msu.su	gateway.phys.msu.su
gateway.phys.msu.su	

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Physics Department, Moscow State University,
Moscow, Russia
E-mail: dean(at)phys.msu.su, sandalov(at)phys.msu.su, suhareva(at)gateway.phys.msu.su

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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Hypermedia Support Practice in General Physics Course

Viktor A. Aleschkevitch, Natalia A. Sukhareva

Introduction.

Information space of Universities of Russia currently has gained a firm regional structure, practically repeating earlier established hierarchy of research and scientifically-methodical schools. As had shown on Russias national and international higher education conferences which were held in 1997 the physics education now based on stereotypes of work on insulated personal computers. The global information networks resources brings a new possibility and technologies to the field of education in physics discipline at the university.

In the presented exploitation through introducing an information providing in the concrete university course, is perfected infrastructure elements of information support in lectures courses, recommended for turning to account at Universities of Russia. Here are not discussed technical and technological aspects of hypermedia providing, but only "initial and border conditions", introduced when making concrete forming general problem of dataware.

Introduction of hypermedia resources in the process of education has put up and required solving four heterogeneous problems:

- selection and development "profound part" of hypermedia supports,
- creating a system of training of developers of hypermedia-systems,
- creating special training program for professorial-teaching personal, using hyrmedia support,
- set up special WWW- and FTP- servers, ensuring systematization information, recommended to introduction in universities and secondary schools of Russia.

Reference positions of hypermedia providing for general physics courses.

Making a base of information resources first of all oriented to the support and development of physics education level, shaping an information working ambiance, generalizing high achievements in the field of methods of scientific research activity.

Basis of university physics education is a general physics course, which interpretative as a course of experimental physics with the detailed presentation of technology and technics of classical and modern physics experiment, methods of modeling of complex physics processes.

Development of experimental physics pass the evolution from the individual labs of alone-investigators, through exploratory groups at universities, national exploratory centers to global international exploratory consortiums. Each stages is characterized with experimental base, determined by the development level of and division of functions when running the concrete measurements. With such standpoints, global network structure of information support presents by itself a regular stage in development of logic in experimental process governing, technologies of data gathering, analysis and generalizing the experimental results.

Priority of experimental operating stages in processing entering information mortgaged in the hypermedia providing base for general physics courses.

Module structure of lecture hypermedia support.

Building lectures hypermedia support on different sections of general physics course passes on standard sequences "steps" for exploratory functioning.

1. Observation of physics phenomena.
2. Choice physics models.
3. Undertaking a qualitative experiment.
4. Processing the results.
5. Computer simulations (modeling).
6. Correction physics models.

7. Undertaking a quantitative experiment and reception of values of physics values.
8. Comparison with analogues from the database.
9. Registration new results in the database.

At present time in the open access submitted varied multimedia elements which allows to realize a flexible information educational material support on positions 2, 4-5-6, 8-9. However, the most important for the general physics courses positions 1, 3 and 7 while insufficiently provided by corresponding information blocks.

In past academic year a work on creation by the module an hypermedia support for lectures in general physics was divided into two directions:

1. selection, analysis and testing of existing information elements;
2. development of new, required for equivalent provision all specified above "steps".

Some examples from thematic systematization of hypermedia resources of opening access for lectures cycles of university general physics courses possible to view on URL http://cdlib.phys.msu.su/GenPhys/HM/

Main types of new information resources under development on Physics Department at MSU is described in two following sections.

Information base "Physics phenomena".

Development of "first step" information support resources for general physics lecturer cycles was conducted within the framework of following requirements:

- unique amongst existing information module,
- development elements must be oriented on greatly broad auditorium and correspond a statement on priority of experiment when studying and teaching a course general physicists,
- inadmissible changing a physics experiment its virtual analogues.

All specified requirements satisfies a network version of demonstration physics experiments catalog, created on analogues passed five-year approbation of videocatalog of Physics Department at MSU. Existing at present catalog generalizes more then 300 years experience of stating a demonstration experiment when teaching physics in the Moscow university and is kept more than 4000 different experiences from the level of school course physics before strictly mini-studies, conducted in academic auditoriums with using the whole spectrum of experimental facilities. Unique demonstration equipment, objects of studying, exploratory style of the demonstrations, unusual experimental deciding putted physics tasks remove catalog material for frames traditional academic-methodical material. VideoVersions of Catalog are used in secondary schools, licees and high schools, many institutes and universities of Russia and abroad.

Development of network variant of videocatalog and granting it in the mode of free access - a first stage of shaping a base of national system resources of remote support of physics teaching. The catalog of animated demonstration experiment is offered clients in two versions, oriented on accompaniment of lectures and functioning.

In "auditorium" version, base separate module is videofile in the format QT Movie with enclosed to it explanatory textual file. The Built-in explaining text expelled in order to avoid language barriers, saved only technological sounds, accompanying undertaking an experiment. Distinctive size one videofile - from 5 Mb before 20 Mb. Expected that lecturer beforehand copies necessary him kit an and carries out some work in out-line mode.

For "out auditorium" functioning is offered version of directory, oriented on functioning in the mode Out-line. Videofile executed in the format animated GIF - a file with the distinctive size in 150 kb. Given built-in textual explanation of observed physics phenomena in Russian language. Text of explanations does not include some analytical transformations and serves only for orientation of lecturer in the searching more detailed information on the observed phenomena. Demonstrations are available at http://cdlib.phys.msu.su/GenPhys/Anidemos/

Experimental remote access systems.

Development and undertaking the experimental measurements in the mode On-line, ensuring "third" and "seventh" steps in hypermedia support - the most labor-consuming information resource element. For this reason on initial stage of the choice of scenarios of interactive experiments, was an accepted decision on maximum unifications of mode of experimental data gathering for as possible broader class quantitative under investigation on lectures of physics processes.

Practically, the whole circle of physics phenomena, considered in the general physics courses, possible divide into four classes:

- Regular nonstationary processes in systems with constant physics parameters.
- Regular stationary processes in systems with changing physics parameters.
- Stochastic stationary processes.
- Stochastic nonstationary processes.

Demonstrative presentation of registering signal for specified four classes of physics processes possible to realize by means of following heels by the program module, passed to a present day an approbation both in the academic demonstration experiment, and in the measurements devices in exploratory laboratories.

- "Time recorder" - regular and stochastic processes;
- "Parametric recorder" - regular and stochastic processes with parametric control;
- "Cyclograph" - Regular processes with cycling changing one of the parameters;
- "Hystograph" - Stochastic and regular processes.

At present hardware and software marketed experiments on the analysis of statistical parameters of physics signals, registrations of temporary rows with remote control of physical system parameters.

Making the educational experimental measurement systems with interactive remote control elements is oriented first of all on the familiarization of students with bases of technology and technicians of modern physics experimental investigations, principles of development of drivers for interfaces of data gathering and parametric control, structure of PERL-scripts, servicing "client-server" dialogue.

A demonstration of interactive experimental system is available at http://calibr.phys.msu.su

Program-minimum for users of hypermedia support system.

Orientation in the flow of exhibits at a rate of the users expects a possession by main notions of network technologies, skills of control in the mode of interactive functioning. The most part of employees, leading teaching the university courses, in the practical person of its professional exploratory activity use only narrow area of existing technologies of network functioning. Below brought program 20-hour, defining minimum of lecturer or assistant of lecturer, preparing to use on lectures of system an hypermedia support:

- Physical and logical principles of information system building. Shaping a datastreams. Addressing the streams. Methods of checking a transmission. Categorization of available information educational resources on the course general physics.
- Protocols of exchange by data. Datastreams based on protocols NFS, FTP, HTTP. Functioning on removed systems on TELNET. Functioning in local networks. Categorization of tasks of information exchange. Practice of information support in universities of the world. Standards of presentation of current educational material. Test tasks. Operative information. Typical structure of information educational server.
- Electronic publications. Operating with news. Electronic conferences. Subscription on electronic journals, mailing lists. Electronic bibliographic bases.
- Organization of global databases of network resources. Principles of working with search systems. Systematization of educational resources in search systems. Typical contextual searching errors. Benchmark analysis of search system efficiency on educational resources. Databases of international physical communities.
- Adjusting the programs-browsers. Use an browsers Netscape Navigator (Mozilla) 3.01, Netscape Communicator, Internet Explorer 3.01, Enhanced Mosaic, functioning with Lynx. Conduct of the direct dialogue by facilities Netscape. Optimization of browser for functioning (working) with multimedia components.
- Multimedia technology in educational network resources. Requirements to hardware ensuring a workstation. Remote education Systems. interactive network courses on the general physicist for different training levels. CD - servers. Development a scenario and creation network CD.
- Modern systems of network multimedia educational exhibit development. VRML Facility. Bases of descriptions and debugged by the program module. JAVA exhibits. Performance Strategy.
- Free, conditionally-free and license software. Order of registration of license agreements on provided to program products. Methods of remote control of spreading software. Evaluation - versions. Beta - versions.
- Preparation information for Web. Elements HTML-3, standards of data presentation, coding molded, graphic information. Adjusting the national fonts. Connection of multimedia elements in Web-a document. interactive documents. Functioning Rules with interactive forms. Protection information, sent on the server.
- Installation personal FTP - server. Rights of users access. Checking an access. Ethics of inviting and warning. The structure of configuration files for FTP - servers, running on the operating system Window's 95, Window's NT. Performance of programs on the server. Protection from unauthorized operations.

The full version program and texts of lectures is available at http://gateway.phys.msu.su/HM/lections97/

Ensuring a development of hypermedia system.

Opened hypermedia system stipulates an unceasing improvement of existing database and new element development. Consequently, second stage, after strictly "start" systems in the usage, it is necessary to consider a training of developers of resources. Under the development of resources in this instance we understand not only programs working the information module, but a development of all functional global information infrastructure (GII) levels coming from tasks of classical university formation.

Training in the considered context has sense additional to main education. For a present day this task dares within the framework of the educational program "High Computer School" at MSU. High Computer School presents an independent subdivision under Department of Computing Mathematics and Cybernetics, in which can enter a student from any department at MSU, passed qualified testing. Academic cycle is consists in two years (four semesters). The special disciplines programs and Out-line lecture courses are available at http://cdlib.phys.msu.su/HCS/Network/

Information project of "General Physics Council Universities of Russia".

General Physics Council (GPC) Universities of Russia unites physics departments from 42 classical universities. Primary task of GPC - a coordination scientifically-methodical investigations and information providing of teaching and learning in general physics discipline. Functioning an GPC is built on the regional principle with the highlighting of leading university in concrete region center. Once per annum pass sessions of GPC, to which are invited heads of general physics divisions of all universities of Russia, once at two year are organized scientifically-methodical conferences "University general physics course: modern problems".

Practical realization of information exchange gets through WWW server GPC universities of Russia. Below enumerated information blocks of server:

- Regional structure of universities Russia.
- Periodic publishing in the field of physics education.
- Information about conferences on questions of contents of general physics courses.
- The papers of past conference, organized by GPC.
- Information about companies-producers of experimental physics equipment.
- Systems of multimedia support for educational cycles.
- Network minimum-course for users of hypermedia support in lecture courses.
- Information about entrance exams on physics departments at universities.
- Information about Internet-search systems.

When creating a server, was expected that mainstream of requests will accounts for information-organizing material. However, after set up a module "Sites for schoolboys, schoolgirls and students of secondary schools", 80% requests is moved to material concerning to undergraduate level of physics education and using an interactive form of consultations.

Comparatively high activity addressing to the server of schoolboys and students of different universities has provided in a present time to the revising of priorities of sharing the resources with displacing an accent with information-organizing questions to the development of remote educating elements and testing with all approving elements hypermedia - structures. The server addresse is http://gateway.phys.msu.su

Conclusion.

As a result of the annual "exploitation" information support system in general physics lecture courses is perfected all base its infrastructure elements:

- logic of information composition hypermedia modules;
- system of training for users;
- system a training for developers.

Output of all described infrastructure elements in the common access for universities of Russia through the system WWW - servers will ensure a coordinated development and usage of network resources in all variety their potential.

General Physics Council Universities of Russia,
Moscow State University
119899, Moscow, Russia
alschkvc(at)gateway.phys.msu.su, suhareva(at)gateway.phys.msu.su

Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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Distribution de l'information dans un centre d'informatique pédagogique

Christel Froissart, Marc Patouillard

Le Centre Informatique Tréfilerie (CIT) de l'université Jean Monnet est un service d'informatique pédagogique issu du plan Informatique Pour Tous. Il est destiné à des enseignants et étudiants du campus, soit 10 000 utilisateurs potentiels. Il regroupe actuellement 130 machines en réseau dans 8 salles avec un libre-accès de 50 places.

Le CIT a acquis une solide expérience en matière de distribution de l'information.

Outre les données qu'on trouve habituellement sur un serveur web, notre serveur joue un rôle important dans la distribution interne de l'information :

- il permet aux étudiants qui travaillent en Libre-Accès, en cours ou en TD autonomes, ainsi qu'aux enseignants, d'utiliser au mieux les ressources qui leur sont proposées :
- plan des salles en liaison avec notre logiciel de gestion de parc, configuration précise et actualisée de chaque machine, logiciels, cédéroms, aides en ligne,
- possibilité de poser des questions par formulaire : constitution d'une F.A.Q.,
- prise de connaissance de notre règlement, et de toutes les informations pratiques,
- aide à la navigation sur le web : pointeurs sur des sites sélectionnés, organisés par discipline, accès aux principaux moteurs de recherche,
- consultation de cours "on line" faits par les enseignants de l'Université,
- consultation de notre base de données documentaire.
- il facilite la gestion du service, en temps réel et de façon interactive grâce à une interface avec notre logiciel de gestion des emplois du temps et des données bureautiques hétérogènes.

Notre système d'information distribuée, grâce à notre intranet RAMANI, est un précieux outil, tant pour les utilisateurs de notre structure auxquels il permet d'être le plus autonome possible, qu'en interne pour assurer une partie de nos activités de gestion.

1. Introduction

1.1. Le système d'information

Notre intervention se situe dans le thème : des systèmes d'information en relation avec l'enseignement, puisque notre structure a pour vocation l'informatique pédagogique et la mise en oeuvre des Nouvelles Technologies Educatives à l'Université Jean Monnet ; mais il s'inscrit aussi, de façon transversale, dans le thème de la distribution de l'information puisque nous parlerons de l'accès aux informations pour les étudiants et le personnel.

Notre objectif est de montrer comment, à l'aide de moyens logiciels communs et peu coûteux, nous avons mis en place un système d'information qui a les caractéristiques suivantes :

il est fondé sur des données hétérogènes,

il est destiné à améliorer la communication entre des utilisateurs qui ont à la fois des statuts, des usages, des moyens d'accès et des compétences très variables ; ses fonctionnalités sont donc paramétrées en fonction des profils d'utilisateurs et des fonctions : communication interne et externe, apprentissage et enseignement, gestion,

il a considérablement évolué depuis dix ans, mais dans la continuité : le système d'information mis en place initialement, qui repose sur un SGBDR, est toujours au coeur de système, et nous lui avons ajouté des "couches" qui permettent d'améliorer l'accès distribué aux données, pour favoriser chez les étudiants et chez les enseignants la pratique des nouvelles technologies.

1.2. Le CIT

1.2.1. Activités pédagogiques

Le Centre Informatique Tréfilerie est le centre de ressources informatiques destinées aux enseignants et aux étudiants du site Tréfilerie, soit 10 000 utilisateurs potentiels. Ces utilisateurs, relevant des sciences humaines et sociales, n'envisagent pas l'informatique comme une fin en soit, mais plutôt comme un outil au service de leur discipline (cartographie, statistiques, infographie).

En 1996-97, le CIT a accueilli 3 000 heures de cours dispensées dans cinq salles ; il offre de plus un service de Libre-Accès ouvert 55 heures par semaine, avec 43 machines, divers périphériques, les logiciels les plus courants, les logiciels spécifiques utilisés en cours, et un accès en consultation au Web. Certains utilisateurs ont de plus des droits spécifiques pour accéder à d'autres ressources, locales ou distantes.

1.2.2. Gestion technique et administrative

Etant donné la taille de notre structure, nous utilisons les mêmes ressources matérielles, logicielles et réseau pour les activités pédagogiques, et pour notre gestion ; celle-ci est relativement importante : il nous faut en effet assurer à l'informatique :

- la réservation des salles et des machines,
- la gestion du personnel,
- la gestion du parc informatique,
- la logistique,
- la gestion de notre centre documentaire,
- la communication avec les autre structures de l'Université,
- la comptabilité du service.

2. Distribution de l'information

2.1. Les sources

Les données que nous traitons sont hétérogènes, à plusieurs titres : tout d'abord, elles sont émises de plate-formes différentes, elles sont générées par divers logiciels, traitements de texte, tableur, SGBDR, navigateurs web, messagerie électronique, telnet, ou acquises selon différents moyens d'enregistrement. Ce sont donc des données sous toutes sortes de formats. Enfin, il n'y a pas de standardisation dans la production des données dont les usages varient au fil du temps et en fonction des personnes.

2.2. Les moyens

Nous utilisons différents moyens de partage des ressources, en fonction de la nature des données et de leur utilisation :

- des serveur de fichiers (cf ci-après § 3)
- la messagerie : avant même l'utilisation d'Internet dans les sites universitaires, le CIT utilisait abondamment la messagerie en interne. Nous avons mis en place un dispositif pour que tout utilisateur, même s'il n'a pas de compte messagerie, puisse nous communiquer ses suggestions ou doléances.
- les serveurs Internet : après avoir été l'un des premiers sites universitaires à créer un site gopher en France, nous avons créé en 1994 un site Web, qui présente des informations diverses :
    - des informations pratiques (descriptif des ressources, fonctionnement des différents services offerts, règlement, emplois du temps, etc),
    - des aides techniques destinés à favoriser l'autonomie des étudiants dans la réalisation de tâches simples,
    - des aides à l'utilisation d'Internet,
    - des supports de cours.
    - la recherche sur notre serveur peut s'effectuer par navigation, ou par recherche sur chaînes de caractères. Il accueille de plus d'autres sites, réalisés par les composantes pédagogiques du campus.
    - les cédéroms d'autoformation : étant donné la culture des promotions d'étudiants qui arrivent, et d'autre part la convivialité des logiciels courants avec leurs dispositifs d'aide en ligne et leurs interfaces "intuitives", il nous semble que la maîtrise élémentaire de l'outil informatique relève de l'apprentissage autonome. C'est pourquoi nous avons installé sur le réseau un certains nombres de logiciels d'EAO interactifs et multimédia, accessibles des salles de cours et de la salle de Libre-Accès.

2.3. Les différentes familles d'utilisateurs

Les utilisateurs du CIT ont des profils très divers : du point de vue de leur expertise en informatique, du point de vue de la tâche qu'ils ont à réaliser avec nos ressources, du point de vue des données qu'ils ont, ou non, à connaître.

a) Communication externe

Les utilisateurs externes à l'Université, qu'ils soient ou non experts, ne peuvent être que des clients "maigres" de notre système d'information : ils peuvent consulter le serveur Web sur Internet, qui joue alors comme tous les sites Web un rôle de "vitrine". Ils peuvent aussi s'adresser au Webmaster, à charge pour celui-ci de décider s'il faut ou non poursuivre la communication.

b) Communication interne à l'Université

Un certain nombre d'utilisateurs internes à Jean Monnet sont aussi des clients "maigres" : ils consultent le serveur Web sur Internet pour s'informer sur le mode de fonctionnement du CIT (ex. : enseignants qui souhaitent connaître les disponibilités des salles de cours, personnes qui interrogent notre base documentaire,…), ou pour trouver une aide technique. Ces utilisateurs ne sont pas des experts en informatique, et ce mode d'utilisation nous semble une bonne illustration de la transition de l'enseignement à l'apprentissage : ces documents mis à leur disposition et d'accès facile contribuent à leur autonomie.

c) Utilisations pédagogiques

Les autres utilisateurs ont nécessairement des droits spécifiques : un compte de messagerie, l'accès à certains répertoires, la possibilité d'éditer des pages Web. Il s'agit d'enseignants, de chercheurs, de groupes d'étudiants qui ont des tâches spécifiques. Ils doivent remplir certaine conditions pour avoir ces droits, et être suffisamment experts dans l'utilisation des logiciels dont ils ont besoin.

Sur le plan pédagogique, les étudiants peuvent réaliser des travaux spécifiques, en liaison avec leurs enseignants : construire un site Web et promouvoir leurs productions ; échanger des fichiers, quels qu'en soient la plate-forme émettrice et le format ; profiter de la messagerie comme outil de "téléenseignement".

d) Gestion interne au CIT

La communication entre les membres de l'équipe du CIT, enfin, est considérablement améliorée par RAMANI, que nous exposons ci-dessous. Les utilisateurs sont de deux types bien distincts :

- les experts que sont les techniciens du CIT : ils maîtrisent à la fois les techniques, et le fonctionnement du centre,
- le personnel administratif, qui maîtrise les logiciels de bureautique et de communication qu'il utilise, mais qui a l'habitude de s'appuyer sur les techniciens dès qu'il faut toucher au paramétrage des applications ou à l'architecture du système.

Etant donné la diversité des utilisateurs de notre système d'information et des tâches réalisées, nous avons mis en place cette année le système RAMANI.

3. L'accès à l'information grâce à RAMANI *

** nom de code du projet*

3.1. Situation initiale

L'informatique du centre est organisée autour de serveurs qui assurent :

a) le partage des fichiers:

- se servir les logiciels utilisés sur les 100 micro-ordinateurs Macintosh et PC des salles de cours et du Libre Accès ; il s'agit des applications, mais aussi de ce qui concerne les systèmes d'expoitation (installation partagée de win 3.1 et win95, et distribution de l'installation de Mac OS)
- imprimer sur 8 imprimantes réparties dans tout le centre
- partager la gestion proprement dite du service (secrétariat, messagerie, partage de données).

b) l'utilisation de bases de données structurées

- Le SGBD 4ème Dimension d'ACI a été employé car le centre a été d'abord équipé de Macintoshs : des application ont été réalisées pour :
- la gestion administrative : gérer la base documentaire, les emplois du temps des salles, la planification et les inscriptions en formation IPT et la comptabilité,
- la gestion technique du centre : gérer le Parc Informatique et le réseau (inventaire, maintenance, télédistribution,...).

c) l'utilisation de données non structurées

Ce sont essentiellement des documents bureautiques issus par traitement de textes, de tableur ou de la messagerie.

3.2. Pourquoi changer ?

Le passage du mac au PC a mis en évidence des problèmes de format de documents bureautiques en ce qui concerne les échanges. En outre, de plus en plus d'étudiants sont équipés personnellement de PC.

D'autre part, il n'y avait pas de possibilité simple de partager ces informations avec les utilisateurs du centre : le filtrage et la restriction de l'accès à nos données était très difficile.

Enfin, il n'y avait pas de possibilité d'accès à nos données en dehors de notre réseau local.

3.3. Une solution

La solution choisie est de greffer sur nos serveurs de données des fonctions de serveur Web intranet et internet et de moteurs de recherche : IIS (Microsoft Internet Information Server) + Microsoft Index Server+ Windows NT 4.

Cet ensemble présente de multiples avantages pour répondre au problème posé :

- un navigateur/lecteur universel, gratuit et indépendant du système d'exploitation,
- la distribution de l'information sur le réseau, local ou distant, immédiate,
- la possibilité de restreindre les accès,
- le faible coût.

RAMANI permet (en consultation) l'accès du public à certaines informations choisies, issues de nos bases de données 4D. Pour cela nous avons mis en place deux solutions :

1. produire de l'html à partir de 4D (par programmation) et le distribuer par le serveur Web via des formulaires javascript,
2. réaliser des exports texte et les exploiter via ODBC (Open Database Connectivity) et Internet Information Server.

La diffusion d'informations d'intérêt général (aides, modes d'emploi, mémos, feuilles de références) est facilitée puisqu'elle se réduit à la traduction d'un document en HTML : cette fonction est maintenant intégrée dans les nouvelles versions des logiciels de bureautique.

L'indexation de nos documents bureautique permet l'exploitation de nos archives : elle permet de retrouver rapidement des documents saisis et rangés par d'autres ainsi que de faire des croisements dans nos recherches : nous ébauchons de la sorte un mini DATA WAREHOUSING, puisque nous pouvons proposer à nos utilisateurs une recherche efficace dans une base de connaissances constituée par nos diverses documentations sur support électronique sans effort de structuration de notre part.

RAMANI offre d'autres possibilités de partage, de présentation et de diffusion de l'information :

- présentation graphique HTML des ressources, extraites de la base de données de gestion de parc et mises à jour en temps réel (SNMP),
- Tableaux de bord graphiques réalisés par des applets java qui reflètent en temps réel certains de nos indicateurs : tirages, fréquentation des salles,
- possibilité pour des étudiants sans compte E-mail de nous envoyer des demandes d'aide ou des avis directement à partir d'une page Web.

Conclusion

Notre système d'information est sans prétention, étant donné la taille de notre structure et les moyens dont nous disposons. Nous avons voulu montrer comment, dans ces limites, nous avons pu développer :

- un système de "gestion électronique de documents" qui permet de centraliser des données hétérogènes et d'y accéder de façon transparente,
- un système de "groupware" permettant à l'ensemble d'une équipe de travailler de façon coopérative malgré des compétences diversifiées et des temps de présence variables,
- un système de consultation facile et convivial grâce à RAMANI, ce qui nous semble indispensable sur un site universitaire de Sciences Humaines Sociales,
- un système de communication diversifié, permettant à chacun en fonction de son expertise et de ses besoins de partager l'information au mieux.

Ce système est peu coûteux, simple à gérer, à maintenir et à améliorer, et sûr.

Notre objectif est de favoriser ainsi l'envie, la familiarité, le besoin de faire appel aux technologies de l'information, qu'il s'agisse d'apprendre l'informatique - mais aussi, bien plus largement, pour toutes les activités qu'étudiants, enseignants et gestionnaires ont à pratiquer. Il nous semble que nous contribuons ainsi, à notre échelle, aux recommandations émises tout récemment par M. Dizambourg (B0 n° 18, 1er mai 1997) : Les enseignants voient progressivement leur rôle se transformer : ainsi se renforce leur fonction de guide pour les apprentissages et de référence dans la constructin du sens à partir des choix opérés dans une masse d'informations.

Centre Informatique Tréfilerie,
Université Jean Monnet,
2 rue Tréfilerie, 42023 St Etienne Cedex 2, France
E-Mail : froissart(at)univ-st-etienne.fr, patouillard(at)univ-st-etienne.fr

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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An Approach to Teaching Medical Informatics to Students of Medicine

I.Mirtcheva

1. Introduction

One of the most recent definitions of medical informatics defines it as the discipline concerned with the systematic processing of data, information and knowledge in medicine and health care. The domain of medical informatics covers computational and informational aspects of processes and structures in medicine and health care.

The ultimate objective of informatics in health care is the achievement of the highest possible level of health of an individual, a nation and the world at large. The ultimate goal should always be to improve the quality of health care, and of research and education in medicine and health sciences.

2. Aims of the education in medical informatics for students of medicine

Medical computing has been around for more than 30 years. Medicine and medical information has been around since the time of Hippocrates. Until recently, however, most doctors and other health care professionals knew virtually nothing of medical computing and very little of medical information science - and until very recently this did not matter much. However, medical knowledge was simple to know and simple to handle, there was not need for knowledge of technology or computing.

Of course this is now all changed. Modern medicine is complex, often driven by technology, and it is impossible for an individual to learn and retain all the necessary knowledge. Some sort of help is needed, and this is widely recognised. It is already clear and generally acknowledged that doctors and other health care professionals (nurses, midwives, health care managers etc.), will need a thorough working knowledge of the new technology in order to practise medicine effectively or to manage a hospital effectively. It is observed that health care professionals are increasingly confronted with computer systems. Since the professional will always be responsible for the consequences of the use of the results of medical information processing it is important that the students in medicine will be taught both the fundamentals of medical information processing and the essentials of existing applications. In medical education the most important skill for medical students to acquire is the ability to identify gaps in their knowledge and go about finding for themselves the answers to the problems they face.

So, it is obvious that students of medicine should study medical informatics. This basic knowledge of information management physicians should have as early as possible in their career. They should have this from the moment they decide to study medicine. So, the place of medical informatics in the undergraduate curriculum of students of medicine is of great importance.

However, teaching medical informatics is not so easy. There is actually no teaching material available which is specifically tailored to the needs and understanding of medical students, doctors and other health care professionals. Of course, there is a great number of available material which claims to teach information science and technology, but this is usually general and in most cases not oriented towards medicine. Most of the material available in this area is completely unintelligible to the average doctor or medical student. For these reasons, the suggestion arose that a special course should be organised. In fact, this is more difficult than it seems for several reasons.

First, there is no such thing as the average medical student in computing terms. Some students have never seen a computer, others can be classified as computer consultants. Some students appreciate quite easy the role and the importance of the computer technology and knowledge, others keep on wondering why should they obtain this knowledge since their aim is to become doctors or other health care professionals. So, one of the aims of the course in medical informatics must be to explain the need and the importance of medical informatics knowledge to the future medical professionals

BECOME A MEMBER
- Join Eunis
- Application form for institutions/organizations
- Application form for Corporate membership
- Application form for personal members
- Member's data change

RESOURCES
- Distribution lists
- Publications
- Newsletters
- Information Network
- Archives

ORGANIZATION
- Statutes
- Board of Directors
- Executive Secretary
- Past Presidents
- Members

EVENTS
- EUNIS Congresses
- Rectors' Conferences
- Elite Award
- Jens Dørup Award

ACTIVITIES
- Task Forces
- Groningen Declaration
- International Exchange Programme
- Partnership
- Best Practices

Search...

REGISTERED ACCESS FOR EUNIS MEMBERS' REPRESENTATIVI

User Name
Password
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Forgot your username?
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and at the same time to comply with the knowledge which the students already have or do not have.

There is a second and more important problem - that of providing the students with up to date material. The world of information technology moves with bewildering speed (even more so than the medical world). So, there is always the danger, that teaching material, a book or even a course itself will be out of date before it is published or presented to the students. So, another aim of the education in medical informatics must be to present always an up to date knowledge.

Another problem rises from the nature of the medical education. It is acknowledged that medical education today requires that students accumulate i.e. memorise a multitude of facts. Because of the explosive growth of biomedical knowledge more and more of this knowledge is crammed into the medical curriculum. Ever since students enrol to a medical university or other school for health care professionals, they are forced to learn as soon as possible how to memorise that multitude of facts and this somehow forces them to forget, or rather give up thinking, reasoning and making decisions. Of course, this is obvious. It is much easier for a person with a good memory to memorise the facts than spending some time on considering them. It is however impossible, and also undesirable for a student to learn everything that can be learned. On one side the knowledge presented to the medical students during their formal education will be more or less obsolete at the time they will practice medicine (the duration of this formal education is at least 6 years). On the other hand, it is difficult to teach medicine of the future, since most of the futures technology is probably non-existent today. Having in mind the above considerations as well as the fact that computer science is the last science that can be learned by memorising, trying to present it to memorising students is already a challenge. It is time to de-emphasise the memorisation of facts in favour of independent learning. So, another aim of the education in medical informatics must be to prepare the course and the teaching material in such a form and contents that it should be understandable and acceptable by the students and at the same time it must awaken their abilities to think. It should help the students develop skills that will enable them to learn throughout their professional lives.

The skills associated with information management are essential to facilitate the acquisition of fundamental knowledge, basic learning techniques, clinical skills and methods for the critical appraisal and effective use of research literature. The student has to be taught how to manage information so that he himself can acquire the necessary information when needed. The student should be required to seek information, rather than be given information. Since more and more information can be obtained via information systems the student should be taught how to manage this information systems. So, another aim of the education of medical informatics, which according to the author is the most important, is to facilitate the education process by providing the tools and methods of computer aided learning both for students and teachers. Of course, this requires that the educational tools, i.e. information systems, different computer applications, data bases, knowledge bases etc. should be available to all teachers and all departments. How this can be organised is not the subject of this paper.

3. Education in medical informatics for students of medicine

Here is one proposal for a general curriculum for teaching medical informatics to students of medicine in the Medical University in Varna. It may be divided in two modules.

Module 1 - general introduction (Introduction to informatics and basic computer skills)

Module 2 - methods and applications (Introduction to medical informatics)

3.1. Module 1 - Introduction to informatics and basic computer skills

This module covers the basics of informatics, the general knowledge, or basic computer skills. The aim of this module is to give the students the general knowledge of computers and computer applications, so that after going through this module they would freely use them. The general introduction should cover the following items :

- Classification of the applications: A classification of the different applications of computers, computer technology and information systems in medicine and health care is discussed. In this context the roles of man and computer in information management in the field of medicine and health care are explained. Also the correspondence with applications elsewhere in society is discussed.
- Systems and hardware: The logical and physical design of computer systems is discussed. The various types of computer systems and peripherals are presented. Also an overview of the

different operating systems and computer languages are discussed. Attention is paid to basic computer skills covering operating systems, word-processing, spreadsheets, representative graphics, statistics, databases, networks, communication skills, bibliography and different commercially available software packages.
- System theory: A formal approach to the general system theory is presented including system design and life-cycle of a system. The role of the user in a software development process is discussed.
- Information theory: A formal approach to the general information theory is presented including aspects of information (syntactic, semantic and pragmatic).

3.2. Module 2 - Introduction to medical informatics

This module covers the basics, or general knowledge of medical informatics. Of course, as it is aimed to non-computer specialist it should apply with their capacity and abilities. The aim of this module is to increase the sophistication of the future health professionals, so that they know, understand and use in the best possible way the available resources. Students should gain general knowledge on medical information and medical data, how to organise this data so that it will be available and helpful when needed, how to assess the quality of clinical knowledge they are acquiring. This module is divided into two parts - (1) methods and (2) applications.

3.2.1. Methods

- Data documentation
- Data registration, documentation, transfer and communication Medical data and medical information are discussed in terms of types, utilisation, quality and communication. The process of data acquisition, collection, documentation, transfer and methods of storage of medical data in databases are described. Various types of data organisation are discussed. Aspects of structured data entry and natural language processing, recording of temporal patient data, electronic interchange of patient data, interaction between users and computers are presented. Various topics such as ownership, protection, security, confidentiality, accuracy, integrity, reliability and availability of data are discussed.
- Databases: Databases in health care are presented. Classification and coding systems are introduced. Attention is paid to data storage and retrieval, query languages, dictionaries and thesaurus, knowledge bases. It should be clarified that in all areas of society data base management systems with industry- standard query systems are used, including standards for the compact storage of data, signals and images. Health care is no exception in this respect. The main difference between applications in health care and other areas in society is the wide variety of different patient data that are stored, from purely financial items to radiological pictures, and the large number of potential users of these data. The complexity of the application of the medical data bases coming from the semantic interconnection of these data and the wide variety of different goals that are to be served is explained.
- Computer-based patient records: The transition from paper based medical record to completely electronic patient record is discussed. Advantages and disadvantages of CPR are pointed. The basic principles, structure, and models of computer based patient records are presented.
- Signal and image processing: A description of signals and images in medicine is given. The process of analogue to digital conversion is discussed. The process of signal and image analysis, pattern recognition, classification and interpretation of bio-signals and medical images is explained.
- Decision support: Decision support systems in medicine and health care as computer programs designed to help health professionals make clinical decisions or systems for information management, for bibliographic retrieval and for using patient-specific data are explained. Phases in the diagnostic/therapeutic process (observation, diagnosis, therapy) are explained. Attention is paid to decision support methods : deterministic, statistic and heuristic. The role of decision support systems in relation to patient management, diagnostics, therapy choices, prognosis etc. and the evaluation of these systems are discussed. The processing of data, leading to information, with the help of available knowledge is explained. It is also pointed that in health care many decision problems deal with real patients and that is why they are unique and sometimes highly individual. Therefore one can never achieve full automation of the decision making and should use techniques with built-in man-machine interaction. The questions of formalization of medical knowledge, using of reference standards (knowledge of multiple experts), integration of computer- based patient records with decision support systems, evaluation of decision support systems are discussed.
- Information systems: The basic functions, aims and architecture of information systems in medicine and health care are discussed. Attention is paid to the problem of defining the requirements and the choice of an appropriate information system. Some basic problems concerning access and security of medical data are explained. General legal issues are explained.

3.2.2. Applications

The applications are closely related to the methods and cover the topics described above. They provide for the visualisation (demo versions) or practical experience (whenever possible) with the available software. They can be divided into three main branches :

- Data. The students get acquainted with various types of medical data, systems for standardisation and classification of medical data (e.g. UMLS diagnostic codes, SNOMED, ICD-10, ICPC etc.), different types and structure of computer-based patient record, and databases in medicine and health care.
- Information systems. Information systems in use in hospitals, in departments or clinics etc. or systems in use by personal physicians (general practitioners). The students get acquainted with hospital information systems, computer systems in different clinics, clinical laboratory,

pharmacy, nursing applications, clinical/epidemiology research systems as well as computer systems for biosignals -EEG, ECG and medical images - computer tomography, magnetic resonance imaging, digital subtraction angiography, picture archiving and communication systems etc.

- Decision support. The students get acquainted with the main parts of a decision support systems - knowledge base, where the medical knowledge for a domain is stored, a patient database, where clinical data are stored and an interface engine, which is a computer program that uses medical knowledge and patient data in the problem solving process. They get acquainted also with some tools and techniques used in building medical decision support such as (a) clinical protocols, (b) statistical database analysis, (c) mathematical models, (d) pattern recognition, (e) probability calculations, (f) decision theory, (g) symbolic reasoning.

Medical University Varna,
Dept.Public Health and Biostatistics,
55 Marin Drinov str., 9002 Varna, Bulgaria
E-mail: somed(at)mbox.digsys.bg

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Tweet

Ref: 062001/2

Table ronde "logiciels"

Discussion session: software

1Yves MAILLAUX, 2Gérard TUDO, 3Roland WIEST

Depuis 1993, fonctionne auprès du Ministère un organe de négociation avec les éditeurs de logiciels : le " Groupe Logiciels ", coordonné par le Bureau DGRTA.2 du MENESR, et comprenant les représentants de 15 Centres Universitaires de Ressources Informatiques (12 en province et 3 en Ile-de-France) et des représentants des Organismes de recherche dépendant du MENESR.

Quels objectifs pour nos Etablissements ? un double but :

- des tarifs attrayants pour l'Enseignement Supérieur et la Recherche
- des tarifs identiques pour tous, et indépendants du volume d'achat

Pourquoi l'éditeur consentirait-il des prix notablement remisés ?

- l'Université est une vitrine pour ses produits.
- l'Université forme des utilisateurs susceptibles d'introduire le logiciel dans leur future entreprise.
- Les CRI prennent en charge une partie de la logistique (cf infra)
- Quelles conditions de mise en oeuvre, pour décider les éditeurs?
- les circuits de distribution sont hautement allégés : soit les CRI, soit un nombre très limité de distributeurs ; un rapport trimestriel de consommation remplaçant parfois la facturation unitaire.
- la " dématérialisation " des logiciels gérée par les CRI, ou éventuellement un distributeur (vente de licence supplémentaire, les docs et les supports ayant été acquis précédemment) ouvre à l'éditeur un marché supplémentaire à peu de frais.
- Les CRI relayent notablement l'information (promotion indirecte du logiciel)
- Les CRI organisent des Journées d'information ou des séminaires techniques à la demande de l'éditeur.

Quelles sont les principales difficultés rencontrées ?

- Les réticences de l'éditeur, devant notre refus de procéder (en général) par commande groupée (assortie d'un tarif dégressif en fonction du volume de la commande).
- Les réticences de l'éditeur, devant notre refus d'engagement sur un volume total annuel ; nous proposons ce volume comme un pari ou un objectif, mais refusons d'en faire une clause entraînant une éventuelle pénalité ; tout au plus, un écart important peut-il induire une révision des prix pour l'année suivante.
- Les éditeurs étrangers (US, en particulier) ont parfois un distributeur exclusif ; il n'y a plus de réelle concurrence, et par conséquent des prix peu remisés.

Que peut nous apporter EUNIS ?

- Connaître et faire connaître les actions analogues menées en Europe?
- Pourrait-on. au sein d'EUNIS, créer un " Observatoire " des prix?
- En vertu des règles européennes, pourrait-on imaginer que pour les produits US des importateurs de plusieurs pays puissent être mis en concurrence?

[1]MENESR/DGRT, rue Descartes, 75005 Paris, France
E-mail: bmi@dgrt.mesr.fr

[2]Université Pierre et Marie CURIE - Paris VI, Centre de Calcul Recherche et Réseau, case 171, 75252 Paris Cedex 05, france
E-mail: Gerard.Tudo(at)ccr.jussieu.fr

[3]C.U.R.R.I., Université Louis Pasteur , 7 rue Descartes, 67084 Strasbourg, France
E-mail: Roland.Wiest(at)crc.u-strasbg.fr

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Table ronde "logiciels"

Discussion session: software

[1]Gordon Young

The purchase and control of software licences for the growing number of PCs in use both within the University and by students at home has become an ever increasing burden for Computer Centres. The speaker hopes to stimulate discussion of the following points:

- The dominance of Microsoft and is there really any alternative?
- The problems of control and compliance with licence conditions in an academic environment.
- The effect that increased student ownership will have on software purchasing policies
- Is there a need for any European wide action?

[1]Limerick University, Plassey Technological Park, Limerick Ireland.
E-mail: gordon.youngg(at)ul.ie fax: +353 (61) 335144

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Administrer un réseau pédagogique sans informaticien : l'expérience "Altaïr

Management of a teaching network without computer specialist: the "Altar" experience

[1]Jean-Michel ADAM, [2]Georges COQUELLE

Introduction

Dans le cadre des plans de rénovation et de construction des établissements scolaires, les collectivités territoriales donnent aux établissements les moyens de se câbler. Ainsi, tous les lieux de travail de l'établissement sont reliés entre eux par des voies de communication. parallèlement, les établissements se dotent d'une connexion à Internet, ce qui, à terme, doit permettre à tous les usagers du réseau d'accéder à ces nouvelles ressources. Les enseignants et les étudiants peuvent alors disposer à tout moment de l'outil informatique. Les pratiques pédagogiques s'en trouvent modifiées, l'ordinateur et le réseau deviennent des outils complémentaires, intégrés par les enseignants dans leurs activités pédagogiques.

Pour réussir cette intégration, les barrières techniques liées aux difficultés d'usage du réseau doivent être brisées. Les usagers doivent pouvoir accéder facilement aux ressources mises à leur disposition ainsi qu'à leurs documents personnels. Souvent, ils n'ont aucune pratique des réseaux, et n'ont qu'une très faible expérience dans l'usage de l'outil informatique. Les systèmes d'exploitation actuels ne fournissent pas de moyens simples pour l'accès à ces ressources. D'autre part, les réseaux pédagogiques ont des caractéristiques particulières qui rendent complexe leur administration. Les établissements d'enseignement ne disposent pas du personnel qualifié pour assurer la gestion d'un tel réseau, le risque d'échec est important.

Notre travail a consisté à étudier ces problèmes et à proposer des méthodes des outils qui permettent à des usagers non informaticiens d'exploiter les ressources pédagogiques mises à leur disposition, aussi facilement que possible.

Après avoir exposé les problèmes posés par l'usage d'un réseau d'établissement, nous décrivons les solutions que nous avons conçues pour permettre l'administration du réseau par des utilisateurs non spécialistes. Nous terminons en décrivant les expérimentations menées actuellement dans plus de 60 établissements de l'Académie de Grenoble.

1.Les problèmes d'exploitation du réseau d'établissement

1.1 Caractéristiques du réseau d'établissement

Les caractéristiques d'un tel réseau diffèrent sensiblement de celles des réseaux locaux des entreprises [1] :

- le nombre des usagers identifiés est important : de 400 à 2000 utilisateurs, en fonction de l'importance de l'établissement ;
- les usagers sont des " nomades " : les étudiants et parfois aussi les enseignants changent de salle de travail plusieurs fois par jour ; ils ne retrouvent donc jamais le même poste de travail d'une séance à l'autre. Les micro-ordinateurs doivent être banalisés : chaque usager doit pouvoir manipuler ses documents personnels depuis n'importe quelle station. Un espace de travail personnel doit donc être mis à la disposition de chaque utilisateur ;
- les groupes d'usagers sont nombreux : aux groupes institutionnels (classes d'élèves) s'ajoutent les groupes de travaux dirigés, les groupes de langues, les sous-groupes de travail, etc. ; un enseignant doit pouvoir construire ses propres groupes et éventuellement restreindre ou étendre les droits d'accès aux ressources partagées pour les membres de ses groupes ;
- le nombre des logiciels mis à la disposition des usagers est important : de 80 à 300 logiciels, mais ces logiciels ne sont pas utilisés par tous les étudiants ;
- la gestion des périphériques est complexe : certaines imprimantes sont attachées à une salle de travail particulière, et ne doivent pas être sélectionnées de n'importe quel point du réseau, d'autres ne doivent être disponibles que pour la sortie de travaux particuliers. De plus, en cas de panne ou de manœuvre erronée, une file d'impression doit pouvoir être vidée, et un usager habilité à le faire doit pouvoir mettre un périphérique de remplacement à la disposition des

usagers bloqués.

1.2 Problèmes liés aux systèmes de d'administration du réseau local

Les outils d'administration de réseau fournis par les constructeurs [4] [5] sont des logiciels interactifs qui permettent de gérer les droits, les usagers, les groupes et les ressources partagées. Ces logiciels sont destinés à des informaticiens qui ont été formés à l'administration de réseaux. Une manipulation erronée peut facilement engendrer des dysfonctionnements du réseau. En outre, certaines tâches d'administration sont fastidieuses ou complexes à réaliser :

- l'installation du réseau en phase initiale avec la création de nombreux usagers et de leurs espaces de travail doit pouvoir se faire de manière automatisée ;
- l'ajout ou la suppression d'utilisateurs, la modification des attributs d'un utilisateur, sont des opérations complexes nécessitant parfois plusieurs manipulations, dans un ordre précis ;
- la gestion des droits ne peut être assurée que par un usager disposant des droits d'administration et ayant été formé à la gestion des droits;
- le partage des périphériques n'est pas satisfaisant : un périphérique partagé est accessible par les utilisateurs depuis n'importe quel poste, ce qui n'est pas souhaitable dans un établissement (cf. [[section]]1.1).

1.3 Problèmes liés aux postes de travail

- Le parc des machines est hétérogène : les établissements sont équipés d'un parc de micro-ordinateurs de type PC, acquis à des époques différentes. Aussi, la configuration matérielle (processeur, taille mémoire, équipement multimédia, disque dur) et le système d'exploitation varient suivant les machines. Les postes étant banalisés, des difficultés d'usage supplémentaires apparaissent.
- L'accès aux ressources du réseau pose des problèmes : quelque soit le système d'exploitation utilisé, les procédures d'accès aux ressources partagées ne sont pas évidentes pour un utilisateur non spécialiste, de plus ces procédures changent en fonction du système.
- L'usage de périphériques partagés différents est source d'erreurs : si les imprimantes partagées ne sont pas les mêmes, des pilotes différents doivent être utilisés ; la sélection d'une imprimante partagée n'entraîne pas l'installation du pilote correspondant, une opération supplémentaire doit être faite par l'utilisateur.
- Tous les logiciels de s'exécutent pas sur tous les postes : certaines logiciels partagés sont des applications " 32 bits " qui ne sont pas exécutables sur les machines équipées de Windows 3.1x, certaines applications DOS ne s'exécutent pas sur les systèmes 32 bits.
- L'accès aux logiciels partagés est difficile, étant donné le nombre important de logiciels gérés.

1.4 Problèmes liés aux logiciels d'application utilisés

Aux problèmes énoncés ci-dessus s'ajoutent ceux liés aux applications pédagogiques utilisées.

- Ces logiciels n'ont pas été conçus pour être utilisés sur un même poste par des usagers différents, même lorsqu'il s'agit de versions “réseau”.
- L'exécution de certains logiciels nécessite une configuration matérielle minimale (taille mémoire, carte son, CD-ROM, système d'exploitation) ; le lancement d'un tel logiciel depuis un poste non conforme peut engendrer un blocage de la machine.
- Certains logiciels sont installés sur le poste de travail (logiciels mono-poste), alors que d'autres sont installés sur un serveur (logiciels en version réseau), le lieu d'implantation doit être transparent pour l'utilisateur.
- Tous les logiciels ne doivent pas être mis à la disposition de tous les utilisateurs : certains logiciels partagés concernent des publics particuliers ; ils doivent être occultés aux usagers non concernés.

2. Solution proposée : l'environnement Altaïr

Toutes les difficultés décrites ci-dessus nous ont amenés à concevoir l'environnement Altaïr pour faciliter l'usage du réseau et résoudre au mieux les problèmes posés, sans pour autant imposer à l'utilisateur d'acquérir les connaissances techniques habituellement nécessaires.

L'environnement Altaïr est composé de trois outils :

- un outil d'installation du réseau pédagogique,
- une interface facilitant l'usage du réseau et réalisant certaines fonctions d'administration,
- un outil pour la gestion courante du réseau.

2.1. Un outil d'installation entièrement automatisé

Pour faciliter l'administration des réseaux, nous proposons une organisation standard des serveurs de tous les établissements. Cette organisation comprend :

- une base de données représentant toutes les entités gérées par le réseau : utilisateurs, groupes institutionnels (classes), groupes définis par les utilisateurs, droits des utilisateurs, logiciels, imprimantes, stations ; afin d'optimiser les accès aux serveurs, la base de données est répartie entre un serveur et les postes clients ;
- des hiérarchies de répertoires représentant les espaces de travail des utilisateurs référencés, et auxquels sont associés les droits d'accès adéquats ;
- un espace réservé à la communication et aux interactions entre les usagers ;
- un espace système hébergeant la base de données et les profils des utilisateurs.

Un outil d'installation initiale met en place toute cette organisation. Il a été conçu pour une installation sur plusieurs serveurs. Il réalise la création automatique de tous les usagers, à partir du fichier des élèves et des professeurs de l'établissement (GEP) ; ce fichier existe sous le même format dans tous les établissements français de l'enseignement secondaire. Les classes d'élèves peuvent être réparties entre plusieurs serveurs, de même que les logiciels.

L'application crée également les espaces de travail personnels, les boîtes aux lettres, les zones d'installation des logiciels, les droits associés aux répertoires créés, les groupes institutionnels, la base données Altaïr.

2.2. Une interface utilisateur intégrant des fonctions d'administration

L'interface Altaïr, a été conçue pour répondre aux difficultés d'usage du réseau exposées ci-dessus. La description de l'interface et de ses fonctions a déjà fait l'objet de présentations [2] [3]. Nous n'exposons ici que les fonctions qui libèrent les usagers des problèmes techniques et celles, destinées aux enseignants, qui relèvent de l'administration du réseau.

- Accès simplifié aux logiciels : l'usager lance un logiciel par simple sélection dans une liste, sans avoir à connaître le son d'implantation ; les seuls logiciels exécutables sur la station sont présentés à l'utilisateur. Si celui-ci n'est pas connecté au réseau, il ne voit que les logiciels installés localement sur la station. Les paramètres d'utilisation des logiciels sont conservés et restaurés à la prochaine utilisation du logiciel.
- Accès simplifié aux périphériques partagés : l'utilisateur sélectionne un périphérique parmi ceux qu'il est autorisé à utiliser depuis son poste de travail. Le pilote de l'imprimante sélectionnée est automatiquement mis en place. A l'installation du réseau, seul un petit sous-ensemble des périphériques est attaché à chaque poste de travail ; les autres ne sont pas accessibles, ce qui évite les impressions parasites vers les autres salles de l'établissement.
- Contrôle des imprimantes : l'enseignant a la possibilité de vider une file d'impression, ce qui permet d'annuler l'impression d'un document volumineux ou erroné par exemple ; il peut également mettre temporairement un autre périphérique à la disposition des usagers qu'il désigne : ceux-ci disposent alors de l'imprimante pour la session de travail en cours.
- Gestion de groupes personnels : l'enseignant peut gérer ses propres groupes d'usagers ; cette fonction lui est indispensable, notamment si ses élèves dépendent de différentes classes de l'établissement, comme c'est souvent le cas pour les classes de langue. Les groupes sont disponibles pour toutes les opérations qui nécessitent de spécifier des usagers : définition des droits, partage de périphériques, communication).
- Gestion des droits des autres usagers : l'enseignant peut agir sur les activités de ses élèves ; il a la possibilité d'interdire ou d'autoriser l'utilisation de certains logiciels ou des opérations de communication ; cette fonction est utile notamment pendant un examen.

L'interdiction est valable tant qu'elle n'a pas été levée par l'enseignant ou par un autre enseignant. Nous avons pris le parti de ne pas créer de hiérarchie de privilèges entre les enseignants pour ne pas compliquer les concepts proposés. Tout enseignant peut défaire les interdictions posées par un autre enseignant ; dans ce cas, un message indiquant la levée de l'interdiction est automatiquement envoyé à l'enseignant qui l'avait posée. Cette fonction d'envoi automatique de message est couramment utilisée dans les systèmes de gestion de processus logiciel [6] [7].

2.3. Un outil de gestion courante du réseau

Les opérations les plus courantes d'administration du réseau d'établissement ont été bien identifiées. Nous avons développé un outil qui permette à un utilisateur non informaticien d'effectuer simplement ces tâche courantes. Elles consistent à renseigner la base de données Altaïr et à modifier le réseau en conséquence. Ces opérations sont les suivantes :

- gestion des utilisateurs : ajout ou suppression d'un utilisateur, et mise à jour de l'ensemble des structures en conséquence ; modification des informations concernant un utilisateur ; modification du mot de passe d'un utilisateur.
- gestion des classes d'utilisateurs : consultation et mise à jour de la liste des membres d'une classe ; les enseignants sont déclarés dans une classe d'utilisateurs privilégiés disposant de fonctions d'administration (cf. [[section]] 2.2).
- Installation ou suppression d'un logiciel : mise à jour de la base de données décrivant les logiciels installés ; l'installation d'un nouveau logiciel consiste à effectuer la procédure d'installation préconisée par l'éditeur du logiciel, puis à renseigner la base de données Altaïr (voir figure 1).
- installation ou suppression d'une imprimante : chaque imprimante présente sur le réseau est décrite dans la base de données ; le logiciel permet d'indiquer au système les imprimantes attachées par défaut au poste de travail.
- édition de listes : possibilité d'imprimer tous les objets et toutes les relations le base de données Altaïr.

Cet outil n'est pas mis à la disposition de tous les enseignants. La gestion courante du réseau est confiée à un animateur local, qui est un enseignant volontaire.

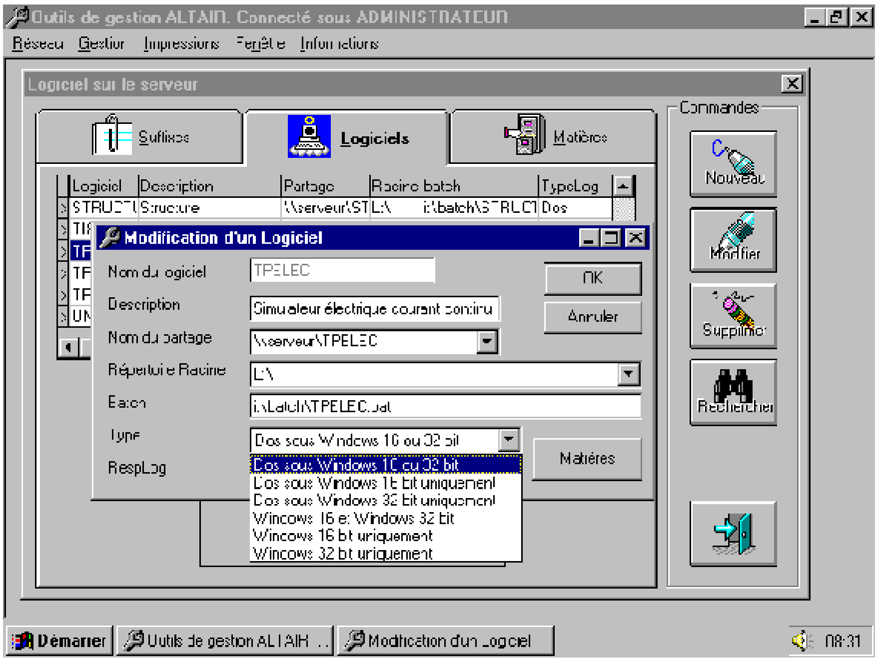

Figure 1 : Gestion courante du réseau : ajout d'un logiciel

3. Expérimentation et industrialisation

Une première version de l'interface et de l'outil d'installation, opérationnelle sur les réseaux Lan Manager puis WindowsNT-Serveur, a été réalisée en 1994. Depuis, des expérimentations ont été menées dans une cinquantaine d'établissements de l'Académie de Grenoble.

Elles font apparaître qu'l'Altaïr permet à l'usager de mieux se centrer sur ses activités. La fiabilité du réseau dissipe les inquiétudes des enseignants face à cette nouvelle technologie. Deux demi-journées de formation suffisent à la prise en main de l'interface par les usagers. La fonction d'animation et d'assistance locale est nécessaire pour assurer la gestion courante du réseau, mais la qualification d'administrateur de haut niveau devient inutile. L'animateur analyse les anomalies, identifie les opérations exceptionnelles à effectuer et, si nécessaire, fait appel au Centre Académique de Ressources qui offre un support technique aux établissements pour résoudre les problèmes complexes.

Ce dispositif a fait ses preuves : environ 70 sites sont installés actuellement, ce qui correspond à un potentiel d'environ 25000 utilisateurs.

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Université Pierre Mendès France,
Centre Académique de Ressources,
Laboratoire CLIPS - IMAG Grenoble, France
E-mail: Jean-Michel.Adam(at)imag.fr
Lycée Marie Curie - Echirolles, France
E-mail: coquelle(at)ac-grenoble.fr

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Information Infrastructure of the Poznan Science Society

Artur Binczewski, Cezary Mazurek, Norbert Meyer,

Jaroslaw Nabrzyski, Slawomir Niwiński, Maciej Stroiński

1. Introduction

The Poznan Supercomputing and Networking Center (PSNC) was brought to life in November 1993 by an initiative of the Committee for Scientific Research (CSR). This initiative was part of CSR's contributions to coordinate the development of the computer science infrastructure in Poland. The Center acts as both the POZnan Metropolitan Area Network (POZMAN)operator and as a high performance computing provider. Besides its day to day activities PSNC is also a significant research center. It concentrates all the scientific research in the city of Poznan.

In this paper we briefly describe both the POZMAN network and the computing resources of PSNC. The services of PSNC and its research activities will also be described.

2. High performance networking in PSNC

PSNC is the operator of the POZMAN network. The POZMAN network is based on its own cable structure and uses two technologies: ATM and FDDI.

PSNC currently owns, within the POZMAN network, a fibre optic cable infrastructure of a total length of 129 km and it leases an additional 47 km from other Poznan institutions. The backbone network was built with monomode (SM) fibre optic wire, however, the access network was built with mixed wires: monomode and multimode (MM). This infrastructure connects all of the scientific institutions in Poznan and 11 Town Offices. The backbone of the FDDI network consists of 21 3COM NetBuilder II routers. In parallel to the FDDI network there are 4 ATM nodes. The ATM network consists of 2 Fore ASX-200BX switches with 2 PowerHub 6000 access switches and 2 3COM CELLplex 7000 switches with 5 LinkSwitch 2700 access switches and 1 Lanplex 2500 access switch. The connection between switches and NetBuilder II routers is of type OC-3 and is based on SM and MM fibre optic cables. Within this network some virtual networks based on the LANE 1.0 standard have been set up: network for city administration and network for connecting the scientific community. Users are connected to the POZMAN network using the following interfaces: ATM (12 ports), FDDI (16 ports), Ethernet (213 ports), synchronous interfaces with a maximum speed of 2 Mb/s (10 ports) and asynchronous interfaces with maximum speed of 33.6 kb/s (48 ports). Currently there are more than 4000 computers connected to the network according to a DNS statistic. POZMAN is connected to the following national operators: NASK, POLPAK-T, TEL-ENERGO and KOLPAK.

The center for managing the network is equipment with 2 management platforms: SunNet Manager on the SUN IPX workstation and NetView 6000 on the IBM RISC/6000 390 workstation. On these platforms the following applications for managing the network devices were installed: Transcend Enterprise Manager for Unix, for 3COM equipment; ForeView for Fore System equipment and one of our own which supports network operators.

Each node of the POZMAN network is equipped with UPS 2000VA from APC with a SNMP based protocol for remote control and a humidity and temperature module. PSNC maintains 24 hour supervision over the functioning of the network and computing resources. Technical team dispose of protocol analyzer type K1102 from Siemens, optical reflectometer type MW9070A and optical powermeter type ML9002A from Anritsu and an automatic fusion slicer type FSU 925RTC from Ericsson.

Further development of the POZMAN network will eventually change to ATM technology. The planned backbone structure of the POZMAN network will be built with ATM switches connecting OC-12 interfaces working with data transfer 622 Mb/s in 1997-98. NetBuilder

II routers with FDDI interfaces will be moved to campus networks and ATM switches will be installed in their place.

At the same time PSNC is designing a new kind of access to its resources via cable television (HFC structured CATV), additionally, PSNC conducts research and development programs like: implementation of the environment control applications (remote control and graphical viewing of UPS, air conditioning and security systems) and trap management systems as well as an application which enables the viewing of the FDDI ring. PSNC is also a beta test site for 3COM equipment. PSNC is the organiser of the largest conference on networking (Metropolitan Area Network in Science, Industry and Government - POLMAN) in Poland . During this conference there was an exhibition of network products which were being used to maintain the conference. This year the network illustrated the usage of the virtual net concept in a heterogeneous environment. Also at this conference PSNC presented the pilot ATM 34 Mb/s network which was built in SDH 622 Mb/s communication environment of TEL-ENERGO operators. The network connected 4 cities: Warsaw, Poznan, Lodz and Katowice.

3. High performance computing in PSNC

The scientific environment of Poznan requires a large amount of computations. The activities of some scientific areas such as chemistry, physics, mathematics, biotechnology, computer science and engineering require computational services.

Some examples of the research conducted by the above mentioned include:

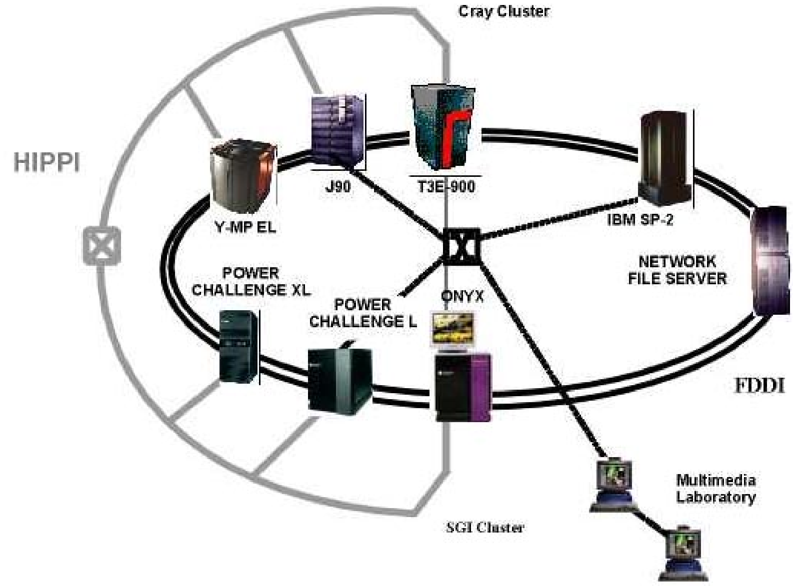
- Optimization and artificial intelligence in science, technology and medicine,
- Sequential and pararallel algorithms for DNA sequencing,
- The genetic backgrounds of laying hen performance traits,
- The theoretical studies of structure, energetics and thermodynamic properties of molecules and anions containing heavy elements,
- Computer simulations of selected models of condensed matter systems,
- Ab initio calculations of small molecules,<
- Statics and dynamics of shell structures.

Our Center also gives access to its computational resources to other scientific communities in Poland. The current number of all users on all systems is 1500 and is increasing. To fulfill the requirements of such different groups of users, PSNC has installed a whole range of computer architectures :

- Scalar
- SGI Power Challenge with 12 R8000 processors and 1 GB of RAM,
- SGI Power Challenge with 4 R10000 processors and 256 MB of RAM,
- Parallel vector
- Cray J90 with 16 processors and 4 GB of RAM,
- Cray Y-MP EL with 4 processors and 512 MB of RAM,
- Distributed memory system
- IBM SP-2 with 1 wide (128 MB) and 14 thin nodes (64 MB).

It is being installed as a massive parallel processing system: Cray T3E-900. This gives our users a new kind of architecture, with 6 processor elements and 6*128 MB of RAM.

The average performance of all of the computer systems (installed at PSNC) is about 18 GFlops. Keeping in mind the requirements of our users and the high efficiency of computer systems, the computers were connected with fast networks : FDDI, ATM, HIPPI.



The FDDI resource ring is used mainly by users to access computers. The ATM network is used for graphics and multimedia applications and the HIPPI network allows an increase in the performance of process-process communications in a distributed environment as well as connecting computer systems into clusters.

The network server (AUSPEX NS 7000/500) fills an important role: The archive system (tape and optical disk archives with a capacity up to 2 TB) and a multimedia laboratory (SGI Onyx, 5 SGI Indigo-2, 3 SGI Indy workstations). The multimedia laboratory allows the results of computations to be seen and animated as well as organizes some tutorials and training sessions for users who then present the knowledge obtained on the WWW as a kind of self-learning tool.

PSNC meets the requirements of users by offering a wide range of software :

- system software
- facilitating the managing and tuning of operating systems,
- allowing to perform tasks in a batch environment (NQS, LSF, Load Leveler),
- programming tools
- programming languages (Fortran 77, Fortran 90, HPF, C, C++, Pascal),
- programming support (debuggers, preprocessors and packages which allows the user to optimize and to parallel written source code),
- libraries of math, scientific, graphic and distributed programming,
- specialized applications for data visualization (AVS, Open Inventor), chemistry and molecular physics (Gaussian 94, BIOSYM, SYBYL, GAMESS, AMBER),
- engineering (NASTRAN, ABAQUS),
- mathematics (MAPLE, MATLAB, SAS, NAG Library, NAG Graphics).

The above described complex environment needs some software tools that will enable a user to access it in the simplest manner and use it with the highest efficiency and performance. Thus, we have started our way to the metacomputing idea. The realization of this idea is one of the main research objectives in PSNC. It requires extensive research to be conducted in the fields of algorithms and tools which will enable the computation in a heterogeneous metacomputing environment.

Our first step in this direction is to unify the access to different metacomputer resources. We propose using Web technology to achieve this goal. This proposal comes from the belief that the explosive turnover in Web languages and protocols has begun to cool down. Today HTML, Java and VRML have now emerged as relatively stable basis for long term planning and development. It seems obvious that, if we are to build, maintain and use such a complex high performance metacomputing (HPM) environment effectively, the Web must be incorporated into it. Our primary challenge is to retarget World Wide Web-computing models to meet the performance and reliability requirements of the (HPM) environment and applications.

We therefore propose that our metacomputer is a collaboratory, multi-user, multi-server, problem solving environment on the local (or wide) area network. This would be based on the existing HPM technologies for local computational backends and the evolving Web technologies for user interfaces, system-wide coordination within the local, national and even world-wide basis. Thus, in our view the metacomputer is a set of specialized Web servers. We link these servers together using generalized Web technologies to allow executable program components to be published as services, and so create a distributed problem solving environment.

The system architecture is built in three layers. The first layer defines computation and communication primitives, initially based on existing Web standards (HTML, CGI, Java) to provide a publication model of computation. It is nothing more than an extension of a computing environment for heterogeneous and distributed high performance computing extended by Web technology.

As the system grows, rather than building problem solving environments on top of the software, the second layer will add more advanced client paradigms to this basis. In this layer, advanced client codes, called agents, may take on server functionality thus becoming autonomous participants in the computing. Increases in client-code mobility and flexibility will also require the addition of "brokers" to mediate the interchange of different data formats between participants in a computing process. This interpolating environment will be a collection of agent based programs to implement interoperability. This layer is still under construction and covers a large part of our research activities.

The third layer serves for running the applications and writing parallel, distributed programs by users. It provides a set of programming tools (i.e. tools for programming with MPI) and environments for computing specific problems. These domain-specific environments range from computational chemistry, biology and other applications to complex ones including weather forecasting, image processing etc.

4. PSNC services

The advanced networking infrastructure increases the user's requirements regarding network services. Therefore, together with familiar, easy to implement Internet services and some information systems based on the WWW interface, more research is being conducted at PSNC regarding telematic services which is aimed at widening the range of services provided with a new generation of applications.

The standard Internet services provided by POZMAN are: WWW, DNS, News, Anonymous FTP, X.500 and e-mail. The WWW server in the POZMAN network has been operating since 1995; providing information about resources and services which also includes a mirror of the Windows Network Application Index. The extended anonymous ftp server provides system and application software either as a local resource on the network server or as a mirror of the most interesting servers in the world. Thanks to this, the quality of the user's access to these types of resources is enhanced as well as there being a decreased load of national and international connections. PSNC also performs the regional coordination of the X.500 service, which provides data on scientists from the Poznan scientific community.

Special attention is given to allow users to have interactive access to bibliographic databases installed at PSNC. The databases installed are: Current Contents (all 6 series), Science Citation Index and the Arts & Humanities Index. The Metropolitan Area Network is also an integrated platform for the Poznan Scientific Libraries Foundation established by 12 Poznan universities and academies with financial support from the Mellon Foundation.

Included in the group of information services developed at PSNC is the Multimedia City Guide (MCG). It is accessible in the Internet within WWW services. The basic goal of MCG is to collect all information regarding the city of Poznan and to store it in one electronic publication guide which broadcasts it in a natural, multimedia form: when a new film is released, you see a clip from this film; when a musical concert is announced, there are audio fragments of some of the music, etc. MCG has an open structure, designed in such a way that each new piece of information is matched to its existing section. Therefore, in the MCG there is a place for information regarding business, culture, science and education, health and social care, tourism, administration, communication, etc. To help citizens to get the most from their city, PSNC is in close cooperation with the City Administration. Thanks to this the content of the MCG is filled with information provided by different branches of the city: newspaper and magazine press editors, statistic offices, communication, administration as well as museums, theaters, cinemas and entertainment institutions. Additionally, part of the information presented by the service is held in databases. Information stored there is used for the dynamic generation of WWW pages which asks the user to answer questions thereby creating a page in real time. This kind of service is based on automatic data updating created by an information provider, also remotely via the network. Services provided in this way include the city communication guide and the weather forecast for the region and the country.

In the multimedia laboratory there are some projects being developing related to the preparation of broadband services which will provide users with new telematic applications, interactive work, videoconferencing, cooperation within the network, entertainment, etc. The project is being developed in close association with the local CATV operator.

5. Summary

The Poznan Supercomputing and Networking Center plays a significant role in the Polish science information infrastructure. Still, the growing needs of the Poznan academic society are always fulfilled by the increasing computational power of the metacomputer together with the high throughput and low latency of both local and metropolitan area networks. PSNC, as always, is hungry for new technology and solutions. This guarantees that all users can conduct scientific research on a world-wide level.

Poznan Supercomputing and Networking Centeri,
Wieniawskiego 17/19, 61-704
Poznan, Poland
URL: http://www.man.poznan.pl
E-mail: naber(at)rose.man.poznan.pl

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Applying Risk Analysis Methods to University Systems

W R Chisnall

Introduction.

The words "Risk Analysis" are used today in several different contexts. In safety critical situations such as the design and operation of nuclear power plants or oil and gas rigs, risk analysis is part of the process of making the chance of a disaster as small as possible. The same thinking applies to the design of aircraft blind landing systems and modern "fly-by-wire" avionics. In these cases the consequences of an accident are so horrendous, and therefore costly, that the chance of one happening must be made almost vanishingly small. The problem is to build a system where components are replicated and human actions are checked so that overall the system will meet its reliability targets.

If, on the other hand, you are a manager on a civil engineering or software development project you will want to know how the actual cost and time to completion of your project might differ from the nominal values. Large projects are composed of hundreds or even thousands of individual jobs, each of which will have had a separate estimate made of its likely duration and cost. But as the work proceeds these individual jobs will each take more or less time and cost more or less than was originally estimated. And the separate jobs are not all independent; some cannot be started until certain others have been completed. And if other constraints such as limited access to scarce resources are taken into account it is easy to understand how project slippages can easily get out of hand. In these circumstances every project manager wants to understand how sensitive his project is to the accuracy of the original estimates and how much freedom of action he will have if things start to go wrong.

Risk analysis in the computer security context is different again. It is accepted that, in a computer system, both equipment and staff may fail, often in ways that are difficult to predict. There may be natural disasters and there may also be deliberate attacks against the system. Countermeasures are, of course, available and the most common ones are found in most installations. But very few installations are set up to safety critical standards to ensure uninterruptable working or to be totally impregnable against hacking or denial of service attacks. Instead they tend to focus on being reasonably resistant to attacks and able to restore normal working as soon as possible after an incident. The issue, of course, is one of cost. What is spent on countermeasures should be appropriate to the risks and to the costs that might arise following any disruption to normal service.

In this paper I shall discuss a particular risk analysis method that I have been using and which originated in UK government circles. I shall highlight some of the areas in which its use in academia differs from how it is used in the civil service and in commerce and discuss some of the benefits that would arise if it were applied more widely across the higher education sector.

Risk Analysis in Government

The UK Government operates very many commercial computer systems either directly or through its various agencies. In the mid 1980s, computer security became recognised as a subject that needed to be taken seriously, even in non-military circumstances, and there was the inevitable competition for limited funds to spend on improved countermeasures. In 1985 the Central Computer and Telecommunications Agency (CCTA), part of the Treasury, studied existing methods of carrying out security reviews so that it could recommend one for use in government departments. None of the methods investigated met all the requirements so a new one was developed to meet the specification written for the study. This became known as CRAMM, the CCTA Risk Analysis and Management Method. Originally it was just that - a method, but soon the method was implemented as a computer program that would run on standard PCs and the package was made available to public and private organisations.

CRAMM's aims are to:

1. Ensure that security requirements are fully analysed and documented for any type or size of IT system.
2. Avoid unnecessary expenditure on unjustified security measures which can arise through the use of subjective and pragmatic risk assessments.
3. Avoid inconsistencies associated with improvised risk assessments.
4. Involve and aid management in planning and implementing security throughout the various stages spanning the life cycle of IT systems.
5. Aid security reviewers to plan and carry out assessments in a reasonable time.
6. Reduce the need for clerical effort by implementing the method as a software tool for standard PCs.

These aims have, in general, been met. But CRAMM's critics said that it nevertheless betrayed its origins by being unnecessarily long winded and prone to generating lots of paper output. It was also seen as being good for large systems with lots of data and many users but unwieldy for the typical systems found in smaller companies. A further criticism was that the system was designed for government-style administrative operations and this flavoured all the interactions with the reviewer and the customer.

More recently, following several internal government reorganisations, the range of available risk analysis packages was reviewed. And CRAMM, in an updated form, again emerged victorious. There are now two major versions. One is for UK Government use only, including the military sector, and includes classified countermeasures in its data base. But alongside this is the commercial product, freely available to anyone wishing to buy a licence. Both products are now the responsibility of the UK Security Services - with the names, addresses and telephone numbers of the relevant management staff freely available.

The General Method.

Computer security is about three things:

Confidentiality:

That information is only disclosed to those who are authorised to receive it.

Integrity:

That information can only be modified by those authorised to do so.

Availability:

That information and other IT resources are available to authorised users when needed.

Security risk analysis and management consists of two related but separate activities.

Risk analysis involves the identification and assessment of the levels of risks calculated from the known values of assets and the levels of threats to, and vulnerabilities of, those assets.

Risk management involves the identification, selection and adoption of countermeasures justified by the identified risks to assets and the reduction of those risks to acceptable levels.

Asset Valuation

There are three principal types of asset involved in an operational IT system:

1. Physical i.e. equipment, buildings and staff
2. Software i.e. the system and application software
3. Data i.e. the information stored and processed

Valuing the physical assets is relatively easy; one simply records the replacement cost. In many cases it may not be possible to buy exact replacements for lost or destroyed items but it is usually possible to find functionally equivalent pieces of equipment - often at less than the original price. And it isn't necessary to be very precise. CRAMM reduces all items to a non-linear "value scale" of between 1 and 10. For example, anything valued at less than 1K UKP is valued as 1; for values between 1K UKP and 10K UKP the scale value is 2. Losses of over 30M UKP are scored as a 10.

This use of a scale of values is important since it allows intangible losses to be equated with those which have a simple cash cost associated with them. We shall see how this is achieved when valuing the data assets is discussed.

Buildings and staff are listed as physical assets and one can readily see how losses in these categories can be just as serious as equipment losses. But risk assessments can easily get too big to manage and one golden rule is to define, at the beginning, the scope of an assessment; and for the purposes of this paper I shall exclude buildings and staff from the discussion.

Similarly, it is easy to understand the value of software to an IT system. An installation that uses standard packaged software which is properly licensed and supported is at little risk since in the worst case new copies can be obtained from the vendor. But sites using bespoke software which may be old, written in an obscure programming language and inadequately documented are clearly much more vulnerable. An example of this is the "millennium" problem - even COBOL has become obscure to many of today's programmers.

To value data assets, the method looks at the impacts of accidental or deliberate :

1. Disclosure
2. Modification
3. Unavailability
4. Destruction.

There are many possible impacts which may be relevant:

1. Political or corporate embarrassment
2. Loss of commercial confidentiality
3. Infringement of personal privacy
4. Personal safety hazard
5. Failure to meet legal obligations
6. Financial loss
7. Disruption to activities.

The CRAMM method leads the reviewer through all combinations of the elements from the two tables above for each data asset that has been identified.

For example, the total loss of a company's payroll file would cause considerable embarrassment and disruption to activities but would not cause a personal safety hazard. It is unlikely to cause a financial loss directly, although there would be considerable cost associated with the disruption to normal activities while the file was rebuilt.

A different example, and one which actually happened, concerns the deliberate modification by a hacker of patient treatment data in a hospital system. In this case at least one patient died. There would also have been direct financial loss to meet compensation claims and extreme corporate embarrassment.

CRAMM deals with all these circumstances by using a series of guidelines which map the scale of the impact onto the scale of 1 to 10 as used for simple asset values. One example is the "Embarrassment Guideline" as shown below:

Effect	Value
Contained in department	1
Other departments aware	2
Public made aware	3
Complaints to Members of Parliament	5
Widespread adverse publicity	7
Calls for Minister to resign	9
Minister obliged to resign	10

This is one table where the civil service wording is most obvious. But substituting "director" for "Member of Parliament" and "Managing Director" for "Minister" makes it quite usable in industry and commerce. It is also clear how it could easily be made compliant with the management structures in universities and other higher education establishments.

The equivalent "Personal Safety Guideline" is shown below:

Effect	Value
Minor injury to an individual	2
More serious injury to an individual	4
Injury to several people	6
Death to an individual	8
Death to several people	10

(Cynics have pointed out that it is apparently less serious to kill someone than to call for a Minister of the Crown to resign)

In making an assessment of a particular data asset, it is important that the reviewer does not make his own judgements about the possible impacts. He should interview the "data owner" and extract the information in this way, preferably without exposing the scoring tables. In this way the assessment becomes a collaborative effort; the reviewer simply the master of the process.

Threats and Vulnerabilities

When all the data assets have been examined it is necessary to consider the Threats and Vulnerabilities. The threats considered are:

1. Natural disasters e.g. fire, flood etc
2. Deliberate threats from outsiders
3. Deliberate threats from staff
4. IT equipment failures
5. Errors by staff

The likelihood of a threat manifesting is assessed by reference to known conditions and recent experience. For example, computer installations in earthquake zones or in the basement of a building below the flood level of a nearby river would be considered to have a significant threat level. Computer installations in buildings which are open to the public are at risk as are installations using old equipment and with a poor staff training record.

Vulnerabilities also need to be considered, and it is frequently difficult to separate a lack of vulnerability from the application of a countermeasure. For example, a computer in a wooden building and where the management of waste paper is poor is very vulnerable to fire. Appropriate countermeasures would be the installation of fire detection and extinguishing equipment - but these would not reduce the intrinsic vulnerability. Another example, particularly relevant in universities, would be that computer installations themselves should be secured, particularly in buildings which have public access.

Countermeasures

At this stage the CRAMM process has information about the physical installation and the totality of the systems that run on it and their overall sensitivities. The package goes into its "expert system" mode and makes reference to its data base of countermeasures to find those which are known to be effective in the circumstances that have been identified. These are listed, cross referenced against the particular threats, and presented as recommendations to management.

For example, base line countermeasures which are generated in almost all assessments include doing back-ups of data and using passwords. In slightly riskier situations the use machine generated passwords and the formal examination of the audit logs might be recommended. At a higher level still the installation of trusted firewalls, encrypted message transfers and the positive vetting of operations staff might be suggested.

As with all consultancy reports, management reserves the right to accept or reject all or part of the report. Countermeasures cost money, some a great deal of money, and management may have important knowledge that was outside CRAMM's data gathering exercise and which, in its judgement, affects CRAMM's conclusions. Or it may just decide to accept the risks.

Conclusions

So, what are the advantages of using a method such as CRAMM? Well, it injects a strong measure of objectivity into the risk analysis process. Universities are multi-faceted institutions. Gone are the days when a university had a single computer installation. There are the machines which support the business functions of a university, those which are used by researchers, often on a faculty by faculty basis, and those which have moved into the basic teaching and learning processes. Institutions are being pressed to operate more and more effectively as businesses while the sources of revenue depend increasingly on quality assessments made of the teaching and research processes - certainly in the UK. And usually the entire campus is wired into the global internet with all the additional risks that brings.

CRAMM enables the relative risks and threats to be assessed so that countermeasures appropriate to the particular system can be selected. It can also be used to show how the risks change with time as the systems evolve. But perhaps most importantly it provides new insights for IS Directors and other university managers about the ever increasing importance of computer based systems in academic life.

Manchester Computing
The University of Manchester
Oxford Road
Manchester M13 9PL
UK
E-mail: ron.chisnall(at)mcc.ac.uk

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Du DOS à Windows NT : émergence d'une nouvelle génération de stations de travail et de serveurs.

[1]François Collin, [2]Khac-Binh Su

I. Introduction

Ce fut avec la création par Microsoft (MS) du DOS, système d'exploitation sur disque pour microordinateur à microprocesseur Intel 8086, que cette famille de puces prenait définitivement sa place incontournable dans le fonctionnement de nouveaux ordinateurs de bureau. Ces derniers jouaient encore modestement leur rôle en bureautique individuelle ou comme terminaux intelligents connectables aux systèmes centraux. L'évolution matérielle, tant en puissance des microprocesseurs et en capacité de mémoire - mémoire vive ou mémoire de masse - qu'en diminution de coût d'acquisition et de maintenance, faisait naître de nouvelles applications sur plate-formes microordinateurs. Mais c'était surtout la concurrence induite par l'interface conviviale du Macintosh de la Société Apple et la prolifération des réseaux informatiques, dont principalement l'Internet qui ont présidé à la conception de la famille des systèmes d'exploitation Windows 3.x de MS. Parallèlement à cette évolution, apparaissait le phénomène du "down sizing" dans le domaine des systèmes informatiques, faisant des miniordinateurs les concurrents directs d'anciens gros systèmes des centres de calculs, avec la prédominance d'Unix sur le front des systèmes d'exploitation. L'autonomie des postes de travail était en augmentation parallèlement à leur capacité à partager des ressources. En 1993, MS lança Windows NT comme son cheval de bataille en cette fin de siècle dans la poursuite du down-sizing au niveau cette fois des systèmes d'exploitation, visant simultanément les deux segments du marché que sont les stations de travail et les serveurs. Comme pour célébrer son quatrième anniversaire à la fin de 1997, Windows NT est apparu dans sa version 4, qui s'avère être fondamentalement différente des versions précédentes en ce qui concerne l'interface utilisateur identique à celle de Windows 95, ainsi que les performances globalement améliorées. Dans ce qui suit, nous présenterons les fonctionalités marquantes de Windows NT 4.0 dont la croissance en unités installées a dépassé toute projection théorique. Nous aborderons ensuite les aspects relatifs à son intégration dans d'autres environnements, à la migration d'autres systèmes vers NT, à son enseignement dans le cadre des services informatiques de l'Enseignement supérieur et de la Recherche, et à la perspective de l'avènement de la version 5.

II. Fonctionnalités marquantes de Windows NT

1. Interface graphique

En adoptant l'interface de Windows 95, Windows NT 4.0 ouvre véritablement l'ère graphique des systèmes d'exploitation dignes de ce nom. Son administration se fait désormais à l'aide de fenêtres graphiques, de menus déroulants, d'icônes, etc.., mettant ainsi fin à la nécessité de recourir à des commandes en ligne rébarbatives, même si l'objectif " zéro administrateur " n'est pas encore pour demain. En effet, l'aspect graphique offre une apparence de convivialité inégalée, mais c'est pour mieux cacher la complexité des mécanismes mis en jeu, dont la maîtrise passera par une bonne connaissance de tout ce qui fait un grand système d'exploitation. Si l'on veut, il est toujours possible de quitter l'environnement graphique pour se plonger dans les profondeurs du Registre, dont on ne sortira pas toujours gagnant, à moins d'être un expert ! Il n'en reste pas moins que la convivialité offerte par le système permettra une exploitation plus facile des possibilités de l'ordinateur, réduisant à la fois le coût de formation des utilisateurs et le coût global de possession du parc informatique. Il convient également de noter que l'homogénéité des interfaces utilisateurs, allant des stations de travail aux serveurs, plus particulièrement sur le plan applicatif, contribue à la popularité croissante de Windows NT.

2. Multitâches

Avec les versions précédentes de Windows 3.x, la technique multitâche utilisée est de type coopératif, c'est-à-dire que le contrôle du processus est assuré par les applications elles-mêmes, d'où possibilité de blocage en cas de défaillance d'une application. Sous Windows NT, c'est le système qui exerce le contrôle (multitâche préemptif). De plus, le multithread est disponible, permettant à une application de lancer en parallèle d'autres sous-tâches : on peut par exemple travailler sur une feuille de calcul Excel tout en soumettant une requête d'impression depuis Excel. Mais Windows NT ne supporte pas le multi-utilisateur : en ouvrant une session sur un domaine, l'utilisateur accède aux différents services offerts (partage de fichiers, partage d'imprimantes,...), sans pouvoir utiliser directement le temps CPU du serveur. Il ne peut donc pas faire tourner un programme Fortran par exemple sur le serveur.

3. Sécurité

La sécurité a évolué de manière fondamentale avec Windows NT. On peut examiner différents composants: la sécurité des données, la sécurité d'accès, le contrôle des utilisateurs et le contrôle des réseaux. Totalement absents sous MS-DOS, ces différents points ont commencé à être traités sous WINDOWS 3 et 95 ; la notion de groupe de travail sur le réseau est apparue avec le contrôle d'accès au niveau de la ressource. Le partage des ressource apparaît à tout utilisateur connecté sur le segment de réseau. Avec Windows NT 4, la sécurité est un point fortement développé :

- L'accès aux postes de travail en local ou par le réseau peut être contrôlé de manière totale sur le base de nom et de mot de passe individuel par un administrateur.
- Les fichiers sur une station peuvent être protégées de manière totale par leur possesseur de tous les autres utilisateurs de la même station.
- Les données partagées sur le réseau ne sont vues que des utilisateurs qui ont accès au domaine et ils ne peuvent y accéder qu'en fonction de leur droit, enregistrés dans la liste d'accès à la ressource sur le serveur.

Les utilisateurs sont administrés de manière centralisée dans un domaine. Un éditeur de stratégie permet de définir une politique de gestion des utilisateurs aussi bien sur la base individuelle que par groupe : il permet de définir les droits et les environnements des utilisateurs ou des stations de travail. Les outils de sécurité au niveau de la gestion des comptes utilisateurs sont diversifiés : durée de validité, période de connexion autorisée, structure des mots de passe...;

Tout accès aux ressources - fichiers, connexions, impressions...; - peut être audité.

Des outils de mise en oeuvre de sauvegardes physiques des données sont proposés. Plusieurs niveaux de technologie RAID permettent d'offrir un bon degré de fiabilité de l'exploitation et de conservation des fichiers.

Le service d'accès distant par réseau téléphonique autorise l'identification et le transfert des données codées.

L'énoncé de ces quelques points, totalement absents avec MS-DOS apportent un éclairage sur l'évolution de la sécurité avec WINDOWS NT 4. Ils lui permettent de se mesurer avec les grands systèmes.

4. Outils d'administration

WINDOWS NT est fourni avec plusieurs outils d'administration de serveur. On peut citer : l'administrateur d'accès distant, l'administrateur de client réseau, l'analyseur de performance, le gestionnaire des utilisateurs pour les domaines, le gestionnaire de licences, le gestionnaires de sauvegarde, le gestionnaire de serveur, l'observateur d'avènement, le gestionnaire de serveur WEB, le gestionnaire de sauvegarde et le gestionnaire de disque.

Ces outils permettent d'administrer un serveur et sur ce serveur un ensemble de services offerts à une communauté d'utilisateurs accédant à un domaine.

Toutes ces fonctions sont apparues avec WINDOWS NT.

5. Réseaux

La transformation des objectifs de fonctionnement est tout à fait claire dans les fonctions réseaux. De poste de travail individuel autonome ou connecté en émulation de terminal passif, on est passé à un poste actif sur le réseau avec Windows for Workgroup puis à un système d'exploitation de réseau avec WINDOWS NT; ce dernier

- fournit comme pour les autres familles de système MS-DOS et WINDOWS l'accès, le partage et le contrôle d'un réseau Microsoft (SMB)
- apporte de manière native les outils d'intégration et de support complet d'un réseau Internet (TCP/IP, WINS, DHCP, SNMP, SMP, DNS...;)
- permet de s'intégrer dans un réseau NetWare.

Le support d'Internet complet peut être réalisé en n'utilisant que des serveurs NT.

III. Intégration

1. Environnement Unix

Le système d'exploitation Unix développé depuis 1969 est traditionnellement considéré comme bien adapté aux serveurs multi-postes d'envergure, grâre en grande partie à la disponibilité de matériel haut de gamme spécifiquement conçu pour Unix. Il faut cependant noter que malgré son appellation générique, ce système n'apparaît toujours pas comme un standard unique et qu'il n'est pas facile à maîtriser.

Comme Unix, Windows NT utilise par défaut le fameux protocole TCP/IP ; il offre en standard les fonctionnalités de serveurs Web, FTP, Gopher et DNS. Il gère de plus les serveurs DHCP et WINS.

Compte tenu des investissements considérables déjà consentis sous Unix ainsi que la jeunesse de Windows NT, il s'avère sage à l'heure actuelle d'envisager plutôt la cohabitation de Windows NT avec Unix. Une intégration complète entre ces deux systèmes nécessite toutefois des produits tiers-partie. C'est vrai pour le serveur Telnet, les client et serveur NFS, et le serveur des terminaux X

2. Environnement Netware

Netware de Novell existait depuis le tout début des microordinateurs IBM PC et compatibles. Il visait l'implémentation du partage des ressources (fichiers et périphériques) gérées par le serveur. Dans une organisation déjà équippée de réseau Netware, la solution à envisager serait l'intégration des serveurs Netware et NT. Etant donné que ces deux systèmes supportent le protocole IPX, les clients Netware peuvent utiliser le serveur NT comme point d'accès aux applications client-serveur basées sur NETBIOS, telles que ORACLE ou SQL Server. Avec l'ajout du Service client pour Netware, Windows NT Workstation peut accéder aux disques et queues d'impression gérées par un serveur Netware.

IV. Migration

Comme il a été indiqué plus haut, la migration d'Unix vers Windows NT n'est pas un choix simple dans l'état actuel de développement de Windows NT.

Par contre, les outils standard existent qui permettent une migration complète de l'environnement Netware vers NT.

V. Enseignement

Depuis pratiquement un an, nous avons mis en place cinq sessions de formation à Windows NT dans le cadre du CSIESR (Comité des Services Informatiques de l'Enseignement Supérieur) et des centres de formation du CNRS (Centre National de la Recherche Scientifique, Garchy, Gif-sur-Yvette et prochainement Luminy). Le but principal en est d'offrir en quatre jours une introduction pratique à Windows NT, traitant des aspects à la fois généraux et techniques, tels que les concepts de base, les méthodes d'installation et de dépannage, les outils d'administration et de réseau ainsi que les principaux services (impression, Macintosh, sauvegarde). Les travaux pratiques sont effectués sur des PC à base de processeur Intel, bien que dans certains stages, des processeurs Alpha aient aussi été utilisés*. S'adressant aux informaticiens des centre de calcul ainsi qu'aux enseignants et chercheurs des établissements d'Enseignement supérieur et de Recherche, les stages de type résidentiel offerts jusqu'à ce jour sont de niveau 1 : ils ont permis aux participants de démarrer plus facilement une première installation de Windows NT dans leur environnement de travail. Un forum privé d'échange d'informations et d'idées a aussi été créé à leur intention. Des stages de niveau 2 sont prévus permettant d'approfondir les possibilités de Windows NT. Notons que selon une récente étude publiée dans la presse spécialisée, la formation complète conduisant à la maîtrise de Windows NT nécessiterait 21 jours. Pour notre part, nous pensons que deux stages de niveaux 1 et 2, d'une durée maximale de 5 jours chacun, suffiraient aux participants venant des mêmes horizons universitaires, d'acquérir des connaissances solides et indispensables à leurs tâches quotidiennes. La structure d'organisation que nous avons mise en oeuvre présente un grand avantage de coüt, ce qui a permis à un nombre plus important d'intéressés d'assister aux stages.

VI. Perspective

Windows NT évolue vite. C'est là un gage de qualité pour tout système d'exploitation de haut niveau. Parant au plus pressé, MS visait en premier lieu le marché alléchant des serveurs de réseaux locaux dont plus de deux tiers sont aujourd'hui encore occupés par Netware de Novell. Pour pouvoir se mesurer à Unix voire le concurrencer avec quelque chance de succès, Windows NT devra intégrer la technologie multi-poste développée par Citrix (http://www.citrix.com), qui la distribue à l'heure actuelle sous la marque Winframe et autres variantes. Une telle éventualité serait envisageable dans les prochaines mises à jour de Windows NT 4.x+.

Windows NT fait largement appel à la notion de domaine qui lui est propre. La complexité de gestion introduite par les relations d'approbation afin de créer de grands réseaux sous Windows NT, conduit rapidement à des difficultés pratiques, rendant cette approche délicate. Des changements à cet égard seraient incorporés dans la future version Windows NT 5, dont la disponibilité ne serait effective que vers la fin de 1998. De même, la technologie des clusters serait incluse dans la version de base.

VII. Conclusion

Il apparaît bien que le système WINDOWS NT fait émerger une nouvelle génération de poste de travail et de serveur. Supporté sur deux plate-formes principales, à savoir Pentium d'Intel et Alpha de DEC, Windows NT offre deux environnements de travail distincts. Dans la version Workstation, il permet de déployer des postes de travail individuels avec un niveau de sécurité satisfaisant et des performances très importantes en regard des applications. Ainsi des stations Alpha tournant à 500 MHz sous Windows NT s'avèrent être des concurrentes sérieuses des stations de travail sous Unix, avec en prime l'environnement applicatif de Windows (Word, Excel,...). En ce qui concerne les serveurs départementaux, Windows NT offre tout l'éventail des outils d'administration, d'intégration et de migration, lui permettant à terme de concurrencer directement Unix, compte tenu des évolutions en cours et à venir. C'est donc un système d'exploitation à surveiller de près, d'autant plus que le coût des matériels et des logiciels est celui qui est pratiqué pour la microinformatique où la grande diffusion et la multiplicité des offres entraînent des coûts plus faibles.

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*Ceci a été possible grâce au prêt de matériel par la Société DEC.

+Selon une récente annonce de presse faite par la Société Citrix au salon Networks 97 à Birmingham, Royaume Uni.

[1]Service informatique,
Université Denis Diderot,
2 place Jussieu, 75251 Paris Cedex 05, France
E-mail: collin(at)paris7.jussieu.fr

[2]Laboratoire d'Electrochimie Moléculaire,
Université Paris 7, 2 place Jussieu,
75251 Paris Cedex 05, France
E-mail: su(at)paris7.jussieu.f

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Erfahrungen beim Einsatz einer Breitband-Richtfunkverbindung zwischen dem Collegium Polonicum und der Europa-Universität Viadrina Frankfurt (Oder)

Werner Fitzner

1. Einleitung

Ein Erfahrungsbericht zum Einsatz einer terristischen Richtfunkverbindung zwischen zwei universitären Einrichtungen ist normalerweise aus wissenschaftlich-technischer Sicht nichts Neues. An der deutsch-polnischen Grenze, die in Frankfurt (Oder) . a. durch die Zusammenarbeit der Europa-Universität Viadrina mit dem Collegium Polonicum gekennzeichnet ist, ist es schon ein Pilotprojekt, das beispielgebenden Charakter hat. Aus diesem Grunde sind die technischen Aspekte des Ausbaus der Informations- und Kommunikationsinfrastruktur vielleicht von nachgeordneter Bedeutung im Rahmen des EUNIS, d. h. der Rahmen in dem sich die Zusammenarbeit vollzieht erklärt das besondere Anliegen des Projektes.

Am 21.12.1993 wurde die Euroregion „Pro Europa Viadrina" gegründet. Der Region gehören von der deutschen Seite die Landkreise Oder-Spree und Märkisch Oderland und die Stadt Frankfurt (Oder) an. Die Region umfaßt auf polnischer Seite ca. 5.000 und auf deutscher Seite ca. 4.700 Quadratkilometer. In der Region leben 345.000 polnische und 449.000 deutsche Bürger. Die Pro Europa Viadrina-Region ist etwas Besonderes, da sie an der EG-Außengrenze liegt und ein gemeinsamer Aufbau sich besonders kompliziert gestaltet. Die Infrastruktur in der Grenzregion ist unterentwickelt und es gibt Störungen in der wirtschaftlichen Zusammenarbeit infolge der Wiedervereinigung Deutschlands, insbesondere durch weitgehende Entindustrialisierung in Ostbrandenburg. Ziel ist es in der Grenz- und Euroregion durch die Arbeit der Adam-Mickiewicz-Universität Poznan mit der Einrichtung des Collegium Polonicum und der Europa-Universität Viadrina den wirtschaftlichen, wissenschaftlichen, kulturellen, sozialen und kommunikativen Austausch zu befördern.

2. Historische Aspekte

Die Neugründung der Europa-Universität Viadrina am 15. Juli 1991 knüpft nach 180 Jahren Unterbrechung an die universitären Traditionen der alten Alma mater Viadrina an. Die neuen Aspekte werden durch die Förderung der Europa-Idee im Partnerschaftsvertrag mit dem Collegium Polonicum festgehalten, der am 06. September 1991 abgeschlossen wurde.

Der Studienbetrieb an der Alma mater Viadrina fand von 1506 bis 1811 statt. Frankfurt (Oder) war rund 300 Jahre lang Stadt der ersten Landesuniversität von Brandenburg und die Alma mater Viadrina war die bedeutendste Bildungsstätte für den brandenburg-preußischen Staat. Es wurde an vier Fakultäten, der juristischen, der theologischen, der medizinischen und der philosophischen gelehrt und studiert. In über 25 Disziplinen (. a. in Rhetorik, Geschichte, Astronomie, Mathematik und Chemie) trug die Universität zum Fortschritt der Wissenschaft bei. Über 55.000 junge Leute studierten an der Alma mater Viadrina. Zu den bekanntesten zählten die Gebrüder Humboldt, Ulrich von Hutten, Carl-Philipp-Emanuel Bach, Thomas Münzer und Heinrich von Kleist.

Am 05. Oktober 1990 wurde der Verein der Freunde und Förderer der Frankfurter Universität gegründet und im Dezember des gleichen Jahres wird in der brandenburgischen Regierungserklärung die Gründung der Europa-Universität angekündigt. Das erste Akademische Jahr beginnt am 19. Oktober 1992 und am 22. Januar erfolgt die Aufnahme der Europa-Universität Viadrina in die Anlage zum Hochschulverzeichnis.

Parallel dazu vollzieht sich die Gründung des Collegium Polonicums in Slubice auf der Grundlage einer Übereinkunft zwischen dem Ministerium für Nationale Bildung der Republik Polen und des Ministeriums für Wissenschaft, Forschung und Kultur des Landes Brandenburg. Das Collegium Polonicum ist als gemeinsame Einrichtung der Adam-

Mickiewicz-Universität Posnan und der Europa-Universität Viadrina errichtet und wird von beiden Universitäten mit dem Ziel der Ergänzung des Forschungs- und Lehrangebotes der Viadrina und der Entwicklung und Unterstützung der regionalen und überregionalen grenzüberschreitenden Zusammenarbeit errichtet.

Die feierliche Grundsteinlegung für das Gebäude des Collegium Polonicum erfolgt am 16. Oktober 1992 und im Wintersemester 1993/94 veranstaltet die Juristische Fakultät der Viadrina unter Einbeziehung polnischer Wissenschaftler die Zusatzausbildung polnischer Jurastudenten im polnischen Recht.

3. Das heutige Profil der Viadrina

An der Europa-Universität wird an drei Fakultäten (Juristische Fakultät, Kulturwissenschaftliche Fakultät und Wirtschaftswissenschaftliche Fakultät) gelehrt und geforscht. Der besondere Charakter der Zusammenarbeit mit Polen kommt auch in der Studierendenübersicht zum Ausdruck.

Fach Gesamtzahl	darunter	andere Polen	Ausländer
Rechtswissenschaft	1.024	332	13
Betriebswirtschaftslehre	641	343	21
Volkswirtschaftslehre	119	40	4
Internationale Betriebswirtschaftslehre	91	10	6
Kulturwissenschaften	446	159	40
Summe	2.321	889	84

Es gibt drei Institute an der Europa-Universität Viadrina:

- das Frankfurter Institut für Transformationsforschung (F.I.T. - 1995 gegründet) mit dem Ziel einen wissenschaftlichen Beitrag zur „Transformation von Wirtschaftssystemen und zur Neuordnung der Gesellschaften Mittel- und Osteuropas“ zu leisten
- das Interdisziplinäre Zentrum für Ethik (IZE) mit dem Ziel wissenschaftlich auf dem Gebiet der Ethik und Philosophie mit Osteuropa (insbesondere mit dem Philosophischen Institut der Universität Warschau) zur arbeiten
- das Heinrich von Kleist Institut für Literatur und Politik mit dem Ziel der interdisziplinären Arbeit auf dem Gebiet der Geistes- und Sozialwissenschaften.

4. Das Collegium Polonicum

Das Collegium Polonicum ist eine neue Form grenzüberschreitender Zusammenarbeit auf dem Gebiet der Forschung und Lehre. Es dient der Festigung der wissenschaftlichen Beziehungen und Zusammenarbeit der beiden Universitäten durch gemeinsame wissenschaftliche Tagungen, Konferenzen, Seminare und Kollegien. Das Collegium Polonicum ist darüber hinaus eine wissenschaftliche Begegnungsstätte für die Universitäten der Länder Ost- und Mitteleuropas und stellt besondere Lehrangebote der beteiligten Universitäten zur Verfügung. Im Collegium Polonicum sollen Fachrichtungen zu Wirtschafts- und Regionalstudien, zur Kulturwissenschaft und zur Rechtswissenschaft vertreten sein. Das CP wird auch eine eigene Verwaltungsstruktur besitzen.

5. Die Partneruniversitäten im Überblick

Europa-Universität Viadrina Frankfurt (Oder)

Gründungsjahr: 1991

Fakultäten:Rechtswissenschaften, Wirtschaftswissenschaften (Betriebs- und Volkswirtschaftslehre, Internationale BWL), Kulturwissenschaften (mit interdisziplinärer Ausrichtung unter Beteiligung von Kulturphilosophie, vergleichender Sozialwissenschaft, Kulturgeschichte, Literaturwissenschaft, Lingusiek), interdisziplinäre Forschungsinstitute für Tranzinformationsstudien, Ethik, Literatur, und Politik.

Studentenzahl: 2.300 (1997

Rektor:Prof. Dr. Hans N. Weiler

Profil: Europäisch ausgerichtete Universität, die Brückenform zwischen Ost- und Westeuropa übernimmt; besondere Rolle der deutsch-polnischen Beziehungen; 30 % aller Studenten kommen aus Polen; Verzahnung der Lehprogramme aller Fakultäten; interdisziplinärer Charakter der Kulturwissenschaften; intensiver Fremdsprachenunterricht

AdamMickiewicz-Universität Posnan

Gründungsjahr:1919

Fakultäten: Biologie, Chemie, Polnische und Klassische Philologie, Physik, Geschichte, Mathematik und Informatik, Sozialwissenschaften, Philogie der neuen Sprachen, Rechts- und Verwaltungswissenschaften, Pädagogik

Studentenzahl: 26.700 (1995)

Rektor:Prof. Dr. habil. Stefan Jurga

Profil:Eine modern verwaltete Universität mit starker Beteiligung an internationalen Forschungsprogrammen; 30 Partnereinrichtungen in der ganzen Welt;

2.000 wissenschaftliche Mitarbeiter, darunter 400 Professoren; 200 wissenschaftliche Veröffentlichungen jährlich; Universitätsbibliothek mit 4,3 Mio.

Bänden

6. Information und Kommunikation

Die Realisierung der Anforderungen an Aufgaben an die zentrale universitäre Informationsverarbeitung und an die Kommunikation wird an der Europa-Universität Viadrina durch das Fachreferat Allgemeine Datenverarbeitung (ADV), das dem Kanzler als Verwaltungseinheit unterstellt ist, realisiert. Das Fachreferat ADV arbeitet in den drei Gruppen:

1. PC-Lokale Netzwerke-Novell Administration

2. Netze- und Netzdienste

3. HIS (Hochschulinformationssystem)

Zu den Hauptarbeitsgebieten im Jahre 1996 zählten . a.:

Ausbau der IuK-Infrastruktur

- Einsatzvorbereitung und Inbetriebnahme des WiNShuttle-Anschlusses für Schulen, öffentliche Einrichtungen, Einzelpersonen und Institutionen der Stadt Frankfurt (Oder) und der Region,
- Einsatzvorbereitung und Inbetriebnahme des B-WiN-Anschlusses (Breitband- Wissenschaftsnetz) in Zusammenarbeit mit dem DFN-Verein (Deutsches Forschungsnetz), der Deutschen Telekom und dem Institut für Halbleiterphysik,
- Aufbau und Inbetriebnahme des Universitätsnetzes im Hauptgebäude der Universität und Inbetriebnahme eines zentralen Serverraumes im Fachreferat ADV - Aufbau und Inbetriebnahme einer Richtfunkverbindung zwischen dem Hauptgebäude der Universität und den Gebäudekomplex Robert-Havemann-Str. in Zusammenarbeit mit dem Landesbauamt,
- Ausbau der Informations- und Kommunikations-Infrastruktur für das Dezernat 1 (Logenstr.) und für die Forschung und Lehre in der Robert-Havemann-Str. 1 und 4.

Software für Forschung und Lehre

- Anschluß an den neuen Select-Vertrag der Universität Potsdam über Microsoft Produkte,
- Anschluß an Campuslizenzvertrag für AutoDesk-Produkte, der Brandenburgischen Technischen Universität Cottbus
- Zugangsberechtigung für ASK-Softwareshop
- Symantec Rahmenvertrag mit dazugehöriger Autorisierung der Hochschule durch Symantec GmbH
- Site License von TSP VERS. 4.3
- Borland FuLP-Vertrag
- Anschluß an Campuslizenzvertrag der Universität Potsdam über SPSS für Windows
- Verlängerung der Teilnahme an SAS-Landeslizenz
- Abschluß einer Kyrillica-Mehrfachlizenz

Organisation und Beschaffung

- Einsatzvorbereitung und Beschaffung von SUN-Servern zur Nutzung der jeweiligen Moduln des Hochschulinformationssystem in den Dezernaten 1 und 3
- Beschaffung und Einsatzvorbereitung für zwei Firewallsysteme in der Verwaltung im Rahmen der Bestimmungen zum Datenschutz
- Beschaffung und Einsatzvorbereitung eines Backup-Systems für den Einsatz der Programme des Hochschulinformationssystems
- HBFG-Antragstellung (Hochschulbauförderungsgesetz) zum Ausbau der HIS-Server-Technik (Dezernate 2 und 4) und zur Konkretisierung eines elektronischen Archivsystems

- Einsatzvorbereitung und Inbetriebnahme eines zentralisierten RAID-Systems
- Einsatzvorbereitung und Inbetriebnahme sowie die Novell-Netz-Einbindung eines zentralen Farbkopierers

Support für Forschung und Lehre

- Organisation, Aufbau, Inbetriebnahme und Übergabe von CIP-Pools:

  1 Multimedia-CIP-Pool(Kulturwissenschaftliche Fakultät)

  2 PC-CIP-Pools(Wirtschaftswissenschaftliche Fakultät)

  1 PC-CIP-Pool(Rechtswissenschaftliche Fakultät)

- Organisation, Aufbau, Installation und Inbetriebnahme eines WAP-Clusters für das F.I.T.

Öffentlichkeitsarbeit

Zur aktuellen Information auf dem Gebiet der IuK-Infrastruktur und zur Bekanntgabe von operativen Regelungen und zur Bekanntgabe von operativen Regelungen zum Einsatz der Hard- und Software, gab die ADV zwei Zeitungen heraus. Zur umfassenden Dokumentation der ADV-Leistungen erschien im März 1996 der Jahresbericht ADV-1995.

Mitarbeit in Gremien

Das Fachreferat ADV arbeitete im Jahre 1996 aktiv in folgenden Arbeitsgremien mit:

- ZKI e.V. (Zentren für Kommunikation und Information in Forschung und Lehre)
- DFN - Mitgliederversammlung und Benutzergruppe
- Arbeitsgruppe - Hochschulsoftwarelizenzen des ZKI
- EUNIS (European University Information System)

7. Der Aufbau der Richtfunkverbindung

Die Europa-Universität Viadrina hat zur Zeit fünf Gebäudekomplexe, die durch in den drei Fällen mit Lichtwellenleiterkabel miteinander verbunden sind. Zwei Gebäudekomplexe sind im Rahmen des Aufbaus der Universität derzeit mit einer Richtfunkverbindung an das Hauptgebäude, wo sich der 34 Mbit/s - WiN-Knoten des DFN befindet, angeschlossen.

Auf der Grundlage der Erfahrungen des Einsatzes einer 38 GHz-Richtfunkstrecke wurde die Zusammenarbeit mit dem Collegium Polonicum zum Ausbau der IuK-Infrastruktur organisiert. Im Zusammenhang mit den vorangegangenen Funkinstallationen stand die Auswahl der Technik. Als Übertragungsmedien wurden zunächst:

- die Übertragung auf der Basis eines gebündelten Infrarotlichtes
- eine Laser- Hochleistungsstrecke (optische Übertragungstechnik mit Infrarot-Lasergeräten) und eine 38 GHz-Richtfunkstrecke in Betracht gezogen.

Auf der Grundlage vorliegender Erprobungsberichte anderer Universitäten in Deutschland und wegen der regionalen und örtlichen Besonderheiten (Odertal mit erhöhtem Nebelaufkommen) und der eigenen Erfahrungen eines stabilen Dauerbetriebes zwischen den Gebäudekomplexen der Europa-Universität fiel dann auch die Entscheidung für das Collegium Polonicum eine 38 GHz-Richtfunkstrecke in Betrieb zu nehmen (Aufbau siehe Anlage 1). Das geplante Richtfunksystem bietet eine sofort einsetzbare und kostengünstige Alternative zur Sprach- und Datenübertragung gegenüber herkömmlichen Lichtwellenleiterverkabelungen, was wegen der Situation des Grenzflusses (Oder) und dem Vorhandensein nur eines städtischen Übergangs von Frankfurt (Oder) nach Slubice, viele Probleme durch die Leitungsverlegung (Schachtarbeiten, territoriale und staatliche Hoheiten und damit Genehmigungsverfahren) bereitet.

Die Sendeeinheit (ODU) besteht aus einem kompakten Sende- und Empfangsteil, das mit einer wetterfesten Parabolantenne direkt gekoppelt ist. Die Steuereinheit (IDU) besteht aus einem Gerät, das im Gebäude installiert wird und die Funktion von Schnittstellen, digitalem Multiplexer, Modulator und Zwischenfrequenzgenerator beinhaltet. Gleichzeitig sind Alarm- und Diagnose- sowie Systemüberwachungsmodule eingebaut, auf die über eine spezielle Schnittstelle zugriffen werden kann. Zwischen der Steuer- und Sendeeinheit ist nur eine Koaxialkabel erforderlich. Bis 300 m Abstand ist eine Arbeit ohne Leistungsverlust möglich.

Zur Einführung des System konstituierte sich eine Arbeitsgruppe aus Mitarbeitern des Collegium Polonicums (Verwaltungsdirektor, DV-Mitarbeiter, Bibliotheksmitarbeiter) und dem Fachreferat ADV (Leiter, Gruppenleiter Netze- und Netzdienste, Gruppenleiter PC-LAN-Novell-Administration). Die Arbeitsgruppe definierte die Zusammenarbeit (gemeine Arbeiten), die Etappen nach denen geplant wird und die Einzelaktivitäten auf der jeweiligen nationalen Seite. Zu den definierten Etappen gehört:

- Gründung der Arbeitsgruppe und Festlegung des Arbeitsplanes und Organisation der

Zusammenarbeit20. Januar 1997
- Definition der technischen Parameter und Ausschreibung der Technik 02. Mai 1997
- Vergabe des Auftrages mit definierten Leistungsumfang 20. Juni 1997
- Beginn des Montagebeginns auf der deutschen und polnischen Seite 04. Juli 1997
- Geplante Inbetriebnahme der Richtfunkstrecke und Erprobung bis zur Aufnahme des Lehrbetriebes im ersten Bauabschnitt des Collegiums Polonicums ab 24. Oktober 1997.

Mit dieser Aufgabenstellung und monatlichen Beratungsterminen stellte sich die Arbeitsgruppe ein terminlich, fachlich und organisatorisch ein sehr ehrgeiziges Projektziel.

Im Vorfeld der technischen Realisierung konnte die Finanzierung mit ca. 160.000 DM aus dem Programm Interreg II sichergestellt werden. Die Kofinanzierung übernahm die Europa-Universität Viadrina.

8. Fazit

Die Realisierung eines solchen Projektes ist gewissermaßen Neuland in der universitären Zusammenarbeit im Informations- und Kommunikationsbereich und zugleich ein Musterbeispiel für die Verflechtung der Wissenschaft zwischen einem EU-Mitgliedsstaat und einem mitteleuropäischen Reformstaat. Vielfach nicht geklärte Rechtsfragen bereiten hin und wieder Zuständigkeits- und Koordinierungsprobleme, wie beispielsweise finanzielle Regelungen, Fragen des Warenverkehrs und der zeitweisen Überlassung von Hard- und Software, Genehmigungsverfahren der zuständigen Einrichtungen für die Frequenzvergabe und die Standortvergabe (BAPT-Bundesamt für Post und Telekommunikation in Deutschland oder PAR-Polnische Agentur für Radiokommunikation) in der Republik Polen.

Mit dem Aufbau einer terristischen Richtfunkstrecke wird ein Beitrag zur Zusammenarbeit auf dem Gebiet der IuK-Infrastruktur geleistet. Der Beitrag ordnet sich ein in eine grenzüberschreitende Zusammenarbeit der Pro Europa Viadrina-Region und schafft eine Basis zur Zusammenarbeit in den unterschiedlichsten wissenschaftlichen Disziplinen.

Europa-Universität Viadrina Frankfurt (Oder),
Große Scharrnstr. 59,
Fachreferat Allgemeine Datenverarbeitung,
15230 Frankfurt (Oder), Deutschland
E-mail: fitzner(at)euv-frankfurt-o.de

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Integrated information infrastructure at the Eotvos Lorand University, Budapest

[1]F. Telbisz, [2]L. Daruházi, [3]G. Gyori, [4]Z. Onder, [5]O. Pintér

1. Introduction

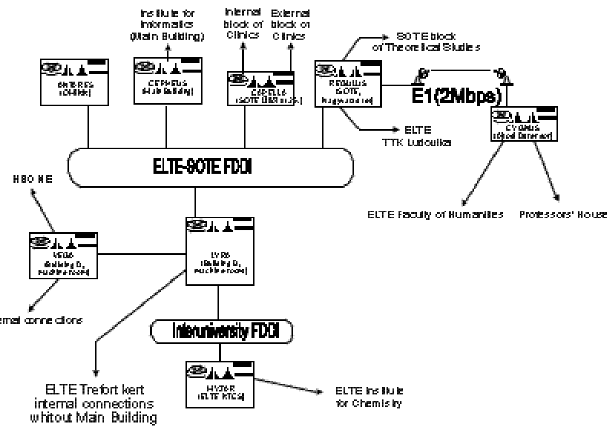
Eotvos Lorand University (ELTE) is one of the largest universities in Hungary with about 12 thousand students. It has four faculties: Faculty of Arts, Faculty of Law and Political Sciemces, Faculty of Sciences, Teachers Training College and a postgraduate Institute of Sociology. The evolution as well as the present state of the information infrastructure is described in this paper. It has evolved gradually with much vigour since 1989 till it reached the present state. The university, like any old one is dispersed in the capital of Hungary, with many distant campuses, even some of them placed in other villages. This was a serious drawback in building a coherent infrastructure.

2. The data communication infrastructure

Although there existed in Hungary an X.25 packet switched network since 1987, the political changes have brought dramatic developments in networking, too. The large universities and research institutes have built their Ethernet based LANs in a very short time.

The data communication network of the University was started in 1989. At that time it consisted of two tiny local area Ethernet networks, the LAN of the Institute for Physics placed in the City (Trefort kert/garden) and the LAN of the Institute for Chemistry. These two institutes are separated by a considerable distance and located on two different sides of the Danube. When the planning was started in 1990, the dispersed structure of the university campuses was a serious problem. Due to this fact, about 8 km of optical cable had to be laid down by the University during the fall of 1991 and by the spring of 1992 the optical backbone was operational. Since then only minor extensions to it were necessary. Now it is connecting 23 buildings at 11 distant campuses. Still in 1992 the main campuses of three universities in Budapest (Eotvos Lorand University, University of Economy and the Semmelweis Medical University) were connected by fiber optics with Ethernet speed.

In 1994 the Eotvos Lorand University (ELTE) and the Semmelweis Medical University (SOTE) have built a common FDDI backbone, connecting the Trefort campus of ELTE (Sciences), the clinics and the Block for Theoretical Studies of SOTE (Nagyvárad tér). This backbone is prolonged by a microwave link in order to connect some Institutes of the Faculty of Arts (Humanities) of ELTE. The ELTE-SOTE network contains 13 CISCO routers, one of them is a CISCO 7000 router.



The internal backbone of the ELTE-SOTE network before the installation of ATM

In the course of the following years the number of nodes connected to the network of the university was increased gradually. By now about 2000 nodes are connected to the network, the majority of them are PC-s, but about 200 workstations are connected, too. Later the optical Ethernet backbone had to be replaced by an FDDI backbone, with microwave extensions to the far distant campuses.

In parallel to the internal network of the University external network connections were also installed. As a first step to a high speed global connectivity at a national level an inter- university optical backbone was laid down in Budapest connecting the University with two other ones: the Technical University and the University for Economy. Using this optical infrastructure an FDDI backbone was operational in February 1993. A CISCO 7000 router is connecting the ELTE-SOTE network and the so called Interuniversity FDDI backbone, as well as the distant campuses of ELTE. E.g. the Institute for Chemistry of ELTE was connected to the central campuses by this Interuniversity FDDI backbone until 1997.

The international internet connections were also started in 1993, since then with ever growing capacity. By 1994 a national internet backbone was also founded, the external connections at national as well as at international level are provided now by the Hungarian IP Backbone (HBONE), operated by the HUNGARNET Society. ELTE provides connections to the national IP backbone also to a lot of other high schools, grammar schools as well as public libraries and other institutes.

3. Number crunching and other services.

The public central service is provided by a VAX cluster, consisting of a VAX 6125 with 128 MByte memory and 8 GByte disk capacity and of a VAX 9000 with 256 MByte memory and 32 GByte disk capacity. Due to a cluster coupler the disks can be used by both computers. There is an IBM Risk cluster, too, consisting of an SP1 parallel computer with 8 processors and of four RS6000 model 580 computers. These computers offer services for the whole community of the University.

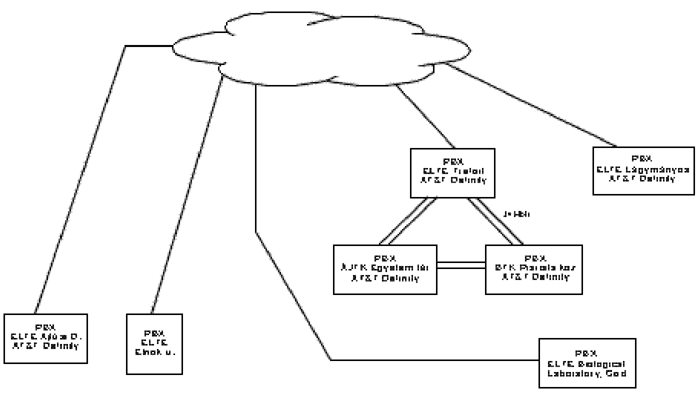
In addition to the central facilities all of the Faculties and Institutes have their more or less powerful servers, too. There is also a further IBM SP2 (with 7 processors) at the institute for Chemistry, but this is used only by this institute.

The central facilities offer not only number crunching service this is mostly done with the departmental computers and workstations but also different other new services like World Wide Web, Gopher, Eletronic Phone Directory, etc..

The distributed library services are based on two IBM RS/6000-370 computers, using the library software from DYNIX Corp. (USA). The system management of these computers is provided by the Center of Information Technologies, while the management of library data is done by the librarians.

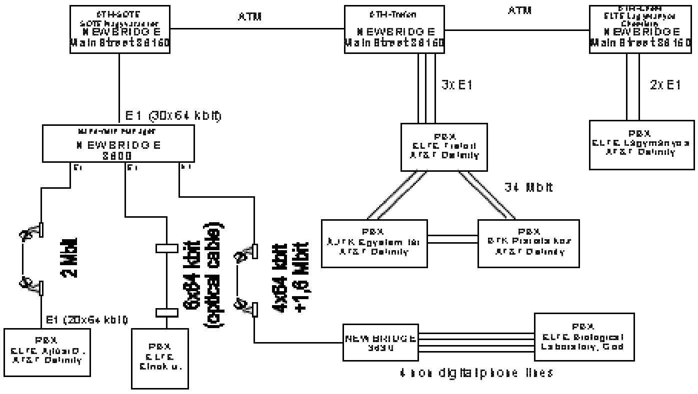
4. Voice communications

The voice communication of the University was also gradually modernised in parallel to the data communications. In 1993 the university started a phone development project in order to exchange the obsolete PBX-s to up-to-date digital exchanges. In the course of this project as a first phase two satellite exchanges were replaced by digital PBX systems. In the second phase in 1995 a second major and several smaller exchanges were installed, and in the third phase, in 1995-96 two further major digital exchanges were installed. (This is a homogenous system as Exchanges of AT&T are installed on each place, Definity G3i systems used as major systems.)



Interconnection of the PBX-s before the installation of ATM

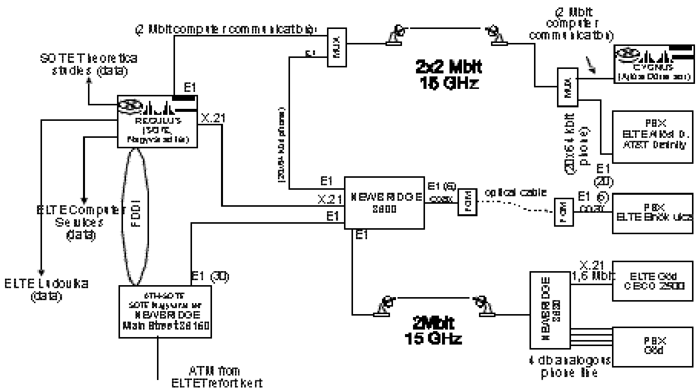
In order to economise the phone expenses the University wanted to connect these exchanges by internal lines, thus avoiding the calls passing through the public phone network. In some cases it could be carried out with the help of the spare fibres of the optical cables laid down for data communication, but just in the direction of the ELTE-SOTE FDDI backbone there were no such facility. This was the time when the idea of using a common infrastructure for voice and data communication emerged.



Phone system of ELTE after the installation of ATM

According to this conception a large section of the ELTE-SOTE fast data communication FDDI backbone was replaced by an ATM connection by installing two mainstream 36150 Type ATM switches maid by New Bridge both in the Trefort Campus and in the SOTE Institute for Theoretical Studies. A similar switch was placed in the Institute for Chemistry. This was connected to the Trefort Campus by the optical fibres of the interuniversity optical connection. All of the ATM switches have E1, FDDI and ATM interfaces.

At one end of the ATM backbone (the node of Nagyvárad tér) a bandwidth manager was also installed, in order to split the phone backbone connections to three different directions. With the help of this facility a remote biological experimental station of ELTE, situated in the countryside could also be connected to the urban network of the University.



ELTE-SOTE data and voice communication system

This integrated communication system works without any serious problem since March 1996.

5. Organisational changes

The technical developments were followed by organisational changes, too. The role of the former Computer Centre was gradually transformed, and by 1995 it gave services for the economic management of the University, only. This changing role was acknowledged by regrouping it from the Center of Information Technologies to the Chancellery of the University, and in contrast the phone services were formally integrated with the Data Communications Services.

A serious management problem for the informatics services at the Universities is the notorious lack of expert peoples who can operate their information infrastructure. Although the Universities are well equipped with up-to-date infrastructure, they can not compete with the much higher salaries offered by the fast growing profit sphere.

6. Conclusion

The case of the Eötvos Lorand University shows an information infrastructure which is comparable to that of many other Universities in Europe, probably struggling with similar problems, too.

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[1]Present address: KFKI Institute for Measurement and Computing Techniques,
H-1525 Budapest, P.O.Box 49. Hungary
E-mail: telbisz(at)caesar.elte.hu

[2]Present address: Hungarian Telecommunication Co.,
PKI-FI FSA, H-1456 Budapest. P.O.Box 2., Hungary
E-mail: daru(at)ludens.elte.hu

[3]Eotvos Lorand University,
Center of Information Technologies,
H-1088 Budapest, Muzeum krt 4/C, Hungary
E-mail: gaga(at)hovirag.csoma.elte.hu

[4]Present address: Hungarian Telecommunication Co.,
PKI-FI FSA, H-1456 Budapest. P.O.Box 2., Hungary
E-mail: onder(at)ludens.elte.hu

[5]E-mail: pinterodon(at)ludens.elte.hu

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The problems of MOLDNET

Nicolae Andronaty, Inna Andronaty

First attempts to create computer networks in Moldova start at the end of 70's.

The work was carried out at Ministry of Communication, the Planification Institute of Gosplan, Academy of Science, etc.

Even some practical positive results were obtained about it.

And some expirience was accumulated it this branch.

But living under the iron curtain of that period, not having access to the technologies used in developed countries, all of the trials to create computer networks failed. Computers and Operational Systems we were having were at the level of IBM 360 and 370 systems but the necessary facilities for network were partially or even completely missing. So naturally in a situation like that it was almost impossible to construct network capable of functioning in real conditions.

The first e-mail systems in Moldova appeared only at the begging of 90's; it was the soviet network - Relcom.

There was not a single leased line at that time, the Relcom servers were working in UUPC mode, that means that they were both accumulating information and interconnecting at certain intervals of time for information transfer on the bases of telecommunication access method. The central computer node of Relcom network, situated in Moscow, were having a connection to West Europe.

It was primitive, but it was a start. And in my opninion an especial importance of that network consisted in the fact that it realised two main objectives:

1. The network were respecting international standards;
2. It was an efficient and cheap means to communicate with the colleagues from all over the world, therefore it contributed to the free exchange of information (For instance, a message by e-mail were getting the Western Europe in a couple of hours, while a letter sent by usual air-mail was covering all of the distance in a couple of months).

The faster and more efficient communication let a group of persons (not too large), who were having access to e-mail, know the developed countries achievements in the branch of electronic communications.

At the time when USSR had disappeared and the iron curtain had fallen, exchanges with all of the countries have intesified; advanced technique and technologies have begun to penetrate our society.

The economical slump was not that bad yet; lots of computers of class PC 286 and 386 (which still work now) were mandated at that time. And the majority of Relcom computer nodes were based on PC 386 and Free BSD operational system.

When western technologies penetrated our market the disparity between West and ex-soviet areas became extremely visible. Soviet technology couldn't face in competition with Western ones and little by little were taken away. At the moment there are no soviet production computers in use anymore.

The first Internet server was constructed in 1993 at Republican Centre of Informatics. It was a PC-based server, rolling the Linux operational system and the most important ! a leased line at 19,2 kbps to EARN network was provided.

Despite the low rate of data transfer, it became possible to make experiments and even to work with utilities like Telnet, FTP, Gopher, WWW in textual mode. In a short time two more computer nodes branched out : one was at the University and another one at Academy of Science. Both the research and the implementations of Internet tecnologies started. The main weakness consisted in low performances of communication canal - for example , it almost imposible to work in graphic mode with WWW.

The work on constructing a computer network for educational and research institutes started in 1995. It was sponsored by Soros Foundation. The network became operational in the first half of the 1996 and it is known as Moldnet (though it would be more correct to be called MoldEduNet, for instance).

The important fact is that this network has a chanel of 64 kbps through satellite to Stockholm, to TideNet and which permits to use graphic mode (of course for video in real-time 64 kbps it isn't enough)

The structure of Moldnet network consists of 5 nodes which are the following:

- Soros Foundation in Moldova
- State University of Moldova
- Technical University of Moldova
- Academy of Economy of Moldova
- Academy of Science of Moldova

(all of them are in Kishinau).

Each of these nodes has: a server, a router and one or more radiomodems.

Routers are connected between them through radiochanels at a speed of 128 kbps.

Moreover, the Soros Foundation router is connected to Internet node in Stockholm trough a cosmic channel at a speed of 64 kbps.

Network is under estension; the equipment for Pedagogical University is already received; connectin of University of Medicine and of other medical institutes is stipulated. I would like to mention the distinct importance of physicians adheration to Internet - there are high quality physicians in Moldova who colligate with Europe and USA but a serious obstacle for this colaboration is the lack of an adequate system of eficient communication between partners. And in this case access to Internet would have a good effect too.

Besides those 2 academic networks we were talking about, that is EARN and MoldNet there are two more providers of Internet services in Kishinau:

1. UNDP. They have a satellite antenna , a canal of 64 kbps. Also through this link local network has access to Internet from UNO office and UNO representatives in Moldova - through dial-up. Do not perform services for some persons . At the moment they provide connection to Internet for External Economical Relations Department of the Government. Also a work on an ample project of connecting some ministries and departments to Internet is carried out. Moldpack. It is a commercial provider. It performs X25 services. Uses an optical fibre canal. Has two more computer nodes in republic.
2. Apriory SRL. Commercial provider. Satellite canal of 64 kbps to TaideNet Stockholm.
3. And the old services performers - Relcom. At the moment besides the UUPC use the leased-lines described upper.

The network problems and their technicak solutions are specific for Universities too. The main specific features that should be underlined are:

The connection of Academic Campus to Soros Foundation Anntena is made through radio-modems at a frequency of 2.4 GHz.

There is a partial functioning of structure based on Thick Ethernet between buildings of different institutes of Academic campus on the str. Academical. Moreover this process is under extention.

Repeaters are used to cover the entire campus. The connection of Botanic Garden, Institute of Genetics, Institute of Plant Physiology and Institute of Biological Protection of Plants which are situated at a considerable distance from academic campus and which are too far to be visible directly by radio-modems will be made through a leased-line.

Also the Praesidium of Academy and the Institute of History and the Institute of Linguistics which are in different corners of the town too will be connected through a leased-line.

The following operational systems are used:

- HP-UX - for the server donated fy Soros Foundation
- Solaris - for SUN workstations and servers
- Linux - for servers based on Intel strusture
- Windows 95 and 3.11 - for users's PC

For navigation through Internet we use Netscape Navigator and Microsoft Internet Explorer, Scripter for MS Windows 95, etc.

The development of Moldnet is supposed to follow like this:

- to connect new users to Moldnet, especially other academies and univeristies, nonprofit scientific-research organizations and different colleges.
- to increase the channel speed ; Possible rate through satellite anntena of the donated by Soros equipment is up to 256 kbps;
-

to create a new powerful channel to Internet; At the moment Moldtelecom, the operator of national telecommunications has installed a channel based on optical fibre which connects Kishinau to Western Europe; it is also going to connect Kishinau to Nothern Caucas and Baltic Sea area. Use of optical fibre channel will substantialy improve the quality of communications. But in this case a problem of payment for channel appears.
- to research, develop and adopt modern technologies of using the Moldnet and Internet networks;

Hard and soft solutions adopted in Moldnet network are good solutions, but we are already facing the necessity of some more performant equipment - server's parameters and storrage capacity need to be enlarged.

- to develop and create new databases and new Internet servers; We appreciate the thing that in the very next future the number of such servers will be increased.
- to upgrade technical base of Moldnet; The problems of development of academic and university information systems in Moldova are similar to the ones described by Guntas Barzdins and Janis Kikutis in “BALTNET Project: Current Network Status in Latvia”, but the situation in Moldova is worse (for instance, Moldnet has access to Internet at a speed of only 64 kbps).

The most important are indicated lower:

1. Not modern and insufficient technical base (there are computers as IBM PC and just a few workstations, so therefore a main part of scientists, researchers and students do not have a free access to Internet). Actualy there is a set of obsolete PS-s at educational and research institutes, and about 40% of them do not allow instalation of some modern softs like Netscape, Windows 95, Unix, etc., talking about servers the situation is even worse - the number of servers and workstations is under 10.
2. We do not have a good (powerful) link to Internet (a rate of 64 kbps isn't enough for a normal work, as you know). It should be taken into consideration that there are about 10.000 people (professors and students) who want to be connected (the channel is only at 64 kbps). Because of this reason universities are looking for resourses to mandate their own satellite antenna and to pay for channels and for data transffer.
3. The number of skilled service personnel for working with Internet is little. Some groups of people who know Internet technologies have been formed at institutes which have access to Internet . There are even Internet courses at some of these institutes.
4. Help for Moldnet was recieved from Soros Foundation, EuroAsia Fond and NATO (not from European structures).

So our suggestion would sound as follows:

- to apply to European Commission and INTAS Countries on behalf of EUNIS to increase the amount of funds INCO, COPERNICUS, INTAS and other programs for support of developing of information systems in the Countries of Central Europe and the New Indepent States and for integration them into European information systems;
- to create working group (from all EUNIS countries) which will:

1. develop a common database of EUNIS Web server using also Web servers of EUNIS countries (topics may be legislation, scientific programs, education programs and so on). This may be suggested as a project to European Commission;
2. to develop the conception of common European academic and university system (including NIS and CEE countries).

Academy of Science of Moldova,
Department of Technical Science,
Stefan cel Mare av., 1, Kishinau,
277612, Moldova
E-mail: andronat(at)tech.moldova.su

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EXPANDING ACADEMIC NETWORKING SERVICES IN St.PETERSBURG AND THE NORTH-WEST REGION OF RUSSIA: ROKSON NW PROJECT

N.V.Borisov, A.Y.Glebovsky, V.A.Kapustin, G.N.Losev, Y.F.Ryabov

The immense scientific, academic and cultural potentials of St.Petersburg -- combined with its advantageous geographical position -- distinguish the city as a strategic point in academic networking in the NW region and the whole of Russia. Academic networking in St.Petersburg originated over a decade ago with fiber-optical trunk lines connecting a number of Academy of Science institutions. The new era in networking development started with the advent of Internet in Russia. A number of projects are underway in the region in allied effort to bring academic networking to a new, advanced level. The paper reports on general activities in the area and focuses on the development of the new-generation Regional Associated Computer Network for Education, Research and Culture in the North-West of Russia (ROKSON NW).

BACKGROUND It is hardly necessary to stress the importance of Internet connectivity for integration of Russian universities into the world-wide academic media, which is the vital prerequisite for all ongoing or planned Distance Learning projects on every level -- regional, national and international.

Co-operative efforts to develop an advanced regional computer network serving the needs of the wide academic and research community of St.Petersburg and its environs started in 1993. At the time a number of organisations have initiated collaboration in the framework of the Russian Space Science Internet (RSSI) project with support offered by NASA, DOE (USA) and Russian Foundation for Basic Research (RFBR). The central site of the RSSI in St.Petersburg was established at the A.F.Ioffe Physics-Technical Institute (PTI) bringing Internet connectivity over a leased telephone line via the Moscow Institute of Space research (ISR) that already had a satellite channel to Europe.

A new impulse in networking collaboration was introduced when Federal Technical University of St.Petersburg (FTUSP) has perceived the great potentials in extending co-operation with its traditional partner LENENERGO -- the leading regional power supply enterprise. The company -- with its vast corporate communications infrastructure built over fiber-optic (F/O), microwave and copper wire lines across the city and environs and a F/O link to Finland -- soon became the strategic provider of wide-band channels for the academic metropolitan backbone and a fast access to Ebone via FUNet and NORDUNet. Development plans reported at ICDED'94 [2] were fulfilled and transcended. LENENERGO together with the Presidium of Russian Academy of Sciences (RAS), the State Committee for Higher Education of Russian Federation (SCHE RF) and Ministry of Science and Technology of Russia (MinSci RF) have all signed the General Agreement on Co-operation in Developing the Regional Academic Computer Network. The Agreement laid the foundation for alliance in future diverse metropolitan and regional computer network projects and initiatives.

The first sites that were linked into a metropolitan academic network, are located on the premises of the St.Petersburg State University (SPbSU) that is resides on its two main campus areas: one on Neva embankment in the central part of St.Petersburg, the other in Peterhof environs. So the problem of connecting both campus networks and linking them to the Internet arose. The connection was completed by fall 1994 in the framework of RFBR project. According to the project a 64 Kbps digital microwave channel was deployed. The channel linked Peterhof Campus with the site at the LENENERGO headquarters in the Field of Mars in the centre of St.Petersburg. The City Campus of SPbSU has been plugged into RELCOM computer network with rented access to the Internet. Linking of the two main computer and communications centres brought forth mutual connectivity of LANs and allowed SPbSU faculties to gain access to the Internet.>

Other important networking projects in the area were underway in parallel contributing to development of academic networking infrastructure in St.Petersburg.

In 1994 FTUSP in co-operation with LENENERGO has started a project to establish a fiber-optic high-bitrate 100 Mbps channel between FTUSP and the Field of Mars site. The channel was later implemented and other organisations will soon be linked to it.

The same year SCHE RF research program “Universities of Russia” announced a special telecommunication direction (Direction V) and St.Petersburg Institute for Fine Mechanics and Optics (SPIFMO) has been assigned the Co-ordinator of the Direction. Direction V was aimed at the development of the nation-wide Russian Universities Computer Network (RUNNet); the network would connect Russian universities via satellite channels. In the framework of the program SPIFMO installed a teleport that connected St.Petersburg with universities of other Russian cities via satellite channels. Also a fiber-optic cable was laid down; the cable linked SPIFMO with the Field of Mars site at LENENERGO premises.

Thus, in 1994, due to the combined initiatives the primary components of the future academic computer network in St.Petersburg were fleshed out and the task to associate these components into a united metropolitan computer telecommunication infrastructure became vital. Representatives of SPbSU, FTUSP, SPIFMO, PTI, B.P.Konstantinov Nuclear Physics Institute (PINP), St.Petersburg Institute of Informatics and Automation RAS (SPIARAS) and St.Petersburg Department of Mathematical Institute (PDMI) actively participated in launching the project; the latter was named ROKSON NW [1].

Consolidation of academic networking activities on the higher, federal level started late in 1995 when the chief participants -- MinSci RF, SCHE RF, RAS, and RFBR -- have come to a collectively settled strategy in telecommunications development. As a result, the State Inter-Agency Programme “Development of the National computer telecommunication networks for science and academia in the 1995-96 period” was forged. According to the Programme the national academic networking infrastructure is based on the inter-regional backbone principle.

ROKSON NW PROJECT PARTICIPANTS AND GOALS

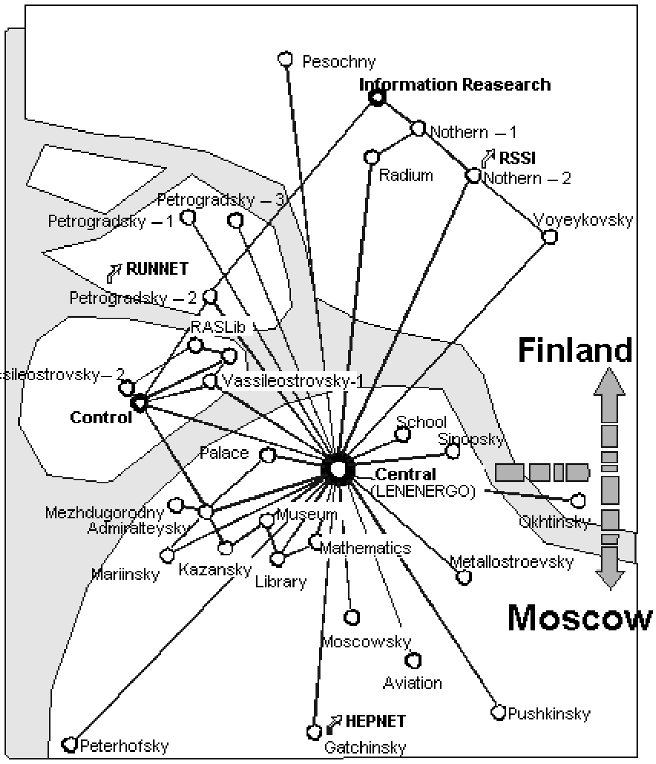
The above principle was to be implemented In the St.Petersburg region in the framework of the Regional Associated Computer Network for Education, Research and Culture (in transliterated abbreviation -- ROKSON NW) Project; the St.Petersburg State University (SPbSU) was nominated as the principal organisation in charge of the Project implementation. Collaborating parties are the leading universities, RAS institutes and cultural institutions, among them: FTUSP, SPIFMO, PTI, PINP, SPIARAS, State university of telecommunications (SPSUT), the State “Hermitage” museum, RAS Library, Russian National Library, and others -- in total over 150 organisations. The project solicited financial support from RFBR and from International Science Foundation (ISF). From 1995 the project is being supported by RFBR. According to the State Inter-Agency Programme, the ROKSON NW network was authorized to become the regional segment of the National network.

The chief objectives and range of activities of ROKSON NW are not limited to providing connectivity and developing the backbone, but extend further in the following directions:

- development and maintenance of information resources of St.Petersburg academic and research organisations, museums and libraries;
- providing access to such resources through the regional computer network;
- informational and methodical support of education;
- introduction of Distant Learning methods and techniques;
- academic network user training and support.

ROKSON NW NETWORK TOPOLOGY

The topology of the metropolitan ROKSON network is star-shaped with rays projecting from the building of LENENERGO headquarters at the Field of Mars in the centre of St.Petersburg. Points of presence (PoP) of several major telecommunication companies of St.Petersburg are resident in the building also. From here start digital channels to Moscow and to Finland.



The topology reflects both architecture and infrastructure of ROKSON NW network. They form a tree-like hierarchical pattern (layout) of the backbone stemming from the central point. Hub nodes are located at strategic points in several selected academic and research organisations across the city and its suburbs. The hub-nodes have fast links with the Central site where all routing is performed - both internal between hub-nodes and external to other networks and to the Internet.

Recently the Central ROKSON NW site is linked to Moscow Backbone network via a 128 Kbps channel provided by the Department of Mathematics of RAS. The Moscow Backbone has a terrestrial 128 Kbps channel from Moscow State University (MSU) to Paris and two satellite channels: one from Nuclear Physics Institute of MSU to HEPNET and the other from ISR to NASA Internet. In addition, the Central site uses a 64 Kbps EUNet/RELARN channel to NORDUNet through Finland. In the nearest future ROKSON NW will have access to a 256 Kbps channel to NORDUNet that has been put into operation in the course of RUNNet project.

The span of ROKSON NW hub-nodes across St.Petersburg steadily expands. The nodes at SPbSU Peterhof Campus, PTI, PINP, PDMI, SPIARAS and RAS Library are already operational. By the summer of 1996 the additional hub-nodes at FTUSP and at SPSUT are to be put into operation. A joint node of SPbSU and ROKSON NW in the former building of the SPbSU Department of Chemistry in the centre of Vassilievsky Ostrov is in the design stage. The nodes at Vassilievsky Ostrov will be interconnected into a highthroughput fiber-optic backbone network. At this stage of development are also used the refurbished old fiber-optic channels of the first-generation Academic Network that was deployed in the eighties. The set of the ROKSON NW hub-nodes will allow full-fledged access to the Internet for scores of scientific, research, educational and cultural organisations in St.Petersburg.

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ROKSON NW Project Headquarters
199178, Russia, St.Petersburg, 14th Line Vassilievsky Ostrov, 29, office 2
Tel: 7(812) 218-4451
Fax: 7(812) 213-7175
E-mail: admin(at)rokson.nw.ru

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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An analysis of the e-mail traffic by a server called TIGRIS.KLTE.HU

György Terdik and Péter Erdõsi

Introduction

One of the first use of Internet is the electronic mailing. Messages are sent between users of computer systems and the computer systems are used to hold and transport essages. There are several advantages of electronic mailing as it is fast, cheap, comfortable and so on. The number of Internet users increasing exponentially therefore more and more people is able to get and send e-mails. There is no doubt about that the academic staff and university students are used to it very much. It is a part of not only research work but of the everyday life as well and stooping services of e-mail would cause unimaginable difficulties at keeping in touch. Electronic mail is an important component of an office automation system. There is a problem one should pay attention to writing an e-mail it is the problem of usage of special characters of languages different from English. The Hungarian Umlaut Û, say, supposed to be encoded and decoded as well before reading it. Most of the client software's are providing automatic coding services. The most popular one at our University is The Pegasus mail with Uuen/decoding possibilities among others. Newer systems support the composition and delivery of multimedia mail, which can combine text, graphics, voice, facsimile, and other forms of information in a single message

The mail server called Tigris

In 1991 a VAX6000/510 was installed at our University it was one of the strongest server that time in the country with one VAX processor, 128 MB RAM, 6 Gigabyte DSSI Winchester later an extra 6 Gigabyte SCSI Winchester was added. The main job of the server is providing Internet services for more then 4000 users and it is playing the role of mailgateway for some other servers. It can be reached by Ethernet (10 Mbit/sec) from the campus and by FDDI Ring (100 Mbit/sec) from all others institutions of higher education of the our city Debrecen end by 512 Kbit/sec leased line from Budapest. Besides the protocols TCP/IP and DECnet the protocol POP3 has also been implemented because of the extensive use of the clients Exchange and Pegasus Mail.

Logging of e-mails

The logging of e-mails gives information about the e-mail traffic. On the base of logging one may monitor the most popular mailing lists the activity of users and so on. The number of outgoing e-mails is not the same as the number of e-mails sent by the users of the server because of the mailgateway function. Note here that the e-mail traffic of the server is sum of its users mailing and the e-mail traffic some other servers. The e-mail traffic of the University is larger then the traffic of this server because there are servers not using the Tigris as mailgateway. The public domain message transport system called Message Exchange 4.2 is taking the responsibility for the mailing function of Tigris. It is familiar with several protocols as SMTP, NJE, UUCP and so on. As the gateway it is used to carry out necessary protocol conversion if it necessary. It is reliable and is running for several months without any problems. In 1996 two protocols were used by Tigris for transferring mails

- SMTP: Simple Mail Transfer Protocol for TCP/IP and
- LOCAL one for local users.

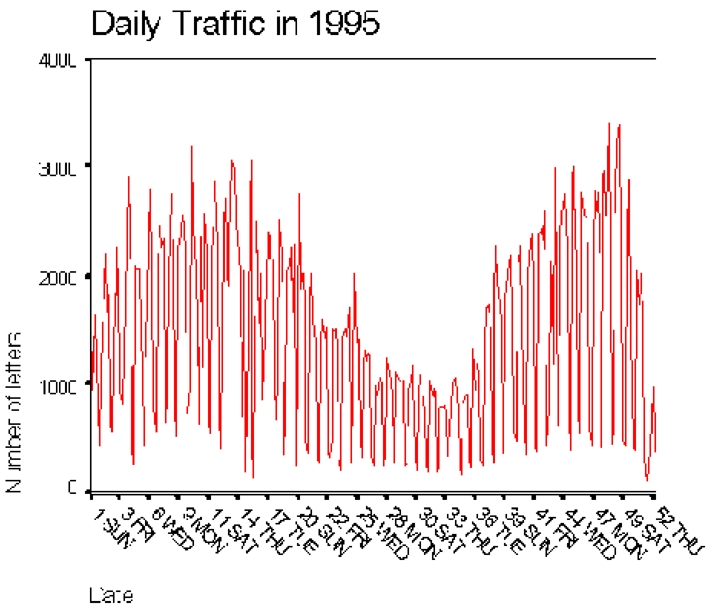
During logging several data are recorded according to the protocols. The choice of data to be recorded is depending on the postmaster. In our case the data are collected by the following table.

Protocol	SOURCE	HOST	USER	SENT	SIZE	DATE	TIME

LOCAL	+	-	+	-	+	+	+
SMTP	+	+	-	+	+	+	+

The agents of MX are registering the data of an e-mail when it leaves the MX-queue. The only outgoing mails are logged so every mail is logged once. The logged data are transferred to an Oracle data base V7 and tables are made by SQL questioning. The MX system was installed in 1994 therefore the time series of daily traffic of the Tigris available for three years 1994, 1996 and 1996. The data are analyzed by the help of MS Excel and SPSS using standard methods of time series.

The following figure shows the daily traffic in 1995 the number of letters are plotted against days.

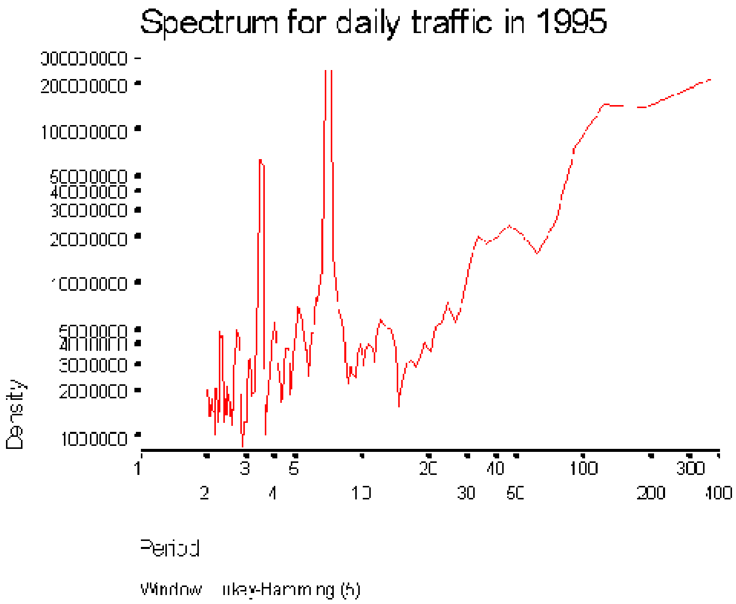


One may realize the increasing number of letters at the beginning and decreasing by the end of the semesters. It is a pity that there is no period by semesters because of the difference in the length of the winter and summer holidays.

We summarizing the e-mail traffic by years and by protocols. In 1994 Bitnet SMTP and DECnet SMTP was also running. It is seen that there is not too much difference between the average size of the letters. The first step of the statistical analysis was preliminary transformation to get rid of outliers. The cause of outlier data is the problems with network, server and mailing system. The outliers was changed by a regression method using the data neighboring it.

The number of letters increasing of cause and maximal value is decreasing it is because the stability of the leased line and the mailing system became better and better. The minimal value in 1996 was 37 showing that practically there was no fault in the delivery.

For the detection of periods the estimated and smoothed spectrum is considered.



The figure above contains the plot of the spectrum for the time series of the daily traffic in 1995. The values of the spectrum, i. e. the spectral density is plotted versus periods in days. It has a high peak at 7 which means not surprisingly that there is a weakly period.

The table of the descriptives statistics concerning to the seven day period shows that the working days in each year are significantly different form the holidays, the minimum p-value is 0.4. The means of the working days traffic are different nevertheless theses difference are not significant. This is the case for the holidays as well. It was checked by t-test.

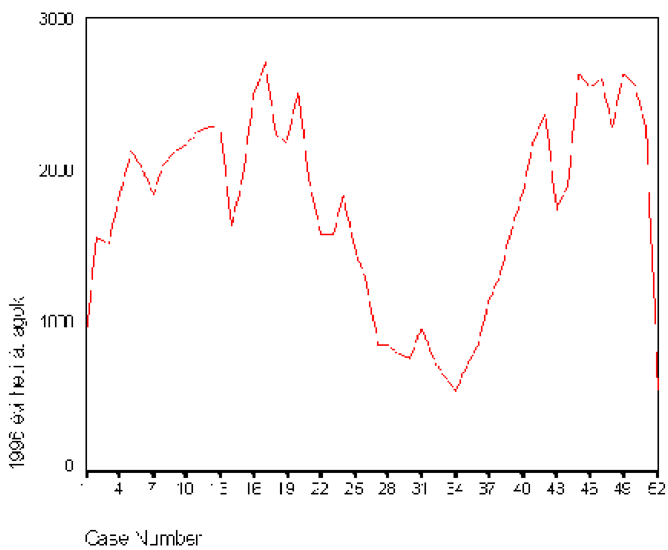
The time series of the weakly averages does not contain the period any more and allows us to make further analysis. The correlation between the time series of 1994, 1995 and 1995 was calculated. The data of 1994 proved to be independent from both series of 1995 and of 1996. Therefore the base of the decision about trend in the series of weakly averages was the years 1995 and 1996. The question is whether the series contains trend i.e. Y_t can be put into the form

$$y_t = a + bt + \varepsilon_t$$

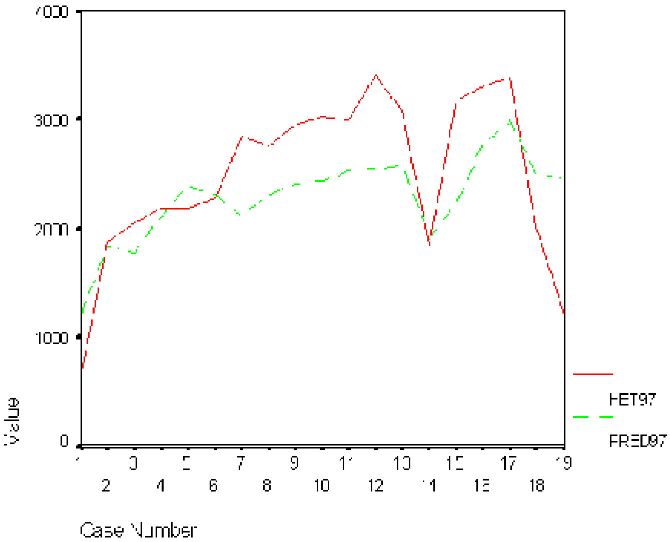
Testing the hypothesis b=0 we differentiated the series once

$$y_{t+1} - y_t = b + \varepsilon_{t+1} - \varepsilon_t$$

and used the one sample t-test for testing $H_0 : b = 0$. The estimated value for b is 3,8 -with 2-tailed p-value 0,94 therefore there is no reason to assume that there is any trend around.



Now we are in the position to predict the weakly average series in 1997.



Denote X_t the traffic in 96 and $\hat{Z}_t$ the prediction for 97. It is calculated by the formula

$$\hat{Z}_t = X_t + a$$, t=1,2,....,52

where a = 279,5. The measured and the predicted values for the first 19 weeks is plotted above.

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Center for Informatics and Computing,
Lajos Kossuth University of Debrecen,
4010 Debrecen, Pf. 58, Hungary
E-mail: terdik(at)cic.klte.hu, perdosi(at)cic.klte.hu

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AMNET: Experience of use in researches and training

[1]C. Gaindric, [2]G.Secrieru

Always, the information is key moment in activity both of scientific and other structures of society, and of individuals. The modern representation of the information was expanded on the basis of computer technologies from simple textual messages up to complex structured documents of formalized data. The search of the necessary information is the beginning of the beginnings when any problem has to be solved. Now anybody can find the interesting information not rising from the computer, connected to the network. This complex organization of computers, networks and people has become quite accessible and in this the major role belongs to a global information network Internet.

The activity of any organization represents complex internal and external interrelations, inducing appropriate information flows. The information is understood as scientific-technical and socio-economical process of optimum conditions creation for satisfaction of information needs of all the structures of the society on the basis of organization of information systems with advanced infrastructure on the basis of perspective and flexible information technologies. Under these conditions a role of information as unique and unlimited resource, being simultaneously raw material and result of labor of the person, increases considerably.

The problems of development of telecommunications in Moldova are very important for maintenance of informational support of scientific researches and integration into European and world community. In the present report a real situation and development of an infrastructure of the information system of the Academy of Sciences of Moldova (ASM) is considered, on the basis of which the essential new approaches of international scientific cooperation, promoting improvement of a situation of the academic society, the development of professional direct connections, interpenetration of ideas and exchange by experience can be developed.

Now ASM consists of research institutes and centers, in which more than 4000 persons, including more than 1000 scientific employees, work. The fundamental and applied scientific researches cover many directions of humanitarian and natural sciences. Simultaneously ASM is the coordinator of a science of Universities of Moldova.

The achievement of a high level of researches assumes operative access to scientific publications, databases and other information, together with intensive exchange of the information and close coordination between scientists and experts, both inside the country, and with other various countries. In this connection the main problems of the ASM on support of information maintenance of fundamental and applied researches are:

- development of an infrastructure of information system of ASM and creation of conditions for access to the Internet and other global networks information resources;
- preparation and raising the level of skill of the staff in the field of effective utilization of new information computer technologies.

In order to solve these problems in 1995-96 years the creation of an academic information computer network AMNET connected with Internet is begun thanks to the financial and technical support of NATO, UNESCO, SOROS and EURASIA funds. Creation of such corporative information systems claims the availability of flexible and reliable network organism. The system engineering, with help of which the problems of access to information are solved includes the following main directions:

- creation of system of the complete solution for Internet/ Intranet;
- maintenance of universal access to all types of the information;
- development of means and methods of automation of research process.

The modern telecommunications infrastructure of the ASM is oriented to application of high-speed communication channels (cable and radiochannels), communication servers in separate buildings of the ASM, information servers and databases servers, to which Local Area Network (LAN) of institutes and separate workstations are connected. This permits to create an advanced network of telecommunications AMNET, and to grant to a wide range of the users in the Academy and other organizations modern telecommunication information services: E-mail, ftp, Telnet, World Wide Web (WWW), access to databases, remote training and raising the level of skill. The arrangement of the communication servers of a network AMNET is based on building principle, which has the following characteristics:

- necessity of connection of a plenty LAN (20 and more LAN);
- significant number of workstations in network;
- necessity of cover by a network of territory of the significant urban area (maximum distance 15-20 km).

As a rule in one building several institutes and establishments with different intensity of users work with means of telecommunications are located. On Fig.1. the topology of a network AMNET is shown, which interacts with Internet through head knot, situated in the Computer Center (CC), having 64 Kbps satellite channel connection with the network MOLDNET.

The network MOLDNET created under project of Soros fund, provides for ASM and leading universities (Moldova's state university, Moldova's technical university, Academy of economic studies), connection to Internet on 64 Kbps satellite channel, which can be increased up to 128 Kbps. This channel connects central unit of a network MOLDNET to unit of a network European Backbone in Stocholm (Sweden),

The AMNET Network Infrastructure

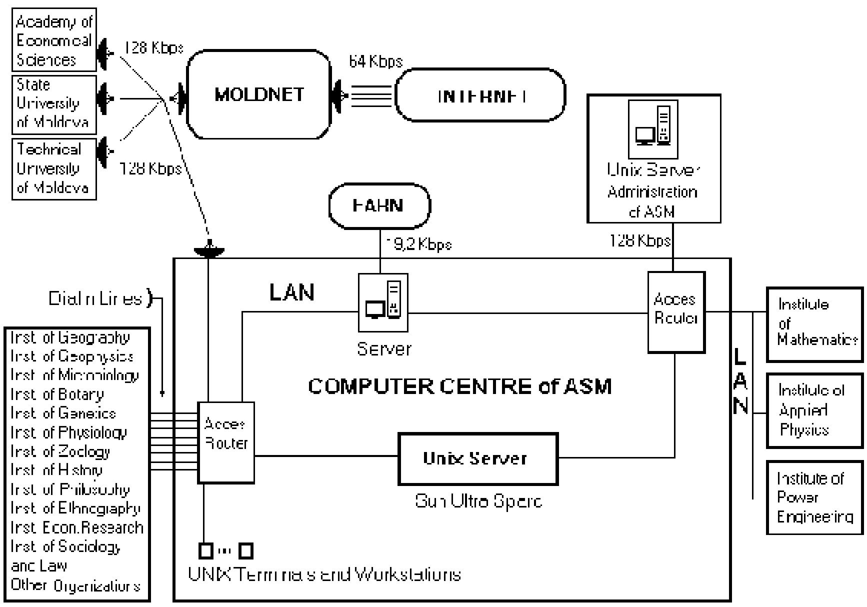


Fig. 1

being part of a network Internet. Taking into account, that the use of radiomeans for data transfer is one of perspective directions of development of telecommunications means in city the connection of central unit of a network MOLDNET with ASM and universities is carried out with use of radiomodems with data transfer speed 128 Kbps.

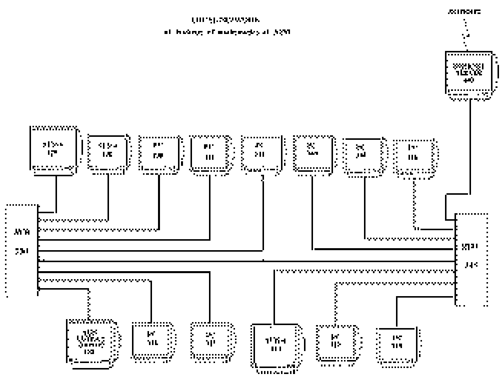
The central information servers and databases servers are organized on the basis of computers of a type SUN Ultra Sparc and Sun SparcStation 5, located in CC and granted by NATO.

Both dedicated, and switched channels are used for connection of various fragments of a network AMNET in one telecommunication infrastructure. On the main directions of the network (connection between buildings) the dedicated channels with speed 19200 bps are used and in the long term the optical and radiochannels will be used. On user's directions are used both as dedicated, as nondedicated channels with speed from 14400 up to 19200 bps. The network organizational infrastructure bases on the use of modems, routers and other communication equipment of the known firms Cisco, Telebit, ZyXEL and other leading manufacturers of such systems.

The workstations of Institutes are united in LAN, which are connected to communication servers of the building. The Ethernet cards, coaxial cable, twisted pair and other components, ensuring on some segments of the network the speed 10 Mbps are used for this purpose.

More than 50 workstations and local network of the Institute of Mathematics (MATNET) are now supported, which cover more than 700 users. On Fig.2. A network MATNET, created within the framework of project " Creation of Educational research in Computer science " (IIP UNESCO) is shown, which is the base for realization of joint researches of the specialists of the Institute and teir colleagues from the universities of Moldova and from other countries (virtual laboratory), for post-graduate students training, teaching of talented students and schoolchildren the computer

science bases. Researches in such areas, as expert systems of new generation, designing and development of the software, natural language processing, decision support systems are elaborated.



The work in Internet is influenced by some factors:

- the capacity of the satellite channel;
- the quantity of telephone numbers and quality of telephone lines;
- the speed data transfer by modems;
- the number of the users and time of day;
- the distance from an information source.

The network AMNET is created to be used by various scientific and educational organizations of Moldova. Separate workstations and LAN of institutes and organizations are connected to the network. The connection of the user is provided by a complex of services dealing with communication, adjustment, connection and training of the users. In the network services, the installation of equipment and software connection to a network on dedicated and non-dedicated lines are stipulated.

The faculty of computer sciences of the ASM carries out training of the specialists to bases of computer science and use of modern information technologies, ensuring a new level of researches and of development. More than 130 post-graduated students, researchers and specialists from institutes of the ASM and other organizations of republic trained are annually.

The main kinds of services offered in network AMNET include: E-mail, ftp, telnet, usenet and WWW. The Web of CC is created, which has the following address: http://acad.moldnet.md

However, each psychological group of the researchers has, frequently completely, various sights on world: physicists, biologists, humanitists. Therefore when separate WWW pages are created it is necessary to take into account the special sight of the future audience: the contents, design, convenience of work with documents given on server and so on. But if to generalize all these approaches, it is possible to make a conclusion, that server to which frequently address is considered to be good server.

The development of modern computer technologies opens the whole world of new applications, strengthens the process of integration of Moldova in international scientific and information community, accelerates gradual transition to information society. The special attention is paid to questions of organization of training and raising the level of skill of the users, including methods of remote training. It permits to realize the policy of Upgrade for those institutes and working groups, which already have sufficient experience of use of network technologies and Internet resources, taking into account that Internet is possible to consider as "society" with own convictions, traditions and rules of behavior, which is necessary to be taken into consideration. If institutes of a humanitarian structure only begin to join to new technology, the Institute of mathematics, Institute of Applied Physics, Institute of Chemistry and other have sharply increased number of the scientists and researchers, which want to work in now already open libraries and to use Internet resources. E-mail and on-line are the mostly used services.

The application of new information technologies in all spheres of activity forces us to pay close attention to opportunity of their use at all stages of development of a science, social and economic reforms, becoming characteristic feature of our time.

[1] Institute of Mathematics of MAS
[2]Computer Center of MAS
Academy of Sciences of Moldova
Academy str. 5, MD-2028, Kishinev, Moldova
gaindr(at)mathem.moldova.su, secrieru(at)cc.acad.md

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TEN-34 CZ-- High Speed ATM Network at Czech Republic

Ludek Matyska

Introduction

Not unlike in the USA, the nation wide computer network infrastructure of the Czech Republic was founded and built by universities and other academic institutes. While the first lines connecting Prague, Brno, and Bratislava were provided as an off-spring of the IBM Academic Initiative of 1990, the universities, financially supported by the Ministry of Education soon established an informal consortium under the name of CESNET (Czech Educational and Scientific NETwork) which took care of the Internet connectivity of gradually all 23 Czech universities. Since the last year, the intercity connections were based on leased lines (lend from IBM and SPT Telecom, and later on using microwave links from Czech Radiocommunications) with capacity ranging between 64kb/s to 2Mb/s (between Prague and Brno). This must be compared with the much higher throughput of local and especially metropolitan area networks, where FDDI (at 100Mb/s) or even ATM on 155Mb/s were already used. The largest metropolitan networks of Prague and Brno were both using fibre optic (leased at Prague, owned by Masaryk university Technical university in Brno) and gradually upgraded the whole MANs from 64kb/s metalic leased lines through 10Mb/s Ethernet to 155Mb/s ATM.

In the last year, under the pressure of inevitable changes in the ministerial financing policy the CESNET transformed from an informal consortium to a legal body. The company is fully owned by universities and Academy of Sciences (they all have a kind of share relative to their annual subscription) and it is a non-profit organization whose primary goal is to provide infrastructure for academic community of the Czech Republic. To some extent CESNET is also providing usual Internet services to commercial customers.

Through the CESNET liaison Czech Republic was an active member of initial stages of the pan-European high speed networking project, the TEN-34, Trans-European scientific Network (as a parallel infrastructure to the Americas' 45Mb/s lines). It was not possible for CESNET to proceed further the initial stage as joining the TEN-34 project required an existence of national high speed network (operating at 34Mb/s at least), a commitment from the telecommunication operator and an appropriate financial budget. This all was beyond the that time Czech republic (and CESNET) capabilities. However, the steps initiated by the European Union had their influence on the Czech government as well, and it launched the TEN-34 CZ program at Spring 1996.

TEN-34 CZ program

This program was officially supervised by the Ministry of Education and it had two parts:

1. To build a national high speed network connected via an appropriate link to the trans-european high speed backbone.
2. To support research projects requiring and utilizing the high bandwidth.

While there were 33 projects submitted in the second category, the first one was covered by just one proposer--the CESNET company. After some hesitation, which was primary caused by the fact that no else decided to submit a project in the first category, and which postponed the start of the project till October 1996, Ministry of Education accepted the proposal and gave the project realization to CESNET. This have started the era of high speed nationwide academic backbone in the Czech Republic.

A total of 16 projects were accepted in the second category, with different subjects belonging roughly to the following categories:

- The remote access to high performance computing facilities, including the trial to use them synchronized for large scale distributed computing. A representative of these projects is the META Center project, presented at this conference [1].
-

The videoconferencing, telepresence and teleworking.
- Web-based multimedia storage and retrieval systems, both for research and educational activities.

The final decision to support the projects was taken in October, 1996, when the Minister of Education signed the projects' acceptance.

TEN-34 CZ infrastructure

The primary goal of the TEN-34 CZ program was to build the national high speed computer network and to connect it directly to the TEN-34 European backbone.

While six companies took part in the initial CESNET tender for the intercity lines provider, only the proposal from Czech Radiocommunication was acceptable. The Czech national telecommunication operator, SPT Telecom, took part in the bid, but offered lines with just 2Mb/s at the usual commercial price (without any reductions). The Czech Radiocommunications offered leased microwave lines for 34Mb/s with the promise for 155Mb/s lines in 1997 (if requested in advance). As there was very good experience with their 2Mb/s lines, the challenge was taken to be part of the research and development nature of the whole project and the TEN-34 CZ backbone is built on top of microwave lines. The lease conditions require that there is no transfer error during 72 hour period before the line is accepted.

The initial international connectivity was provided by SPT Telecom, because there was no other possibility. However, as SPT Telecom offers only 2Mb/s lines and the TEN-34 backbone requires at least 10Mb/s for the national link, two 2Mb/s lines were leased for the first half of the year 1997. They connect Prague with Munich and Stockholm European Internet crossroads. The new tender for international connectivity, which will join Prague with the TEN-34 point of presence at Frankfurt am Main, was won by Global One, the consortium of German Telecom, France Telecom, and Sprint. While they offered full 34Mb/s fiber optic based leased line, just 10Mb/s will be used, the remaining capacity being free for some experiments and/or for direct transatlantic link.

The national TEN-34 CZ backbone connects metropolitan area networks in nine cities, covering thus a substantial majority of all the universities in Czech Republic. The MANs connected are operated by individual universities or their consortia and in this way the whole TEN-34 CZ network is directly or indirectly operated (and mostly also owned) by Czech universities. The cities connected are Prague, Brno, Ceské Budejovice, Hradec Králové, Liberec, Olomouc, Ostrava, Plzen and Pardubice. The largest MANs, located in Prague and Brno, are already running on up to 155Mb/s, but the smaller MANs and university networks are close behind them (some running FDDI rings, other upgrading gradually to ATM on 155Mb/s; at Liberec two main switches are already connected by a 622Mb/s ATM link).

Technical realization

The TEN-34 CZ is realized as a pure ATM network with IP services on top of it. The TEN-34 CZ backbone connects the above mentioned cities and each connection point is equipped by one ATM switch and one ATM router. All the switches and routers are provided by CISCO systems, the TEN-34 CZ uses CISCO Lightstream 1010 ATM switches and the CISCO 7500 series ATM routers. Each switch is equipped with at least one E3 link, connecting it to the radiowave backbone, and at least two OC-3 (155Mb/s) links, one to the router and the second one connecting the TEN-34 CZ backbone to the metropolitan (local) area network. The routers primary serve as virtual LAN routers, but they are also providing a connection point for the local FDDI rings (as, e.g., at Ceské Budejovice or Plzen) and they usually have several Ethernet ports as well for diagnostic, maintenance and experimental purposes.

Although ATM is its primary interconnection protocol, currently only IP services are provided by the TEN-34 CZ network. The primary protocols are LANE version 1.0 with SSR (Simple Server redundancy, the enhancement implemented by CISCO), classical IP (as specified by RFC 1577) and RFC 1483. The TEN-34 CZ backbone routers use PNNI Phase I dynamic routing with support for quality of services. The same signalling protocol is used by some of the metropolitan area network routers connecting these MANs to the TEN-34 CZ backbone. The remaining MANs use IISP static routing, which is redistributed to PNNI.

One of the most serious problems in building the TEN-34 CZ network was the separation of the pure academic network traffic from the commercial traffic of companies using CESNET as their Internet provider. The TEN-34 CZ project is a purely academic undertaking and, according to the rules, no commercial traffic may use TEN-34 links for transit. While the TEN-34 CZ backbone is built as a parallel network to the already existing CESNET intercity infrastructure, metropolitan area networks were used to transfer both academic and commercial traffic. Two basic approaches were implemented:

- The MAN was ``purified'', i.e., the academic and commercial traffic use different physical lines. The lines with non-academic traffic are connected to the original CESNET backbone, while the academic (TEN-34 compliant) lines are connected both to the original and the new TEN-34 CZ backbone. This is the preferred realization.
- The MAN uses virtual LAN technology to logically (although not physically) separate academic and non-academic traffic. Special internal routing policy is adopted in these cases, with ``policy routing'' (where the routes are selected with respected to the originating address) and selective redistribution of OSPF/EIGRP routing information to avoid commercial packet transit through the TEN-34 CZ backbone. A non negligible increase in router load was observed by the use of policy routing (a 20% load increase is not uncommon), and the tables needs a lot of maintenance to work properly.

The original CESNET intercity infrastructure is used as a ``backup'' of the TEN-34 CZ backbone. All MANs (or, more precisely, all the academic parts of MANs) are connected to two autonomous systems: the TEN-34 CZ backbone and the original CESNET backbone. The commercial parts may use only the original CESNET backbone. Both backbones use the OSPFv2 routing protocol.

While MANs usually provide connectivity for both the academic and non-academic users, they are not used for transfer between the TEN-34 CZ and Internet. There is only one peering place between original CESNET and TEN-34 CZ networks, at the CESNET headquarters in Prague. The OSPF and ``backdoor'' BGP protocols are used for this purpose. The dual connectivity of MANs is used for TEN-34 CZ backup only.

Use

The whole TEN-34 CZ backbone serves two main purposes: (i) providing an appropriate high speed infrastructure for research projects and (ii) providing a high speed academic interconnect. Internally, the TEN-34 CZ network is also used to test new up-to-date information technology in slightly unusual conditions: (i) pure ATM over radiowave links on E3 (with planned increase to OC-3 in 1998 for the Prague-Brno link), (ii) the use of QoS in a mostly IP over ATM environment.

Due to the lack of interest from the national teleoperator, the whole TEN-34 CZ infrastructure is in fact operated by the academic company CESNET. There are plans to use this unique situation for experiments with dynamic bandwidth management and allocation, with the aim to combine the "best effort'' services of the classical Internet IP protocol with the new more advanced possibilities provided by ATM networks. A part of the total capacity will probably be used for www caches and ftp mirroring services, while the rest will be divided between the "usual'' (unspecified) academic traffic (using UBR and/or ABR) and dedicated "links'' for the individual scientific experiments (videoconferences, wide area distributed computing[1], telework, vizualization, ...). It is expected that experience on dynamic bandwidth splitting and allocation gained during this "experimental'' stage will be used as a basis of future academic infrastructure management.

As already mentioned, the TEN-34 CZ program encompasses not only the infrastructure building, but its use as well. These ``pilot'' projects will test the feasibility of adopted infrastructure implementation while opening to researchers an easy access to the high speed network. These projects may be also seen as forerunners for the rest of academic community, serving as examples of potential advantage of high speed interconnects.

Conclusion

The TEN-34 CZ project is a part of a trans-european activity to increase the general network throughput on both the national and international levels. The backbone was officially ``opened'' on June 17th in Prague in the presence of representatives of government and Parliament of the Czech republic. The backbone uses E3 radiowave transmitted links, with pure ATM and IP over ATM as the primary services. The whole backbone, which connects nine cities in the Czech republic, is operated by CESNET, a non-profit company founded and fully owned by Czech universities and Academy of Sciences. The TEN-34 CZ is fully financially supported by a three year grant from Ministry of Education.

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Faculty of Informatics and Institute of Computer Science,
Masaryk University, Botanická 68a, 602 00 Brno, Czech Republic
E-mail: ludek(at)ics.muni.cz

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Tweet

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TUM-Net: an Internet/Intranet Project

Veacheslav Sidorenco

Abstract

The background, main objectives, topological particularities, troubles and problems of TUM-Net Project as the University Area Network at Technical University of Moldova are presented.

Technical University of Moldova.

Technical University of Moldova (TUM) is a single technical high education unit of the New Independent State (NIS): Republic of Moldova. During all the period of its history Moldova, been geographically placed between Romania and Ukraine, continue to exists as a basic agriculture-oriented country, having significantly old and traditional wine-making infrastructure and foods industry. During last years of its development Moldovan national economy has been redirected toward modern electronic devices and apparatus industry, microelectronics, industrial and civil building, energetic. In order to cover the needs of various branches of growing national economy in specialists of engineering-oriented profiles TUM is preparing a wide range of scientific and technically skilled people having the technological, energetical, mechanical, radioelectronical, electrotechnical, civil and industrial building, architectural and other knowledge. Great attention is paid now to prepare specialists ready to work in the conditions of free market relations. This is because a number of new specialities include new subjects related to economical aspects of engineering: management, marketing, business etc.

TUM is placed in Chisinau, the green and picturesque capital city of Moldova Republic. Before 1993 TUM has the name and the state of Polytechnic Institute of Chisinau. The campus of TUM is divided into next four regions, displaced in different parts of Chisinau:

- Northern - placed at the northern periphery of Chisinau and formed from relatively new modern buildings. This part is planned to become main TUM place.
- Western - placed in the old building in western part of Chisinau's centre and been main administrative establishment of TUM.
- Central - placed also in an old building in the centre of Chisinau.
- Southern - placed in a new microregion of south part of Chishinau.

The development of integrated information service for all regions of TUM becomes an acute problem and real up to date necessity.

Current state of information services

Computer and information systems (CIS) used at TUM must be studied from both historical and economical points of view. Polytechnic Institute of Chisinau was formed, mainly developed and equipped during historical period of Moldavian Soviet Socialist Republic as part of former USSR (1944-1990). During last period of Moldovan independence governmental support of TUM's technical infrastructure development significantly decreased in amount and now is practically stopped. The current state of CIS at TUM can be characterised by:

- old and very old computers used, great part of which been produced in exUSSR as copies of IBM/XT's clones: ISKRA-1030, NEIRON I9-66, ES-1840/41; or DEC's LSI-11 clones: ELECTRONICA-60, 85. Another part has been built by second PC/XT/AT producers from Asian states (China, Taiwan and other). Such kind of computers cannot be used for modern Windows-oriented software packages.
- the absence of mainframes and powerful servers/workstations platforms. The biggest machine is SM-1420 (very old Soviet copy of DEC's PDP-11 mini-machine);
- very insufficient quantity of computers used: every PC is extracharged by collective form of personal computers using with strong time scheduling and queuing. A very hard task consists in providing of individual students work;
- mostly stand alone using of computers without any kind of networking;
- significantly far distance displacement of faculties: Northern, Central and Southern TUM's regions resides at the distances of 2 to 6 km one from another without any kind of electronic data communications;

- lack of sufficient Internet connectivity for mass teaching, learning and individual using by students and staff. The first Internet connection was made by "utm.md " domain via Moldavian/Romanian branch of European Academic and Research Network (MD/ROEARN - "mdearn.cri.md") based on the very slow coaxial cable connection between Moldova and Romania at only 9.6 Kbps. This branch is used only for dial-up e-mail service and cannot serve for serious web online browsing [1].

The main impacts of computer and information systems used at TUM are caused by next external factors:

- difficult economic situation of Moldova's transition period as a tiny independent state;
- extremely small state budget allocations invested year-by-year in all education's branches;
- practical impossibility to allocate budget for technical information service improvement and modern reequipment of higher education;
- impossibility to get help from the Moldovan state industry, which is also in serious economic troubles.
- practical absence of new private industry, interested in making investigations in and/or support of technical higher education in Moldova;
- near-to-zero presence of powerful Western Europe and USA industry collaboration with Moldova's economical infrastructure due to inconvenient conditions for foreign investors;
- very small support from higher education units of developed countries due to consequence of political insulation of Moldova as part of exUSSR in past and informational and economical insulation of Moldovan education from the rest of the educational world at present;
- main activity of foreign foundations in Moldova capable to support education needs are not oriented toward helping technical education development. Their programs include support only for language, art, culture, and journalistic projects, which are also important but not directly for TUM.

Networking: TUM-Net Project

Partial solving of the above mentioned problems is planned to be made by a series of consequential CIS improvement projects and, first of all, by the TUM-Net project, which has next main architecture, hardware and functionality subjects of tasks:

increasing of the number and the diversity of computers used. The equipment of every faculty becomes to be on the responsibility of faculty's deans, their adjunct staff and chiefs of education departments.

local integration of computing resources via building of local area computer subnetworks for teaching, library and administrative purposes. Local area networks must be preferably made on the base of Intranet conceptions in order to be easily and natur ally connected to Internet resources when the conditions of their availability will become reality. From this point of view, all local servers are planned to be equipped by computers, capable to run Microsoft Windows NT (Open NT for UNIX applications) operating system as most appropriate and fast growing modern Intranet/Internet platform, supporting TCP/IP protocols.

integration of local area distributed information system's resources of TUM into University Area / Metropolitan Area Network (UAN/MAN). In order to implement this task a number of information transport channels is need to be built/leased. On the first stage of project conventional copper telephone lines are planned to be mounted. On the next stages is planned to improve connectivity by using radiochannels or optical channels. The problem of in-regional and between-regional routing is also planned to be solved on the open architecture platform. On the first stage of TUM-Net project a star-topology of UAN Intranet will be realised.

connection of regional Intranets to Internet accesses points in Moldova. On the star topological schema all links will be concentrated to the MoldNET access point's router placed at the Faculty of Computers, Informatics and Microelectronics.

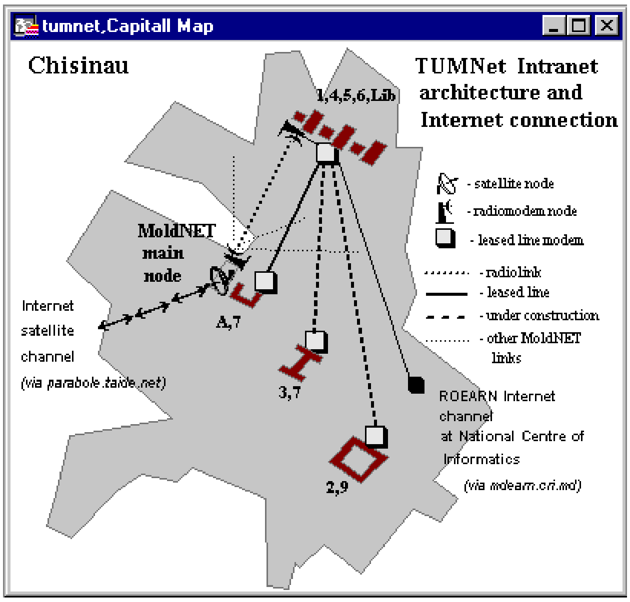
introduction of new Internet-related and Internet technologies based curricula.

The local integration will be made by faculty-level subprojects, implemented on the independent base by computer science specialists from every faculty. The interfaculty integration is expected to be constructed by the team of university-level specialists, using the Moldovan Telecom's leased lines under special agreement.

The most important part of the project: relatively fast Internet connection - is based on the new educational branch of Internet in Moldova: MoldNET - Academic and Research Network of Moldova. This network covers the next IP addresses range: 193.219.21 5.0 - 193.219.215.127. The upper layer of Internet access to MoldNET is ready to be used now and the other parts are under construction. MoldNET creation and maintenance was proposed and supported by Moldovan department of International Soros Foundation (ISF) (having next domains: "moldnet.md", "soros.moldova.su").

The main MoldNET server now is connected via 64 Kbps cosmic satellite line provided by "taide.net" branch with Stockholm's Internet access node. A local switch makes star-distribution of the main satellite line via 128 Kbps radiomodem-based equipment and lines between next end-points in Chisinau city:

- Soros Foundation, Moldova, Open World Society ("moldnet.md" - 193.219.215.18);
- Academy of Sciences of Moldova ("acad.moldnet.md" - 193.219.215.75);
- State University of Moldova ("univ.moldnet.md" - 193.219.215.83);
- Technical University of Moldova ("poli.moldnet.md" - 193.219.215.91);
- Academy of Economical Studies ("econ.moldnet.md" - 193.219.215.99);



On the above figure the general topology of TUM-Net together with the main Internet access nodes are presented. The figure shows that TUM-Net can be characterised by significant territorial distribution of information service resources and clients. It must be viewed and treated as a metropolitan area network (MAN).

Numerical marks, placed near projections of TUM's buildings have next significance:

1. Faculty of Computers, Informatics and Microelectronics
2. Faculty of Industrial Construction
3. Faculty of Energetic
4. Faculty of Light Industry
5. Faculty of Engineering and Management in Machine-Building
6. Faculty of Engineering and Management in Mechanics
7. Faculty of Radioelectronics
8. Faculty of Technology and Management in Food Industry
9. Faculty of Urbanistics and Architecture

A - is main Administrative building of TUM, having the residency of rector and staff service.

Lib - is main TUM's library.

Two of nine faculties support the main responsibility for TUM-Net implementation, management and providing. The first is the Faculty of Computers, Informatics and Microelectronics together with the University Computer Centre, equipped with radiomodem connection node to MoldNET and cable connection node to ROEARN, having powerful HP-UX - based server and star - distribution equipment for TUM-Net connectivity support. The second is the Faculty of Radioelectronics, which is placed in two central regions of TUM, which is responsible for connectivity maintaining tasks and for making practical and laboratory networking students training work.

For today only one ray of TUM-Net star is practically realised and is working: the link between Northern and Western regions is implemented via leased cooper underground line and a pair of external modems. This link is dedicated only for the administrative using by TUM's Rectory Computer Centre LAN and the respective infrastructure. Students and teaching stuff don't have access to above resources. The rest of TUM-Net is under construction now and encounter significant troubles in searching support for leased lines, servers, modems, routing and switching equipment and for financial support of the implementation of this part of project.

Great support can be obtained from IBM Corporation for the Faculty of Radioelectronics, which promised to offer AS/400 machine together with the 15 users places classroom equipment for free in order to make the faculty-level Internet server. Unfortunately, for the long time the sponsorisation for this part of project, concerning the software license purchasing from IBM Corporation cannot be found.

Unit Hengelo Centrum Techniek from ROC Oost-Nederland has supported the Faculty of Radioelectronics by a pair of 28.8 Kbps internal "Bullet" modems, which can be used at the first steps of connectivity establishing between Northern and Central regions of TUM. This throughput is very far from to be enough for the purposes of 2 to 3 LANs Internet providing but is much more than nothing.

Nevertheless TUM-Net project continue to be realised. Now Internet-related subjects has been introduced in the curricula of modern telecommunications studies for the specialities of the Faculty of Radioelectronics and are teached off-line in the frame of LAN:

- Internet structure, management and services;
- HTML language basics and WWW services programming;
- JAVA programming course (under projection).

In order to improve the efficiency of the TUM-Net management, maintenance and monitoring a Geoinformation System (GIS) based Telecommunication Management Network System is under projection now. The network topology is reflected onto the database of the electronic maps used as background and provided by MapInfo Professional v.4.01 package. Network structure, current states of lines and network elements will be continuously monitored by active distributed network agents (sniffers) [2]. MapInfo Package is also planned to be used for exceptional events signalling and for statistics of network events displaying on the network topology base. It can be notified, that figures of current report was made by means of MapInfo package.

Conclusion

The success of implementation of TUM-Net project as an open window into the infinite world of information is based on the efforts and enthusiasm of future users and is highly conditioned by the possibility to get real international help and assistance. And the role of EUNIS as experience exchange and international collaboration organisation is expected to be very fruitful on this road.

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Technical University of Moldova, Stefan cel Mare 168, 2004 Chisinau, Moldova
e-mail: svv(at)cinf.usm.md
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EUNIS97, Grenoble (France) 9-11 September 1997 (Ref.I/032102G)

Last Updated on Wednesday, 16 November 2011 10:35 | |

Tweet

Ref: 081901/I

Grenoble Network Initiative (GNI) : un environnement pour le développement des TIC.

Gérald DULAC

Je salue les membres d'Eunis et je leur souhaite un grand succès pour ce congrès Eunis 97 à Grenoble.

Tous ceux qui s'expriment sur le développement des technologies de l'information et de la communication citent toujours la formation comme une des premières priorités à investir.

Le succès que je souhaite à Eunis est donc nécessaire pour répondre à cette priorité : quelle responsabilité!

Il ne se passe pas une semaine sans que paraisse en France, un livre, plusieurs articles qui réclament une mobilisation en faveur des TIC.

Ces analyses, par un mimétisme commode, convergent souvent : ce serait la faute du minitel (alors que la fonction kiosque est géniale), ce serait la faute de nos élites (ben voyons, c'est bien connu ce sont eux qui font évoluer la France), ce serait parce que les français ont peur d'entrer dans la société post industrielle (dans les années 80 on nous a fait déjà le coup du secteur des finances plus important que l'industrie).

Et si le graal était ailleurs. Et si le graal était simplement d'analyser les freins, de les résoudre en se donnant des objectifs de moyens.

Et si nous tentions d'approcher la situation par les problèmes plutôt que par des solutions.

A Grenoble nous avons choisi la voie du travail collectif, du travail coopératif pour aborder cette question du développement des TIC.

Cela se passe au sein de Grenoble Network Initiative. Je ne saurais que vous inciter à taper immédiatement www.gni.fr.

Lors de ma conférence je vous expliquerais les trois phases que nous avons vécu à GNI et celle que nous devrions vivre sous peu.

Revenons aux freins et aux problèmes.

- Tout d'abord la question philosophique : mondialisation ; remise en cause des Etats-nation démocratiques ; érosion et parfois destruction brutale de cultures pour citer Philippe Engelhard.
- Ensuite la question sociale : risques d'exclusion culturelle, d'emploi, confusions entre les demandes ultra libérales et les libertaires.
- Enfin la question des coûts : le paiement à la durée n'est-il pas vraiment le frein?

En posant la problématique des TIC comme cela on aborde la situation radicalement différemment.

Il faut créer de la compétence et faire naître des médiateurs (et notamment dans le domaine de la formation), d'abord pour ne pas dire n'importe quoi et ensuite pour créer des expérimentations communes qui font avancer tous les intéressés.

Il faut créer des lieux d'accès qui éliminent le risque de l'élitisme que, pour la grande majorité d'entre nous, nous n'acceptons pas.

Il faut se mobiliser pour que se créent des infrastructures de communications flexibles, à coût forfaitaire pour tirer le réseau et je cite Jean Pierre Verjus président scientifique de GNI << vers le haut (le numérique à fort débit) et vers le large (la majorité des gens) >>.

Enfin il faut se faire une vision partagée de cette société de l'information, en y entrant dedans mais en ne jetant pas aux orties notre histoire et nos valeurs.

Voilà le travail de GNI, il est ambitieux.

Ce n'est donc pas un hasard si c'est à Grenoble qu'est partie l'initiative de la création de la section française de l'ISOC, si il y a environ 10% de la population de l'agglomération qui est connectée à Internet.

Il me tarde de vous expliquer cela.

Il me tarde aussi de vous dire comment nous espérons développer encore plus l'utilisation d'Internet dans le secteur de la formation des écoles primaires à l'Université.

Il me tarde aussi de vous dire notre mobilisation pour faciliter le développement et la création de P.M.E. sur ce secteur des TIC.

Président de GNI, Adjoint au Maire de Grenoble
Vice-président de la Communauté de Communes
de l'agglomération grenobloise.

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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The Electronic Library

Päivi Kytömäki

1. Change in publishing - Web publishing

Library collection development policy has always aimed at maintaining physically accessible collections that are as extensive and comprehensive as possible. Now the Internet and electronic publishing are revolutionizing the library world to such an extent that the earlier collection development policy and the division of labour agreed within its framework no longer work. We still collect printed materials in our libraries, but they have now been joined by electronic (digital) publications, such as books (with hypertext links), periodicals and databases.

Bibliographic CD-ROM databases have for long been used in libraries either locally or through intranets. Now they can also be accessed via the Internet, as well. The number of electronic journals is growing rapidly. Some of the journals are back issues digitized by the university libraries. Some are published only in the Internet, and they are not at least for the time being considered proper quality journals. Their attractiveness has a lot to do with their multimedia properties, such as hypertext links and 3D images. Their continuity is in doubt, however. The rest of the journals have parallel printed and electronic editions coming out simultaneously. Most of these are refereed journals renowned for their quality. This group is without doubt the most important, since the printed versions are so well-known and frequently used. Among the publishers of the latter type of journal are for example the American Mathematical Society, Academic Press, Springer and the Institute of Physics Publishing. Periodicals are the type of publication that is estimated to grow most quickly in the Internet. In 1995 it was estimated that there were 115 periodicals available on the Internet in the fields of medicine, technology and science (1). Now there are about 2000, according to the information given by the publishers. British Library recently estimated that in five years time approximately half of the currently existing 16000 periodicals in these fields will be published in electronic form (2). In some estimates the rate of growth is expected to be even quicker. According to some estimates the traditional printed journal will disappear altogether and be replaced by its electronic counterpart in 10-20 years (3).

The number of electronic books is growing rapidly due to several digitizing projects around the world (4,5). Such projects in English are for example the Cornell University Projects, Project Gutenberg, the Oxford Text Archive, the Open Book Project, University of Virginia Electronic Text Center and the American Memory Project. The British Library (1996) estimates that there are at least 20 000 books in English already available on the Internet. The Bibliotheque Nationale has (or soon will have) digitized 100 000 works. Smaller publishers are also digitizing books on diskettes. It is estimated that in addition to the printed version publishers will produce parallel electronic editions for the Internet of books, as well.

Some of the material available on the Internet is permanently free of charge, some only for the time being (introductory offers). Some of the leading scientific journals are free to those who subscribe to the printed version, but some are always subject to a charge. Why should we buy expensive electronic journals when recent cuts in library grants and inflation together have made it impossible to buy even the needed printed materials?

The greatest benefit of electronic collections is their excellent availability regardless of space or time. A researcher can browse a scientific journal on his own workstation and print out the articles he wants. The technology also makes it possible to have many concurrent users. Availability in a library is often to a greater extent subject to different kinds of impeding factors; either the journal is in in-house circulation, someone is reading it at the moment or it is missing altogether. It is more than likely that in time researchers will learn to use electronic journals, but since old habits die hard it is necessary to use two overlapping publishing methods for some time to come. As far as CD-ROM databases are concerned, their use via networks has turned out to be technically very difficult to implement and require highly specialized knowledge and skills from the end users. Direct network use through the Internet maintained in collaboration with the vendors has proven considerably easier.

On the other hand a situation where we have collections a) in the library, b) in the university intranet and c) available via the Internet is very demanding both for the user and the library in order for them both to have control of the whole.

From the viewpoint of the library this two-sided situation not only puts more pressure on the funds allocated for the acquisition of new materials, but it also causes additional work in the search, acquisition and organisation of networked materials. The increase of electronic materials available on the Internet means that in addition to the traditional physical collections libraries also maintain virtual or electronic collections which can be accessed via hyperlinks on the libraries' WWW-sites. In addition to the work of individual libraries many countries have nationally funded, large-scale eLib or Electronic Library projects. I will look in detail at the Finnish national electronic library project and briefly at the projects in the United States, England and Denmark.

2. Why to plan a national electronic library ?

The Finnish Ministry of Education appointed in January 1997 a working group to prepare a plan for the development of electronic information services for research and the implementation of a national electronic library as part of the Information Society Programme. The Ministry stated that the goal of the project was to guarantee access to a high-quality, well organised and diversified national and international information resource, and thus improve the conditions for research and education and cater for the needs of trade and industry, as well.

The working group submitted its motion for a national electronic library to the Minister of Education at the end of May (6). The author of this article was a member of the working group.

Why did the Finnish Ministry of Education ask for a group consisting of librarians and computing professionals to prepare a plan for a national electronic library? It can be said that the time was right in many ways. Three factors that have certainly contributed to this are the arrival of the information society, electronic publications and the current situation of the university libraries.

The Ministry of Education has purposefully and systematically built a foundation for a Finnish information society. It has built an effective data communications network especially for universities and research institutes, and schools, universities and libraries have been equipped with modern hardware. It can be said that during the past few years a solid information technology infrastructure has been built for research and education institutions. As the physical framework is now in reasonably good shape, all that is needed is the actual content of the information networks and the information society. With regard to content, the national electronic library could be one of the mainstays of the information society.

Another factor is probably the rapid increase of the number of electronic parallel versions of important scientific journals, which I already described above. Contractual practices with scientific publishers are changing, enabling the creation of a national electronic library. Previously each library purchased a separate site license but now many large publishers are prepared to negotiate over joint nationwide licenses.

A third factor that is certain to have influenced the assignment by the Ministry of Education is the gradual decline of the standard of foreign collections in Finnish university libraries. The financial resources of universities have been cut, which has caused a decrease in the acquisition of new literature. The universities have repeatedly reminded the Ministry of Education of the decline of this resource which is essential for research. The national electronic library could significantly improve the supply of literature required by research and education, as a nationwide license would buy materials that one university alone could not afford.

In addition to the reasons mentioned above and a lot of goodwill, we shall need money, as well. The time is also right in this respect, and this could be one of the reasons for the assignment by the Ministry of Education. The Finnish state is privatising its property, and some of the wealth accumulated from this will be used to improve the conditions of research and education, i.e. libraries and information networks. Examples set in other countries where electronic libraries have been built have naturally had an influence on attitudes. However, the Finnish national library plan is not a copy of any of the above projects.

3. Finnish national electronic library (FeLib)

A committee was appointed to draw up a plan for the outlines of the development of electronic information services for science and research and for the structure of a national electronic library. A national electronic library demands reliable and quick network connections for data transmission and communication between members of the academic community. The main function of the electronic library is to ensure that well organized national and international information meeting customers needs are accessible over networks and other technical information infrastructure.

An electronic library offers many economic, technical and social benefits. It is global and accessible regardless of place, space or opening hours. It speeds up communication and enables purposeful, resource-saving cooperation. Joint purchases of electronic materials can raise the degree of self-sufficiency with regard to information resources in Finland. In the ideal situation the end user is able to access the versatile, decentralized services via a unified and easily accessible virtual library.

3.1. Services of the national electronic library

The main idea of the working group was that the electronic library should form part of an electronic campus of the universities, which is typified by electronic publishing and effective use of networks. The national electronic library will in the future be complemented by various kinds of personal virtual libraries, which can be customized to suit the needs of each user so that only the most relevant materials are retrieved from national and international information resources.

The resources of FeLib consist of both national and international materials, for example special and reference databases, electronic documents available on the Internet, multimedia, electronic educational materials and other networked materials.

All electronic materials must be searchable via an integrated, easy-to-use interface, enabling easy access and use of all the above networked resources. Searchability and personal control of information resources will be facilitated through the use of WWW-indices, program agents, subject catalogues etc.

The goal is to make at least some of the articles and monographies available in full-text form via hyperlinks in reference databases. Thus they can be transferred to the user's own workstation or printed straight away. If the desired materials are not available in electronic form, the user is directed to interlibrary lending services or the collections of other libraries. The system can be used to retrieve all kinds of information materials, which means that the search results may be in the form of hyperlinks to WWW-documents, to various special databases and the data they contain, to reference, multimedia or full text materials.

3.2. Recommendations for the development of the electronic library

The following measures are needed to improve the electronic library:

A. The amount of information available in electronic form is considerably increased by:

- buying and acquiring usage licenses for free electronic materials and recording and making them available for the public
- increasing the volume of electronic publishing in universities
- digitizing materials

B. The availability of both networked and library materials is improved.

- by directing resources to the improvement of retrieval methods, equipment and standards

C. The national electronic library and its operation is organized

- by naming the organs responsible for its development and implementation
- by determining the guidelines for the future funding of the project

Recommendations for the acquisition of electronic materials

1. Electronic materials for university libraries are acquired under joint nationwide contracts. Such contracts are made on electronic journals published by the most important scientific publishers and other electronic primary materials, on reference databases and on the use of foreign joint catalogues and national bibliographies.

2. Long-term storage of electronic publications and their future usability is looked into.

3. The core materials from the national resources are chosen for digitization.

4. All of the most important national reference databases must be accessible via the national electronic library.

5. The research databases of universities and research institutes are part of the national electronic library.

Recommendations for electronic publishing

6. The working group recommends that universities issue their publication series and theses in electronic form. The publications should conform to open standards.

7. Universities should use the print-on-demand system and principles and guidelines for its use should be developed. The objective must be to use existing hardware and software as efficiently as possible.

8. In future the Ministry of Education will publish its own publications also in electronic form. To make the publications easier to retrieve their bibliographic and classification information will be recorded. Standards that are in common use in state administration will be used.

Recommendations for educational materials

9. The electronic library and electronic learning environments are closely connected. They will support and complement each other through the use of hyperlinks.

Recommendations for information retrieval

10. Retrieval of information from the Internet is made easier by developing new, compatible subject indices that cover all the most important disciplines from Finland's point of view. Information retrieval from the indices and their maintenance is facilitated. Applications developed in similar projects abroad can be utilized.

11. The national WWW-index maintained by CSC (Center for Scientific Computing) is developed further so that it will complement global WWW-indices such as Alta Vista.

12. The Ministry of Education facilitates end users' access to public information resources in its own field and furthers the development of a service similar to GILS (Government Information Locator) in Finland by starting a similar project in its own field of administration.

Recommendations for the library system

15. The use of a uniform library system in all university libraries is a unique advantage, which must be maintained. In order to improve the ease of use and searchability of the OPACs the present VTLS-94 applications will be upgraded to new generation versions.

16. The usability of joint databases in Finland and abroad is improved by using a program based on the information retrieval standard used on the Internet (Z39.50).

17. Inter-library lending is rendered more effective by using programs that conform to the international interlibrary lending standard (ISO ILL).

In addition to the above the working group suggested that the Finnish Free Deposit Act should be modified to cover electronic materials, as well. With regard to copyright legislation it was suggested that libraries

- should have the possibility to store electronic materials, as well
- should facilitate the use of materials bound by copyright both in the library and via networks
- should provide facilities for the copying of electronic materials in the library both for personal use and for research purposes.

The National Library has the responsibility for the practical implementation of the operations that require cooperation between several organizations. In technical matters it shares the responsibility with CSC. A separate working group plans and coordinates the information resources and draws up the development plans. Maintenance of the most heavily used document servers is centred as far as possible in Finland, in which case the maintainer could be the Center for Scientific Computing, the National Library or one of the computing centres. The maintenance of special databases in different disciplines will be decentralized should the need arise.

The working group proposed for 1997-1999 budgets of 18, 20 and 22 million Fmk, respectively (approx. 5 million USD per year).

4. Other eLib-projects

One of the most interesting projects is the English eLib (7): " In 1993, an investigation into how to deal with the pressures on library resources caused by the rapid expansions of student numbers and the world-wide explosion in academic knowledge and information was undertaken by the Joint Funding Council's Libraries Review Group, chaired by Sir Brian Follett. This investigation resulted in the famous Follett Repport. One of the key conclusions of this report was that the exploitation if IT is essential to create the effective library service of the future. As a consequence, The Higher Education Funding Bodies in the UK invited proposals for projects which would transform the use and storage of knowledge in higher education institutions. [[sterling]]15 milj. was allocated to the "Electronic Libraries Porgramme", managed by the Joint Electronic Systems Committee on behalf of the funding bodies."

Of several hundred proposals 30 were initially announced in July 1995, lasting up to 3 years in duration. Since then, several other projects have been approved and currently 60 projects are being funded. They are working on the 11 subfields: Access to network resources; Digitisation; Electronic document delivery; Electronic Journal; Electronic short loans; Images; On demand publishing; Pre-prints; Quality assurance; Supporting studies and Training and awareness. The projects have standars to follow and the full day officer and the leading group.

Many relevant scenarios are done too in Denmark. One of these is Info-samfundet år 2000: rapport fra udvalget om Informationssamfundet år 2000 (8), published by Danmark's government (1994). Next year was published Fra vision till handling (9), from the vision to the practice. Following these guidelines there are now in Denmark over 50 organizations including libraries, archieves and museums in the Kulturnet Danmark-project managed by Det Konglige Bibliotek (10). They are bringing a lot of electronic material for citizens to the Internet.

In the USA there is no one leading scenario like in Finland, England and Denmark which to follow. The government of President Clinton published in 1993 the raport "National Information Infrastructure: agenda for action" (11). The importance of electronic libraries are evaluated to be very high: "The ability of digital libraries to store and share knowlegde, history, and culture will be central to the success of the NII" (12). A lot of electronic library projects are going on managed mostly by university libraries. The Library of Congress has a very big American Memory project. Maybe the biggest of eLib-projects in the States is the Digital Library Initiative-project (13). It has six subprojects getting funding for 4 years each 1 million dollars. These projects are very technical, managed by university libraries and funded through a joint initiative of the National Science Foundation (NSF), the Department of Defency Advanced Research Projects Agency (DARPA) and the National Aeronautics and Space Administration (NASA).

Why are all these efforst done in so many countries? Maybe the answer is said in the last mentioned project: "The projects' focus is to dramatically advance the means to collect, store, and organize innformation in digital forms, and make it vailable for searching, retrieval, and processing via comminication networks - all in user-friendly ways." Librarians move the focus away from the library as a physical space to the virtual library with netservices.

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Oulu university library,
PB 450, Linnanmaa, 90571 Oulu, Finland
E-mail: paivi.kytomaki(at)oulu.fi

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Institut IMAG et bibliothèque virtuelle

Jacques Voiron[1], Françoise Renzetti[2]

L'IMAG (Informatique et Mathématiques Appliquées de Grenoble) est un institut fédératif de recherche du CNRS de l'Institut National Polytechnique de Grenoble et de l'Université Joseph Fourier regroupant des chercheurs dans le domaine de l'informatique, des mathématiques appliquées et de leurs applications ; des étudiants de second et troisième cycle dans ces domaines sont directement concernés par les activités de l'IMAG.

Depuis plus de 30 ans cet institut dispose d'un centre de documentation spécialisé commun (Médiathèque IMAG) à l'usage de ses chercheurs et de ses étudiants de troisième cycle. Cette médiathèque a régulièrement évolué avec les besoins des chercheurs et les technologies de l'information. Elle doit actuellement relever le défi de l'" Internet " ou du " Web ", qui transforme profondément les moyens et usages traditionnels de diffusion et d'accès à l'information scientifique spécialisée.

1. L'Institut IMAG

La communauté scientique de l'IMAG a été très active dès le tout début du développement des mathématiques appliquées et de l'informatique en France et en Europe. Ses chercheurs ont toujours participé aux évolutions de la discipline et de la technologie ; ils ont maintenu des équilibres entre les recherches fondamentales et les applications. Ils sont attentifs aux évolutions des usages de l'informatique tant au niveau de la société que dans le monde de l'entreprise.

1.1 Structure

L'Institut IMAG est une fédèration de 7 unités mixtes de recherche du CNRS, de l'Institut National Polytechnique de Grenoble INPG et de l'Université Joseph Fourier UJF. Environ 650 personnes travaillent dans les laboratoitres de l'institut.

- L'Institut d'Informatique et Mathématiques Appliquées de Grenoble, IMAG, FR 0071, directeur Jacques VOIRON, b.p. 53, 38041 Grenoble Cedex 9
- Les 7 unités mixtes de recherche du CNRS, de l'INPG et de l'UJF :
  - **CLIPS**, Communication Langagière et Interaction Personne-Système, directeur Yves CHIARAMELLA, UMR 5524, b.p. 53, 38041 Grenoble Cedex 9
  - **GRAVIR**, informatique GRAphique, VIsion et Robotique, directeur Claude PUECH, UMR 5527, b.p. 53, 38041 Grenoble Cedex 9
  - **LEIBNI**Z, informatique fondamentale, mathématiques discrètes et systèmes cognitifs, directeur Philippe JORRAND, UMR 5522, 46 avenue Félix Viallet, 38031 Grenoble Cedex 1
  - **LMC**, Laboratoire Modélisation et Calcul, UMR 5523, directeur Patrick WITOMSKI, b.p. 53, 38041 Grenoble Cedex 9
  - **LSR**, Logiciels Systèmes Réseaux, directeur Paul JACQUET, UMR 5526, b.p. 53, 38041 Grenoble Cedex 9
  - **TIMC**, Techniques de l'Imagerie, de la Modélisation et de la Cognition, directeur Jacques DEMONGEOT, UMR 5525, IAB, Faculté de Médecine, Domaine de la Merci, 38700 La Tronche
  - **VERIMAG**, spécification, conception, validation, de systèmes parallèles et temps réel, UMR 9939, directeur Joseph SIFAKIS, Centre Equation, 2, avenue de Vignate, 38610 Gières

1.2 les principaux thèmes de recherche

Les domaines de recherche de l'IMAG concernent l'informatique et les Mathématiques Appliquées. L'évolution du secteur sciences et technologies de l'information, les avancées technologiques récentes, l'ouverture vers d'autres disciplines et vers le secteur aval, la banalisation des usages de l'informatique, ont conduit l'IMAG à identifier sept axes stratégiques pour conduire sa politique de recherche :

Modélisation et calcul: calcul formel, équations aux dérivées partielles, géométrie algorithmique, informatique du parallélisme et calcul scientifique, modélisation stochastique.

Logiciel, systèmes, réseaux: développement de méthodes et outils pour l'ingénierie du logiciel et des systèmes critiques, la recherche d'informations complexes et réparties, les applications réseaux. Complexité des logiciels et systèmes, rapprochement informatique et télécommunications, grands volumes de données multimédias, qualité et fiabilité.

Communication langagière et interaction personne-système: communication entre individus et systèmes informatiques, communication médiatisée entre personnes. Recherche et expérimentation complémentaires en langage naturel, parole, dialogue. Systèmes d'interaction et systèmes multimédia

Image robotique vision: outils de modélisation et de construction intégrant des capacités de perception, localisation, reconnaissance et planification, dans le cadre d'applications en robotique, bases de données d'images et interaction homme-machine. Maquettes numériques 3D, simulations et réalisation de systèmes de réalité augmentée.

Ingénierie et informatique médicale: outils mathématiques, informatiques, physiques et biologiques en liaison avec la médecine clinique et la chirurgie. Gestes médico-chirurgicaux assistés par ordinateur, imagerie multidimensionnelle, modélisation de systèmes biologiques, exploitation clinimétrique de bases de données médicales.

Mathématiques et logiques pour l'informatique: logiques classique et non classiques, mécanisation de l'inférence, mathématiques discrètes, combinatoire, graphes, optimisation, recherche opérationnelle, problèmes multi-critères.

Systèmes cognitifs: étude, modélisation théorique et mise en oeuvre informatique d'activités cognitives : connaissances, raisonnement, apprentissage, langage, perception et action.

1.3 Les activités d'enseignement

Les scientifiques de l'Institut IMAG dispensent des enseignements à 1000 étudiants dans deux établissements de formation supérieure (l'ENSIMAG, École Nationale Supérieure d'Informatique et de Mathématiques Appliquées de Grenoble (INPG), et l'UFR IMA, Unité de Formation et de Recherche en Informatique et Mathématiques Appliquées (UJF)) et quatre formations doctorales regroupées au sein des écoles doctorales " Mathématique et Informatique " et " Génie Biologique et Médical ".

Environ 300 boursiers ou allocataires de recherche sont accueillis dans les unités de recherche de l'IMAG pour préparer une thèse de doctorat de l'INPG ou de l'Université Joseph Fourier.

1.4 Les partenariats

L'Institut IMAG développe des partenariats avec d'autres organismes (INRIA, CEA, CNET, GEMAGREF, INSERM...) et avec le secteur industriel. L'objectif est d'établir des relations de coopération pluriannuelles pour mener des actions de recherche stratégiques et des actions de valorisation de la recherche avec des industriels (par exemple, Verilog, Dassault Systèmes, Texas Instruments, Praxim, ...).

La collaboration avec l'INRIA se définit autour de projets communs de recherche (APACHE, IDOPT, iMAGIS, MOVI, SHARP, SPECTRE) et d'actions d'expérimentations technologiques avancées.

2. La Médiathèque IMAG

2.1 Rôle de la Médiathèque

La Médiathèque est une réponse aux besoins d'information d'une communauté scientifique dont l'éventail des recherches s'étend aux Mathématiques Pures et Appliquées, jusqu'à l'Informatique et à ses applications.

La Médiathèque a pour premier public les membres de l'Institut IMAG.

La Médiathèque, bibliothèque de recherche, se doit de fournir l'ensemble de l'information nécessaire à une communauté diversifiée.

2.2 Valoriser les collections de la médiathèque

Les collections traditionnelles constituent un noyau de haute tenue qu'il est important de valoriser :

*** Des collections dont l'origine remontent à la naissance de l'ordinateur**

Les collections de la Médiathèque remontent aux années cinquante, à la naissance même des sciences de l'ordinateur en France ; à côté de leur intérêt historique majeur, elles constituent un atout essentiel pour la recherche puisque dès l'origine, elles se caractérisent par l'ampleur des thèmes représentés ; elles s'étendent aux mathématiques pures et aux mathématiques appliquées, à l'informatique théorique, à l'automatique théorique, la programmation, les domaines de l'équipement, des systèmes, de l'intelligence artificielle, des applications de l'informatique (par exemple biologie, santé, mécanique).

Comme en témoignent les rapports d'activité, des données quantitatives de ces collections permettent d'en vérifier la bonne répartition tandis que l'internationalité des documents et la densité des échanges sont une garantie de leur qualité.

Aujourd'hui la Médiathèque est une des grandes bibliothèques en France dans les disciplines des sciences et technologies de l'information.

*** Une politique scientifique élaborée par les chercheurs**

L'objectif est d'anticiper les besoins d'une communauté dont les thèmes scientifiques s'élargissent très rapidement. Des structures et des outils particuliers permettent l'élaboration et l'application de cette politique.

<u>La Commission bibliothèque</u>

Comme il est d'usage dans les bibliothèques, pour connaître les besoins du public et pour les sensibiliser aux problèmes documentaires, une commission d'utilisateurs se crée vers 1980. La partie scientifique de sélection des acquisitions est réalisée par le Président de la Commission qui s'appuie sur la collecte des informations adressées par les spécialistes.

<u>Les expositions scientifiques</u>

Pour valoriser le patrimoine scientifique et souvent, en dyptique des manifestations scientifiques organisées à l'Institut IMAG, une ou deux fois par an des expositions thématiques qui peuvent atteindre une grande ampleur mettent en valeur des collections[1].

<u>Les collaborations : RNBM & INRIA notamment</u>

La Médiathèque a collaboré depuis toujours avec les bibliothèques de mêmes spécialités, lorsque ces collaborations se sont organisées et structurées en réseau, elles en est devenue tout naturellement un noeud important. La Médiathèque fait partie du réseau documentaire INRIA et du Réseau National des Bibliothèques Mathématiques[2].

=> Il s'agit donc de constituer la mémoire commune de l'Institut en profitant des compétences et des outils en place dans les communautés parentes.

*** Une tradition en informatique documentaire**

1973 : automatisation des catalogues (N. Gastinel)
1983 : système réparti de gestion (INRIA) (Claude Delobel)
1993 : serveur W3 et diffusion électronique des publications IMAG (fichiers PostSript)
1995 : Projets Callimaque et Calliope (IMAG - INRIA - XEROX)

Ces actions, novatrices en leur temps, n'ont pas toutes été poursuivies, par exemple la création d'index automatisés permettant d'accéder aux documents ou le système de gestion réparti de bibliothèques entre les bibliothèques de l'INRIA Rocquencourt, de l'IRISA à Rennes, de l'INRIA Sophia Antipolis et de l'IMAG.

On note cependant la volonté de la Médiathèque d'utiliser les mêmes outils (l'ordinateur et le réseau) que les usagers et ce dès les années 70.

*** Une communauté répartie sur 5 sites dans l'agglomération grenobloise**

A partir de la seconde moitié des années 80, les chercheurs de l'IMAG se répartissent sur cinq sites académiques dans l'agglomération grenobloise. La Médiathèque avait été conduite, non sans difficultés, à la création d'une " Antenne bibliothèque " au centre ville. Le problème du partage des collections, au travers de quelques essais provoque toujours l'insatisfaction générale. Quel qu'en soit le site, les fonds sont jugés insuffisants par les usagers, qui, afin d'en terminer avec les méprises fréquentes de localisation, préfèrent la réunion des collections.

Dès lors, la Médiathèque se tourne résolument vers les outils de communication pour signaler ses collections et offrir des documents en texte intégral.

*** Conclusion**

Les missions de la Médiathèque consistent essentiellement dans la mise en oeuvre de services de proximité, tout en contribuant au rayonnement scientifique de l'IMAG sur le plan national et international:

> a) gérer des collections scientifiques recouvrant les grands thèmes de la recherche locale,

b) participer au rayonnement de l'Institut IMAG en affichant la mémoire commune et les publications des chercheurs (thèses et rapports);

c) assurer ces services au moyen des outils de communication qu'utilise la communauté elle-même : l'ordinateur et le réseau.

Se pose alors, l'ensemble des questions qui sont liées à l'adaptation au virtuel et à la gestion d'un environnement transitoire et hétérogène.

3. L'Adaptation au virtuel

3.1 La bibliothèque virtuelle

La Médiathèque de l'IMAG assurant trois services majeurs : la gestion des collections, des activités de diffusion et des services de documentation, une bibliothèque virtuelle IMAG doit rendre accessible les mêmes services à partir de la station de travail de chacun.

La bibliothèque virtuelle prendrait appui sur les faits que :

a) La situation scientifique et géographique de l'IMAG est éminente dans la région Rhône-Alpes, l'IMAG, à la fois par ses compétences de recherche en Informatique et en Mathématiques Appliquées, la richesse de ses collections et son savoir-faire technique. La médiathèque IMAG peut être un site privilégié d'un support de diffusion électronique d'information.

b) Les collections de la Médiathèque qui sont celles d'une grande bibliothèque spécialisée en Informatique et en Mathématiques Appliquées pourraient constituer le point de départ des activités de diffusion.

c) Une expérience d'une quinzaine d'années dans le déploiement et l'usage des réseaux au sein de la communauté l'IMAG.

3.2 Projet d'un CDEIMAG (Centre de Diffusion Electronique de l'Information en Informatique et en Mathématiques Appliquées de Grenoble)

3.2.1 Objectifs

Diffuser ou rediffuser des revues électroniques (tables des matières, résumés ou texte intégral) et d'autres documents électroniques (publications non commercialisées ou publications dont l'Institut bénéficierait de la propriété intellectuelle) dans le cadre d'un CDEIMAG, (Centre de diffusion électronique en Informatique et en Mathématiques Appliquées de Grenoble).

3.2.2 Politique documentaire

* <u>Au niveau des outils</u>

Dans le cadre d'un service public, le but est d'assurer l'accès aux utilisateurs de la Médiathèque à des documents de forme nouvelle (scannérisés ou mémorisés) ou à d'autres documents électroniques (revues, autres centres).

*** Agir au niveau du champ social de la recherche**

- Intégrer la politique documentaire dans la stratégie de la recherche
- Valoriser l'Institut auprès des tutelles finançant les recherches menées,
- Insister sur leur utilité sociale ;
- Renforcer la notoriété de l'Institut par une diffusion internationale en affirmant les compétences scientifiques de l'IMAG.

3.2.3 Points d'ancrage de la politique de l'information scientifique

Les activités de diffusion ou de rediffusion de revues électroniques (résumés ou texte intégral) et d'autres documents concerneraient :

* Les revues commerciales en abonnement à la Médiathèque

Les revues constituent un des enjeux de la recherche. Dans les domaines des mathématiques et des sciences de l'ordinateur la majorité des revues commercialisées sont sous format électronique. Les revues électroniques commerciales doivent être rendues accessibles en considération de leurs usages par les chercheurs grenoblois.

* Les éditions électroniques IMAG

Plusieurs types de publications concernant la vie scientifique à l'IMAG pouraient être promues.

* Propriété intellectuelle

La diffusion électronique doit se faire dans le respect du Code de la Propriété intellectuelle.

* Echanges

Il serait intéressant au moyen des revues et publications électroniques de l'IMAG de structurer des échanges pour obtenir des publications qui, si actuellement sont libres d'accès, semblent vouloir orienter leur diffusion future vers un mode de consultation payant.

3.3.4 Prises de décisions techniques

* Aspects serveurs et réseaux

Les aspects techniques relatifs aux serveurs, aux réseaux, à l'archivage pourraient profiter du savoir-faire du service des " Réseaux et moyens informatiques " de l'IMAG.

* Négociations commerciales

Les revues électroniques commerciales doivent être rendues accessibles en considération des conditions offertes par les éditeurs, notamment celles concernant les structures en consortium.

3.4 Conclusion

Le contexte électronique change radicalement l'environnement des bibliothèques, un CDEIMAG en tant que structure forte permettrait de discuter avec les parties prenantes (auteurs, éditeurs, publics points de diffusion).

4. Bilan sur 3 ans

La bibliothèque virtuelle n'a pas encore été réalisée. Des aspects partiels permettent d'entrevoir ce que pourrait être la future bibliothèque virtuelle de l'IMAG.

4.1 Les aspects partiels développés

*** La page Web de la Médiathèque[3]**

C'est à partir de la page Web de la Médiathèque que l'on peut dresser le bilan de l'activité de diffusion électronique. L'usager y trouve des renseignements sur la Médiathèque elle-même et les conditions pour y accéder. L'usager peut préparer sa venue à la Médiathèque en consultant le catalogue ou la carte de la Médiathèque. L'usager peut utiliser différents services, comme celui assuré par Calliope, base de données de sommaires de revues d'articles à partir de laquelle il peut appliquer des outils de recherche d'information ou de veille documentaire.

*** Les catalogues[4]**

Ils permettent d'accéder à 60 000 références qui concernent des livres, des thèses, des rapports de recherche et des documents video.

*** Le serveur Web du projet Callimaque[5 et l'histoire de l'IMAG]**

Le projet Callimaque propose d'ouvrir sur Internet de larges accès à des collections composées de 3000 documents montrant l'évolution des Mathématiques Appliquées et de l'Informatique depuis 40 ans. Callimaque est un projet de gestion électronique de documents. Il intègre le traitement, la production de documents et la recherche d'information. Callimaque est basé sur un produit de Xerox appelé XDOD (Xerox Document On Demand) qui permet la scanérisation, le stockage et l'indexation des documents. Des outils de recherche d'information qui prennent en compte la syntaxe et des outils d'aide à la traduction français<->anglais permettent :

> a) d'interroger la base en français ou en anglais.
>
> b) d'obtenir une traduction contextuelle sur certains textes comme le résumé des thèses[8].

Aujourd'hui, dans un but de valorisation, il paraît intéressant de clore rapidement ce projet (corrections des documents et réglements des questions de droit du document) afin de le rapprocher du projet ARCOLE9 de la BNF (les collections numérisées de la BNF : 85 000 documents numérisés, dont certains documents concernent les mathématiques).]

*** Le serveur Web du projet Calliope[8]**

Le projet Calliope est un autre projet, mené en collaboration avec l'INRIA Rhône-Alpes et le laboratoire de recherche Rank Xerox de Grenoble :

a) Calliope permet d'accéder via le Web aux sommaires[9 d'une sélection de revues scientifiques reçues à la Médiathèque de l'IMAG et au centre de documentation du Laboratoire de recherche Rank Xerox de Grenoble, (le serveur de la Médiathèque s'alimente sur le serveur de notre agence d'abonnements pour les mises à jour hebdommadaires),

b) le projet Calliope est une expérimentation en recherche d'information. La fourniture du document électronique qui devait, à l'origine, constituer un volet de ce projet, n'a pu encore être résolue et appliquée à l'IMAG.

*** L'Interface d'accès aux revues électroniques commercialisées[10]**

Depuis mai 1997, les usagers accédent au format électronique de revues en abonnement à la Médiathèque via le serveur Web de la Médiathèque. Plus de 300 abonnements commerciaux sont actuellement accessibles ; 150 abonnements sont en test :

Academic Press	test (période limitée de 3 mois)
Springer	abonnement
Kluwer	abonnement
SIAM	abonnement

Des négociations sont en cours avec d'autres éditeurs.

*** L'édition électronique et la diffusion**

Un consensus pour valoriser les recherches et mettre en oeuvre des outils de rayonnement de l'IMAG, permet l'émergence de plusieurs moyens nouveaux.

<u>Les Annales de l'IMAG</u>
Une équipe de chercheurs, en collaboration avec la Médiathèque travaille sur un projet de création d'une revue scientifique électronique couvrant les domaines de la recherche à l'IMAG, avec l'objectif de pérenniser le rayonnement scientifique grenoblois dans la tradition des pères fondateurs.

Au niveau technique, il a été décidé que cette revue multimédia comporterait un résumé en français d'une page et demi, d'un résumé de 8 pages en anglais et des annexes éventuellement amovibles. L'objectif serait d'arriver à une revue de haut niveau afin qu'elle soient référencée dans les grandes bases de données mondiales de recherche et d'évaluation.

<u>Les Prépublications</u>
Parallèlement à cette revue, une collection des meilleures thèses et des meilleurs rapports de l'IMAG est en cours de lancement.

<u>La diffusion des actes marquants de la vie scientifique</u>
La Médiathèque essaie de collecter des données relatives aux différents séminaires scientifiques et aux autres manifestations scientifiques internes à l'IMAG afin de concrétiser la vie scientifique commune.

4.2 L'impact des réseaux sur la politique documentaire

D'autres actions se sont développées ailleurs qui auraient pu faire partie intégrante du CDEIMAG.

4.2.1 La diffusion des rapports de recherche en Mathématique et en Informatique

<u>Thesauria[11]</u>

Thesauria, action INRIA, qui consiste en la mise en ouvre d'un serveur d'information concernant l'ensemble des publications françaises en informatique et en automatique.

Le serveur des prépublications de MathDoc

En partant du fait que les mathématiques sont, avec l'informatique, une des disciplines les plus en avance en ce qui concerne la présence des prépublications scientifiques sur le réseau (31 sites de prépublications mathématiques en France) et que la recherche d'une prépublication par navigation dans les serveurs Web de ces différents sites est fastidieuse pour l'utilisateur, la Cellule MathDoc a entrepris la constitution d'un index interrogeable regroupant l'ensemble de ces publications. Actuellement l'index est construit par le système Harvest, un "robot" qui parcourt l'ensemble des sites, et construit un index "full text " à partir des fichiers trouvés, quel que soit leur format (html, postscript, dvi, etc). La consultation de cet index plein texte est certes utile pour l'utilisateur désirant localiser une prépublication, mais la nature de l'indexation ne permet pas une recherche précise, et génère obligatoirement du "bruit". Le projet de la Cellule MathDoc est en train de constituer un index basé sur des données bibliographiques classiques telles que le(s) nom(s) d'auteur, mots du titre, classification MSC, date, mots-clés, etc...

4.2.2 BiblioWeb

Projet à l'initiative de chercheurs grenoblois pour mettre à la disposition des laboratoires grenoblois les abonnements aux Currents Contents[12 au moyen de plusieurs sites miroirs dans l'agglomération grenobloise. Ce projet a l'objectif de s'étendre à un grand nombre d'abonnements.]

5. Quelques perspectives?

La structure forte projetée (CDEIMAG), viserait à éviter la décentralisation de la Médiathèque et à sa pulvérisation au moment où l'information n'a plus besoin de support centralisé ; elle permettrait aussi d'améliorer la visibilité de l'activité scientifique de l'institut.

Il n'est pas trop tard pour structurer un CDEIMAG dont les activités se redéploieraient essentiellement sur :

5.1 Une fonction éditoriale pour la médiathèque?

Les connaissances sont élaborées dans les laboratoires, et sélectionnées par des scientifiques,

Les supports de formation sont créés et évoluent grâce aux enseignants chercheurs.

Dans le cadre de l'évoution vers l'électronique, la médiathèque élargit ses fonctions aux activités éditoriales.

5.2 la protection des droits des laboratoires : l'enjeu de l'archivage

Le réseau en ouvrant potentiellement l'accès au document développe de formidables enjeux autour de l'archivage électronique, de là l'importance de protéger les droits des chercheurs et les droits des laboratoires.

5.3 Bibliothèque et consortium

En ce qui concerne l'accès aux documents commercialisés, les groupements par consortium paraissent dessiner des solutions intéressantes pour les bibliothèques, en gérant un site miroir, un CDEIMAG pourrait y avoir un rôle majeur.

Notes termes techniques et leur traduction

- bibliothèque virtuelle - digital library
- numérisation - digitalization
- diffusion - dissemination
- revue de grande portée - first rate journal
- exposition scientifique - scientific exhibition
- IMAG : Informatique et Mathématiques Appliquées de Grenoble
- noyau - core
- bibliothèque physique - printed document library
- texte integral - full text

1. http://www-mediatheque.imag.fr/Mediatheque.IMAG/inter/expositions.html
2. En 1986, l'IMAG organisait à Grenoble, un des premiers colloques RNBM.
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Directeur de l'Institut IMAG,
Professeur à l'Université Joseph Fourier Grenoble-1, France
E-mail: Jacques.Voiron(at)imag.fr

Directeur Médiathèque IMAG

E-mail: Francoise.Renzetti(at)imag.fr

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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SGML PUBLISHING AS A JOINT EFFORT

Tuija Sonkkila

It may take quite a while for a new standard to gain acceptance. In this respect, SGML (Standard Generalized Mark-up Language) has been no exception. SGML was given the status of an ISO standard in 1986. Before and after that, the principal usage of SGML has taken place in the field of technical documentation, where the benefits of getting different end-products for different clientele from the same, structured SGML database have been obvious. It is only now, in the age of multiple new and evolving electronic publishing platforms like the Internet, when SGML is getting foothold in academic circles as well. Indeed the future of SGML looks very promising. This is partly due the fact that the focus is shifting from publishing documents to publishing information.

DOCUMENTS ARE CONCEPT OF THE PRINT ERA

In the age of WYSIWYG desktop editors we are mentally locked to the idea of putting documents together by merely choosing the right fonts and margins. Styles are there for us to get the familiar look and feel of the document. This is only natural, because this is the way the WYSIWYG editors are meant to work. Their aim is to produce individual paper documents. The layout is unseparable from the content which means that the transfer of the document to another software or hardware platform poses a risk, resulting to some loss of properties at best. At worst the document has to be rewritten altogether.

In contrast, if it is the intellectual content of the document we liked to turn our attention to, if we wanted to make sure that whatever the medium in any given time, the message has to be easily transferrable to other formats, then we need a whole different editing approach. This means a separation between the content and the layout; a common understanding that without a proper distinction between the different structural elements of the content there is no life beyond the next generation of publication platforms; a set of tools and policies to accomplish this. In an organisation with a variety of traditional ways of doing things, the change in thinking may take a long time to get through, perhaps never fully. Still, it is worth all the trying.

PREDICTABLE STRUCTURE LEADS TO INFORMATION

In terms of academic publishing, Helsinki University of Technology (HUT) is a major producer in Finland. Annually, it publishes well over 400 titles of research publications in roughly 200 different series, ranging from laboratory notes to Ph.D. thesis. The lifespan of the publications varies considerably, but three things are in common. Firstly, the publishing process is decentralized to the degree that quite often it is the individual researcher herself who takes care of the whole publishing process, from tapping the keyboard to shelving the print run. Secondly, the only standard that publications are expected to follow concerns layout. Thirdly, the University Library gets a set of copies of every publication.

From the Library's - and ultimately from the end-users - point of view, quality of metadata is the top one concern. Metadata is that part of the publication that identifies it from another, giving a compact, predictable, standardized representation of the origin, content and format of the publication, essential for archival and retrieval purposes. It is no surprise really that HUT publications are quite challenging in this respect, because widely accepted local guidelines of how metadata should be formulated are missing.

There seems to be a relationship between information needs and the structure of information. Research in the field of digital libraries is bringing up evidence that academic users are interested in distinct parts of a scientific document rather than the whole document. As an example, some claim that

figures reveal what the authors have really done, as opposed to what they wished they had done. 1

Given the document is in structured, electronic format like SGML, and given the structure is following a semantically meaningful pattern, SQL-type languages could be used for this kind of sophisticated information retrieval.

In spring 1996, the Library took the initiative of seeking funding from the Ministry of Education in Finland for a four-year project of HUT electronic publishing. An amount of FIM 180K (30KECU) was granted by the Ministry from its special Information Society Fund. After that, a subsequent FIM 130K (25KECU) has been recieved.

The main goal of the project is to establish a set of procedures for electronic production of HUT serial publication series. Another important goal is to increase local understanding and knowledge about the importance of standards in academic publishing in general, and the benefits of SGML. In-house project partners include the Department of Automation and Systems Technology, the Department of Computer Science and Engineering, and the Computing Centre.

Q:TOP-DOWN OR BOTTOM-UP? A:BOTTOM-UP.

Implementing SGML in the publishing process is a tremendous task, a change in publishing paradigm really. Therefore, it is usually thought that for an SGML project to succeed, the involvement and commitment of the whole organisation is needed, from the day one. This might be true in communities with clearly formulated common goals, like companies. But one might argue whether it is foolish to even dream that something like that could ever be achieved in an heterogenous academic community where, quite understandably of course, individualism is a virtue and departments are traditionally very independent. Other strategies might come more handy. One of them might be called “Request For University Comments”, after the well-known procedure of how new Internet standards have to go through an open evaluation process before they are accepted. This is roughly the strategy chosen by the HUT SGML project.

What we need is two or three workable solutions on how to publish successfully using SGML as the underlying concept. By a solution we mean a publishing procedure consisting of the following steps: editing, layout description, creation of metadata, database storage, information retrieval, network delivery, and printing on-demand. Depending on tools and methods used we get a number of different solutions. Regardless of the solution, every part of it has to be truly operable. Otherwise it fails to get attention and approval. Without approval there will be no followers.

At the time of writing this the first prototype done in the HUT SGML project is approaching its completion.

THE FIRST PROTOTYPE

The prototype is based on the assumption that some of the writers might be interested in experimenting with a native SGML editor like FrameMaker+SGML, whereas some others, not being ready to give up their familiar Word desktop editor, would volunteer to act as a fore-runner and use a given template file for later SGML conversion purposes. In that case, the conversion would be done with FrameMaker+SGML, which most probably will be replaced later on by a true SGML conversion tool like Balise. Dublin Core Metadata Element Set, was chosen for metadata. Finally, instead of network delivery in pure SGML format, conversion to HTML was thought to be more appropiate at this stage. Jade, DSSSL engine by James Clark, will be used as the HTML conversion tool. The question of database management is still under discussion.

For those familiar with the issue of whether or not to use an industry-standard document type definition (DTD), it might be mentioned that document analysis resulted in the choice of constructing an own DTD. Future work with subsequent real-life examples will show if this was a wise move or not. SGML analysts tend to emphasize the benefits of industry-standard DTDs (or subsets of them), particularly in network delivery, where stylesheet construction and maintenance may otherwise become a substantial burden.

WORKSHOP - STEP TOWARDS REAL LIFE

A prototype is only a prototype, no matter how technically workable as such. It has to be tested against other types of publications for hints about shortcomings of the DTD. The tools have to be tested by writers for getting feedback. The model of workflow has to be evaluated to find out if it is feasible to put forward at all. This asks for a close cooperation between project workforce and HUT researchers.

Short-term plans of the project include a start-up of a workshop where a small number of HUT researchers are invited to participate. The aim of the group is to bring forward researchers' experience in publishing, and to lay ground for closer cooperation. At the same time, evaluation of the prototype will take place as another sub-project.

COOPERATION MAY BE JUST AN EMPTY WORD, BUT IT ONLY NEEDS FILLING

Cooperation at university level is never a trivial task, partly because of the amount of time and effort it takes, often without any immediate results. Differences in work culture may be hard obstacles, clashes of interest between organisational units likewise. Nevertheless, cooperation do counts, particularly in publishing, and especially now.

Academic publishing will face fundamental changes in five or ten years to come. Signs are there already. Commercial publishers of scientific journals are losing market, quietly but steadily. At the same time, universities are gradually taking back their former role as academic publishers. To name just few examples, Stanford University's HighWire Press, based at the University's Cecil H. Green Library, announced recently2 about its work with scolarly publishers in publishing electronic versions of traditional print journals, Lindköping University Electronic Press3 in Sweden has done innovative work in establishing publishing guidelines, and University of Montreal in Canada will shortly establish an Electronic Press with SGML as the underlying publishing concept4. There is still time to learn from their examples. Why not start today?

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Helsinki University of Technology Library,
Finland
E-mail: sonkkila(at)cc.hut.fi

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Vilnius University Library Automated System - Change to the new technology

Daiva Keraite

1. Introduction

Vilnius University Library automated system is based on an integrated library system BIBLIO, developed in Vilnius University Computer Center. It was started in 1992 and since then it has grown from small library system containing only two modules to the integrated library system with 60 working places, accessibility from Internet and the central database which contains 85 thousand bibliographic records not only from Vilnius University Library but also from several Lithuanian academic libraries. The last big improvement in the development of library system was the change of hardware and database platform from initial old-fashioned ND/Sintran/Sibas environment to the modern Unix/Oracle environment. At current time library system is moving to the client/server technology. This paper is an overview of the system development in general and particularly its last big change -- the project of porting to the modern platform. Revealing future perspectives connected with this change are discussed shortly too.

2. Development of library system

Technical background for creation of library system was delivery in 1992 to Vilnius University and other Lithuanian universities of several ND (Norsk Data, Norway) minicomputers as a technical help for initiation of Norway-Lithuania computerization project. Vilnius University computer network and Lithuanian Academic Network (LITNET) started from these computers too. ND computers were taken out of production in Norway in that time, so for library system development it was very important to choose appropriate tools which will guarantee possibility to port in the future to another database system and another computer hardware platform not only data accumulated in the database but also software applications of library system. Unique software development tools (Unique Concept, production of Unique, Norway) were chosen for this purpose. Unique Concept tools consisted of high level programming language, automated software development tools and support to several the most popular database systems (SIBAS, Oracle, Informix, etc.).

After choice of development tools the first modules of library system were designed. Library system was designed as integrated from the very beginning, but only two modules (acquisitions and cataloguing) were created. It was sufficient to have only these modules to start accumulate data about new incoming publications into database. Input of bibliographic records into the database started in the beginning of 1993. Modern software development tools allowed to build application programs rather quickly, so the new modules were added to the library system in a short time. In 1994 on-line catalogue module was added and as the library system computer was connected to the Vilnius University computer network that had connection to the Internet at that time already, at the same time library system became accessible from the Internet. Later, periodicals, information services, reports, and import/export modules were added to library system. It is planned to add circulation module when more records will be stored in the database.

Library system was designed to run on the central computer with the terminals in working places. At the beginning only central building of the library was equipped with terminals, but after development of Vilnius University computer network the working places were equipped in several branch libraries in the University.

3. Short description of library system modules functioning at current time

Acquisitions module enables to register necessary information about acquired books, supports file with information about each supplier and allows to make reports for analysis of library activity.

Cataloguing module include applied programs for bibliographic description of acquired publications, keeping and accumulating that information in database. It allows to describe monographs, periodicals, and create analytical bibliographic records. System uses UNIMARC format as internal for this purpose (UNIMARC is recommended by IFLA and adopted by Lithuanian National Library).

Information services module supports periodical retrieval of lists of bibliographic records and representation in printed or file form for publication purposes. Alphabetical order or grouping by a UDC is supported.

Import/export module supports bibliographic data exchange from and to library system. All data exchanges support UNIMARC bibliographic standard. Two Unimarc formats - ISO-2709 - IFLA recommended magnetic tape format - and our own designed textual human readable UNIMARC file format are used. Also this module includes converting software for handling of different character coding tables in UNIMARC files.

4. OPAC interfaces

OPAC module is the most important module of library system. It was added to library system after successful realization of acquisitions and cataloguing modules. OPAC supports possibility to search and retrieve information about bibliographic records. Search is based on keyword search method. Words from different fields of bibliographic record can be combined together with Boolean operators AND, OR and NOT.

There are several user interfaces to OPAC, and they show how library system was growing. The first OPAC interface was built for Tandberg terminals, operation with OPAC was based on function keys (user must press special key to perform a search, to move with arrows within the screen, to press another special key to show search results, etc.).

When library system was connected to the Internet, it was realized that there are a lot of different types of terminals all over the world and that the only one way to make it possible to all of them to use remote OPAC in terminal mode is to create user interface which would operate not with keys but with commands. Standard command language (CCL, Common Command Language for information search and retrieval, ISO 8777) was chosen for this purpose, and now all OPAC users, which connect to the library system with telnet, access database through this interface.

The last interface is WWW interface, and it became possible to develop this interface only this summer after successful completion of porting of library system database to Unix computer and to Oracle server (this process will be overviewd later). Oracle Web server supports this interface. The current version of OPAC WWW interface allows to search database by author, title, ISBN/ISSN number, UDC code, subject headings, series. The filters for language and year of publication can be used. Search results are represented in catalogue card format. Several search fields can be filled, and logical AND operation is performed with terms in the fields. Only 50 records satisfying the search request are retrieved from database in order to reduce system and network overload.

5. Change to the new hardware platform. Joint catalogue project.

Successful implementation of OPAC in Vilnius University library raised an interest of several other Lithuanian academic libraries to create a joint catalogue in Vilnius University library system basis. This idea looked especially attractive for smaller libraries, which have no possibilities to create their own systems accessible on WAN. Libraries, participating in joint catalogue project would prepare their own information locally on PC's and this information would be transferred and imported into a common database in VU. Technical parameters of existing computer system were too week even for VU at that time, so it was necessary to move the system to more powerful computer on Unix platform. Possibilities to create the Union catalogue of 6 Lithuanian academic libraries and other tasks such as training of library staff to use Internet and other modern technologies were thoroughly discussed and involved into special TEMPUS application as Joint European Project. Partners from EC - Denmark, Netherlands and Sweden were involved to support realization of it.

The grant for this project called “Integration of Lithuanian Academic Libraries” was received in 1995. The main goal of the project was to port Vilnius University Library system to modern hardware and database platform and to give opportunity for libraries participating in the project to acquire appropriate hardware in order to install BIBLIO library system in their libraries. Before porting process and installation was complete, libraries-participants would prepare their own bibliographic records with other tools and import them into Vilnius University Library system database. Testing and improvement of import/export module of BIBLIO were also a part of the project.

The main and the most complex task of the project was porting of the library system. Library system was initially designed with the future intention to port it to another hardware and database platform. Application software was built with Unique 4GL programming tools, and the first hardware platform was Norsk Data (Norway) minicomputers with not-Unix-compatible operating system SINTRAN. Unique software development tools consist of Unique 4GL -- high level programming language, tools for quick software development and database porting tool. At the project start time Unique Concept supported several the most popular operating systems and environments (SINTRAN, Unix, Windows 3.11/95/NT, etc.), several the most popular databases (Sibas, Oracle, Informix, Sybase etc.). It supported terminal mode in Unix, but in Windows environment it supported Windows GUI as well.

The Sun Ultra server and Oracle database management system were chosen as the next platform for VU library system.

The porting of library system was planned in two phases. As the existing computer system was working in terminal mode, the first phase of porting was considered to port database to Oracle server and to port library system applications to Unix for operation in terminal mode. This phase was planned to finish in autumn 1996 but because of delay in delivery of computers and reduce of staff in programming working group, this phase was completed only in the beginning of 1997. The work considering platform change was bigger and required more reprogramming than it was expected but in spite of all it required less human resources than to create new system or purchase and adapt other library system.

As the new Unique Concept version supports Windows environment and client/server technology, the second phase was to port library system applications to Windows environment to operate in client/server mode. After completion of this phase BIBLIO library system would be able to operate in terminal mode, client/server mode and on individual PC computer. It would be possible to change working places from terminals to PC's gradually. The second phase is completed successfully in current time as well, and the first 20 computers are installed in Vilnius University library. The new software is being tested in working places. So today system is functioning in mixed terminal and client mode. In the nearest future it will be working in such a way, until all the terminals will be replaced with PC's.

The BIBLIO library system has gotten a new life after porting it to another platform. It can be used in other libraries and the final phase of Joint catalogue project foresees installation of BIBLIO in other academic libraries. The current technical requirements for computer system are Oracle server and PC's in working places in order to work in client/server mode. Possibility to use cheaper database systems (Informix, MS SQL server, etc.) exists as well, but such a project needs some investigation and testing. BIBLIO also could be used in a stand alone computer in the smaller libraries for the initial phase of library system development.

6. Future perspectives

After changing of hardware platform the new possibilities are evolving in development of Vilnius University library system. These possibilities could be divided into three directions.

The first: integration of library system with modern Internet technology. WWW interface to OPAC is the first step in this direction, and another step could be usage of WWW tools to exchange bibliographic records with other library systems or other bibliographic databases. Integrated Windows working environment makes this work easier: for instance you can use Netscape in one window to find information and to paste or import information into library system in another window.

The second: to use Oracle server as the basis for integration of library system with other information systems in the University. After acquisition of Oracle server the library system was the first information system in the University being ported to Oracle server. But it became possible to plan reconstruction and porting to Oracle server of other information systems in the University. The same database platform would make it easier to exchange data among these information systems. Information systems under the closest interest for library system are Student database and database of scientific publications of University workers.

And the third: increasing of system modularity. Client/server technology and open database architecture enable not only easily build new modules but also add modules of other producers to existing library system. For instance, circulation module may be purchased from well-known library system vendor and integrated with BIBLIO. Of course closer investigations in this field are necessary.

Senior programmer of Library System Group,
Vilnius University Computer Center,
Sauletekio al. 9, Vilnius 2054, Lithuania
E-mail: daiva.keraite(at)sc.vu.lt

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Information Services - the convergence agenda

M.J. Clark

An Introduction

Salford University recently celebrated its centenary, which included its existence as a former College of Advanced Technology. The University was, until 1996, one of the UK's smaller institutions but has more than doubled in size following what is probably going to become a common UK phenomenon, merger with an associated college. Merger, the national agenda towards convergence, and an opportune vacancy arising for a new Director of Service allowed the University to consider major restructuring. I was appointed with these issues as my agenda on arrival at Salford early in 1995.

The current restructuring in merger, is the continuation of a process started earlier in the University's history. The financial jeopardy experienced by the Institution in 1981, and subsequent re-structuring, led the Vice Chancellor to propose a convergence of computing and library services under a common management structure. The services were finally converged in a single location, an extended library building, with the title Academic Information Services (AIS).

The University post merger has 20,000 students, in a wide range of disciplines, and is situated approximately 1 mile from the centre of Manchester. The merger resulted in change in AIS from a single-sited `somewhat converged' campus service, to a seven-sited `fully converged' post merger service.

The Pre-Merger Environment

In 1988, following lengthy consultation, the Librarian was appointed Director [1], responsible for both Library and Computing Services with a Deputy Director directly responsible for each of these areas was . The reality of the situation was that there was some shared infrastructure, i.e. a common building and hence common work space and customer space; however, the services developed as less converged than in some totally independent service Universities. The AIS building had been extended to house the computing service on its transfer, with little if any thought being given to converged service delivery. The additional space provided open-access facilities, accessible from the former Library, with its own computing help-desk and advisor service.

The former College operated independent services and locations, on each of their sites. There was no common model for service provision and little relationship between the staff. Generally the College staff were on lower salary scales than their University counterparts and the service provision for Computing was lacking investment, strategic planning, or direction.

Convergence - a viewpoint

Converged delivery of services is appropriate if it enable better support for the customer and hence a better service. There are many models for converged services; most claiming convergence within the UK have managerial convergence without attempting to undertake the necessary restructuring and re-training.

Clearly there has been convergence between the Library and Computing Service activities in support of their users needs. The desktop computer is more commonly used for information access or processing than for mathematical computation purpose. Similarly, the library serves its customer through networked services including the OPAC, CD-ROMs and World-Wide-Web. In many disciplines the network has become the first and sometimes sole route to timely information access. Equally, the traditional material will continue to be a significant resource for the foreseeable future.

The customer wants a single point of entry to service support and often is unable to discriminate a problem to the service provider. The complexities of infrastructure or service mechanisms are of little importance to them. The need is for instantaneous support, without excuse for inability to provide that support. The scale of support required has grown dramatically as the customer base grows with little or no increase in staff resource to support this growth. Thus, measures must be adopted to reduce the need for support by simplifying the interface, and by providing alternative measures to expensive staff resource.

Information is at the heart of learning. Neither the Librarian nor Computing Specialist has an exclusive right to its control or access. There is no right model for convergence other than partnership to support the customer's requirement. The pressure of reducing financial resources for staffing requires effective partnerships to be formed where the service delivery is customer focussed. Thus the impending merger provide a route to re-shaping the service at Salford. Although complete convergence was not a short-term achievable, it was not to be an issue sidestepped in the haste of merger. It has thus been put at the centre of AIS's operational agenda.

Merger - An Opportunity

Merger discussions had been underway for several years prior to my arrival at the Institution. The College Principal and University Vice-Chancellor had this as their personal objectives. I was appointed from outside as the Designate Head of the planned merged and converged service that would result Merger of the institutions was resisted in many quarters, and was by no means a certainty until fairly close to the final date, although realistically most felt the process was inevitable.

The University was persuaded that service should be equable across all sites, and agreed to invest major capital funding in refurbishment of the former College Library premises to support both merger and converged service delivery. Major investment in the network and telephone infrastructures was undertaken, essential for facilitating both merger, and converged service delivery.

Merger- the process

Merger, for areas of the University and College that were replicated by both, would be undertaken by an assimilation process. Individuals would have to compete for posts, created in the new structures, derived for the post merger institution. (There was little replication in the academic departments, as the merger was a very good match of disparate subject areas). The appropriate senior person, (often following an internal competition between former heads in the two institutions), created the structures and application for the posts in the structure would proceed tier by tier enabling staff with relevant previous experience and grading to apply, with appeal processes in place.

A blank sheet of paper is a great place to start a service; however, the agreement existed that all existing staff should nominally be accommodated in the structure, and that the combination of the old and new should nominally produce a 10% saving in the cost model. The former grades, service conditions and custom and practice relating to terms and conditions would require to be tackled. There was opportunity for staff to take early retirement under a generous merger related package.

Complete restructuring is a very threatening process for the staff involved, I would not wish to understate the difficulties through the process and beyond. The new AIS staff structure attempted to provide a common framework for former computing and library staff by recognising the individual professional and non-professional experience of the staff concerned. There was an attempt to provide a path for the non-professional to professional status by providing a suitable intermediary `para-professional' tier in the structure. Re-skilling was seen as essential and budget was earmarked. The new structure focussed on the need for information professionals and attempted to expunge the concept of library and computing terminology. However, the users recognise the physical as a Library, despite the other services integrated into the facility. We now naturally talk about AIS services being in the Libraries.

The structure recognised two categories of AIS staff. Firstly, those who were customer and service focussed and who had a major role in providing the public service. Secondly, those who provide private services essential for the public service but who were by the nature of their role actually invisible to the customer at the point of access. There were of course many that ranged in their duties from the private to the public or spent time in different roles. It was desirable that as many staff as possible should at least serve in the public service on occasion, to ensure awareness of purpose.

The first management `away-day' of merger set a context where there would need to be an internal re-focus; it was to be forcefully stated that `AIS is a customer of AIS'. The failure of the public service was often in the hands of the private service that had failed to deliver to the needs of AIS colleagues. It was my stated view that the private side felt that they served the needs of the external customer first and AIS staff second. Thus systems to support the public AIS operation were given a lower priority. Associated with this was a major lack of communication within the service between functional areas and inconsistent views of priority and purpose.

Assimilation and Re-structuring

Many would envy the opportunity offered by assimilation. The service could be planned from scratch, with a structure necessary for an Institution whose size had more than doubled, and would now be operating across several major campus locations. The overall structure was loosely defined with generic job descriptions, consultation was then was undertaken with staff and Trade Unions. The new structures were required to demonstrate efficiency or effectiveness gains in merger; the associated assimilation rules allowed people who could claim posts in the new structure contained significant elements of their previous role would have automatic right to apply for that post. Staff had their former salary protected in the event of assimilation at a lower grade. There was a merger early retirement and severance scheme available for staff who wanted an opportunity to leave. There were to be no compulsory redundancies.

The assimilation process was lengthy since as each tier was assimilated, the appointees would join the process of re-defining the job descriptions in the subsequent tiers, and being involved in the appointment process. Where new roles were created, both internal and external candidates competed through open competition. Effectively every former member of staff had to apply for a post in the structure unless the new role was a replication of a former role. The attempt at total fairness, with a visible process, with many stages for appeal, was naturally lengthy. It was clearly understood that AIS assimilation would be the most difficult anywhere in the University and would create the largest assimilated structure.

`Generic' job descriptions, emphasising information services, was an attempt to make posts available to staff from either a Library or Computer background. Convergence was at the heart of the structure with clarity that the new operating model for AIS would be through team based management. Re-skilling is essential, the public function of AIS has a majority of relatively junior graded staff providing support to AIS customers.

AIS today

The opportunity may appear to be every Director's dream, i.e. to re-structure. However, the process itself is very threatening for staff. Clearly there have been winners and losers. However, the initial perceived benefits hide the difficulties. All change is threatening; during assimilation morale fell to a low level, with all the associated attributes such as high sickness and stress-related absences. During assimilation staff found they were both moving into their new role, whilst not fully released from former responsibilities. The process continuing whilst trying to deliver a full service.

Sickness, vacancies, and the overhead of the process itself all resulted in difficulty in achieving significant staff development. Assimilation and filling of vacancies arising took almost a year. During this period, staff had to support other massive changes resulting from service requirements arising from integrating the two very different environments. Major networking developments of around [[sterling]]2 million, a programme of re-development of AIS library locations at [[sterling]]3 million, and high investment in services infrastructure, were all undertaken. These investments kept staff from reflecting on the perceived threat as they could see AIS was to be at the heart of the University's future mission.

AIS - the near future

AIS continues to modify structure as staff are offered opportunities of Voluntary Early Retirement and Severance arising from projected budget deficit without institutional attention to overall staff cost issues. A tier of senior management will effectively be lost. The managers of service areas and service locations will be further empowered. The senior management of AIS will become light, an appropriate model, as a more predictable period of change follows. Team structures are developing but at unequal rates and hence require further senior management support and monitoring.

We have or are putting in place mechanisms to review the costs and costing of all our operations, and looking for measures which will improve efficiency or effectiveness. The Institution continues to support AIS closely, allowing continued re-structuring, to provide fitness for purpose.

AIS - the next three years

There are tremendous opportunities within G. Manchester. The four Universities have a special relationship, which is largely based on the close relationship that exists between Senior Management of the Institutions. Salford is the only institution of the four, that has adopted convergence strategies; however, this has no way impeded the special relationship. The institution Libraries have developed a special relationship and founded CALIM [2], which will be the framework for future developments in information delivery. CALIM is preparing strategy and business plans for a hybrid library service operating in some form of commonwealth model. It is likely that CALIM will found a company to provide service to the institutions, providing benefits of shared resource and efficiency, possible when scaling to support approximately 100,000 students. The Computing relationship has enabled the development of a MAN, which serves the institutions providing 155 Mbs connectivity to all major and satellite sites of the institutions. Similarly, a model for joint service provision, shared resources, and economies of scale are all attainable. The anticipated Deering agenda for regionalisation positions Manchester in an excellent position for the future. The four institutions are well positioned to be an exemplar for collaboration in the UK higher education sector.

Salford has founded a project called GEMISIS [3] that has a major Cable & Wireless Communications and the City as its partners. This 10 million pounds project has laid the infrastructure to support the GEMISIS mission. We have launched the BITN [4], which is rapidly connecting business across G. Manchester and will permit the University to deliver remote learning, technology transfer, and collaboration in many areas. We will be using connectivity planned for local schools and Further Education to facilitate Salford drive towards being the Institution of Enabling Technologies. We wish to use our new Video-on-Demand server to support the remote learner and to this end we are developing content applicable for the BITN, the remote learner, and the local student.

Conclusion

Salford has undertaken massive change in its model for service delivery now and into the next decade. Change is threatening, but it will not go away or slow down. Staff must accommodate change as a continuous process of opportunity. AIS at Salford is better positioned, than similar services elsewhere, for the changes ahead. The role of AIS is as a front-line customer support unit, for both local and remote customers. The cost of both infrastructure and services are decreasing whilst the need for customer support grows. The astute will observe the continued de-skilling by technological development, and accept the thrust towards customer focussed support in a rich information environment.

[1] Academic Information Services at the university of Salford - C. Harris, British Journal of Academic Librarianship, pp147-152, Vol 3, Number 3, 1988, ISSN 0269-0497

[2]CALIM Consortium of Academic Libraries in Manchester

[3] GEMISIS is an umbrella for projects which demonstrate the viability of the Information Super Highway

[4]Business Information Transfer Network

Director of Academic Information Services,
University of Salford, M5 4WT, UK
E-mail: M.J.Clark(at)ais.salford.ac.uk

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Computer based functions for advanced student services

[1]Soren Berglund, [2]Einar Lauritzen

1. Introduction

One of the major goals of the educational reforms that began in the early 1990's has been to accelerate the decentralisation of leadership of Swedish universities and colleges. The process has continued across a wide front of organisational and administrative arrangements. The new legislation ties financial grants directly to contracts each university is expected to negotiate periodically with the government, spelling out detailed targets for student enrolment and graduation. Such tangible incentives obviously raise the competitive interest in institutional research. Less obvious was the persuasive power of the benefits that would accrue from collaboration in establishing a self-governing consortium that can collect, analyse, and establish standards for reporting student and institutional performance.

The Ladok consortium now includes practically all degree-granting institutions in the nation. The large majority of its work is performed at member universities, supervised by university faculty and technical experts. Ladok governance is in the hands of senior university officers; day-to-day management is exercised by a central staff of experts selected from university ranks; performance is audited regularly by government officials and experts from other organisations.

This paper outlines the organisational arrangements that safeguard independence, accuracy, and security; provide incentives for continuing innovation and technical leadership; and remain responsive to the needs of member institutions, students, and the general public. The paper describes the student data and related services routinely delivered and the experience with the continuing stream of innovations to keep pace with changing needs and technology.

The paper also outlines several new projects now being developed and deployed, including some instructive examples of cooperation with industry and government agencies.

2. Computer-based student services

For any educational institution, the reliability and safety of its student records are of great importance. The design of the Ladok system recognises this central fact, and incorporates stringent safeguards to protect against tampering as well as accidents. It monitors performance and supports the administrative and academic staff in their professional services to a clientele that includes universities, students, and government agencies.

The primary functions of a student records system are to keep track of individual students with transcripts of academic performance, and to furnish the raw material for institutional research about students. Ladok has expanded from this core by adding such related services as an admission system and very soon a service to keep track of alumni. In many countries -- though not yet in Sweden -- the student record system also delivers other data, such as student fees, financial aid, housing, and related services.

An important part of a student records system are the aggregated reports that summarise the performance of departments, faculties, and the university as a whole. These reports contain important performance indicators for institutional research that help guide university governance and allocation of resources. They are also of interest to government agencies and foundations that help support the university financially.

The Ladok system can also furnish key data about applicants for admission, and thus can assist the admission staff of any university that wishes to apply its own algorithms for screening applicants. The screening can focus on special interests of individual departments or set of disciplines. Admission systems often work with competition algorithms that aim to fill classes with applicants that best match the standards set by faculties in specific fields, such as physical sciences or fine arts.

Exchanges of students with foreign universities are becoming increasingly popular. Ladok has grown to collect and report student information in a standardised format that facilitates communication among participating universities, including implementation of the European Credit Transfer System, ECTS. This encourages cooperative arrangements between sister institutions, and the dissemination of relevant information to students and their faculty advisors.

Protecting privacy and security in a student records system is vital for its users, clients and funding agencies. The development of advanced security software and devices is a continuing effort, in which close cooperation among member universities and with industry has been especially fruitful. An example of recent efforts is the adaptation of the so-called Smart Card, which gives individual students an identification device the size of a credit card that contains a machine-readable chip with individual information about credit status, etc.; the chip also permits bringing user data up to date after each transaction, such as adjusting the account balance after each purchase or deposit.

Just as individual records are of long-lasting importance to each student, reports on the aggregate results are important measures of departmental and institutional effectiveness. One direct application is the use of the summary reports by the government in allocating appropriations to individual institutions and special projects.

3. Development of new standards and advanced functions for students

Further development of advanced functions are driven by opportunities for cost-savings and the competitive advantages offered by additional information. Ladok seeks to keep its services abreast with developments in industry and commerce. This is consistent with the natural expectation of faculty and the general public that universities should be in the forefront in technology and functional design.

In this section we describe some current activities in the Ladok portfolio of projects.

3.1 Delivery of written material via computer and hybrid channels

Printing of admission certificates, student course certificates, certificates of study etc. are high-volume tasks in student systems. Such printing used to be performed at considerable cost by individual university computer centres.

During the past year these large-scale printing runs have been moved to the National Post. This has been the result of extensive negotiations by Ladok. The shift takes advantage of the postal service's investment in a system of regional printing centres that accept computer output from Ladok directly to a central node. Reports are sorted by postal code of the addressee and then transmitted to the regional print center nearest to the receiver before being printed on paper.Thus, hard copy reports are generated only just before delivery to the ultimate addressee. The new procedure minimises physical transportation and maintains control by a service that has a well-established reputation for safeguarding the privacy of the mails.

The advantages for the consortium are substantial. The cost has been reduced by half, compared to printing at computer centres. Investment costs for special printing equipment are absorbed in a much larger whole, and printing quality and distribution speed has improved. This agreement between the consortium and the National Post will be further developed in the near future with functions for special enclosures, including applications for housing, letter from the rector, etc. Work is also under way on special handling for enclosures with high intrinsic value, such as airline tickets, and identity cards that are usable as credit cards in university book stores and cafeterias, and for other university goods and services.

For the more distant future, we are exploring options for servicing some other institutional printing by departments and at desktop.

Today, we write our documents in a word processing program in a personal computer, instruct the computer to make a printout, walk to the printer, search for an envelope, write the receiver address on the envelope, insert the document in the envelope, seal the envelope, add special instructions for air mail or registered mail, and put the envelope in the box for outgoing mail. The internal post service weighs the envelope and calculates the appropriate postage and finally handles the mail to the Postal service for distribution.

Soon, we expect to instruct the computer to make a virtual printout and choose in the print manager window to send the document to the printing service. We expect to achieve next-day delivery to the addressee, without internal handling of documents and distribution. This differs from e-mail and fax by the way the final distribution is done by ordinary mail delivery by the Postal service. Not everybody has access to fax and e-mail yet. The distributed content can include official documents and supplements that are most efficiently delivered by ordinary mail.

3.2 Special concerns about security and privacy

The system for reporting and safeguarding the academic transcripts of individual students is naturally of great importance to each student. Lapses in accuracy or privacy can cause considerable embarrassment, and perhaps expense, even after the student has graduated.

In Sweden and in some other countries, the reports of aggregate results from the system are an important factor in determining the allocation of government appropriations for education, a primary source of institutional support. There is no hard data on the use of institutional summaries by private foundations and other sources of financial support in assessing the merits of applicants for grants and research contracts, but the prospects are clear. With this in mind, accuracy and security of records are of great value to students, to the universities, and to agencies that depend on accurate and impartial records for allocating their support of education. The Ladok consortium addresses this problem by applying several security methods:

- internal control mechanisms with electronic certificates
- log files
- strong logon password and other security schemes
- encapsulation of clients, communication, server modules and database and servers
- periodic security reviews by external reviewers with wide experience

The latest approach in this area is the application of Smart Card technologies, allowing even stronger encryption and authentication methods. Our current project includes commercial vendors that service banks for the development of a national identity card with photo and a chip imbedded in the plastic card.

The identity of the card holder is guaranteed by the National Post, which is the official agency to issue the national identity cards for Swedish citizens. The high degree of public confidence in that system has encouraged us to use the new card for a variety of applications that demand reliability and security.

3.3 Hot technology development strategies (client/server, Internet, JAVA, WWW, etc.)

Many traditional student systems were originally mainframe-based, acting as legacy systems. They are difficult to keep up to date and demand large investments for deployment and maintenance. User interfaces are frequently not attractive to modern users and they are difficult to adapt to the continuing flow of demand for new services and safeguards. These difficulties are especially awkward in systems that experience a constant turn-over of users.

Student systems, especially, continue to change and grow. Therefore, it is important to accept change as a given in planning for the maintenance and development of the system. For this, we need access to the latest techniques and modern methods in development. The Ladok consortium are currently reengineering its old COBOL-based system to a modern client-server system, running on PCs and Macintosh clients. The wide use of computer-generated and machine-readable forms in industry and commerce has raised the general level of demand for user-friendly appearance and function. University faculty and students expect us to keep pace with improvements they see elsewhere. We are re-designing printouts to be more attractive and easier to use. Graphical user interfaces are easier and quicker to use than traditional text instructions.

Increasingly, our users are faculty and managers who expect professional service. Analysts are replacing clerks as primary contacts, and we have a constant influx of new users.

The client-base of universities continues to expand in size and diversity. Descriptive material, course catalogues, and application forms need to be accessible to prospective students (not to mention parents, advisors, potential employers, foundations, research agencies, government agencies, and sources of research and consulting contracts).

In an increasingly competitive field, universities have found that many of their high-potential prospects turn to computer-based information sources. This trend has been encouraged by the rapid growth of PC's and PC-based tools of substantial power. Java systems are now within reach of modest budgets, allowing users to work with their web-browsers. The cost of applications continues to drop relative to traditional, paper-based alternatives for reaching a mass market.

The obvious problem in this rapid expansion in technical improvements is the maintenance of safeguards against unauthorised access and against mis-use. Those problems are high on the agenda of Ladok staff and contractors.

4. Incentives for Continuing Evolution

The academic world is - to say the least - extremely dynamic. University officers, faculty, students, and staff are notorious for their appetite for "the latest, at the lowest price". Ladok has a lot of pressure on what can be delivered to Swedish universities in the area of computer-based services, with due attention to reliability and cost. A very important dimension in this continuing drive is Ladok's success in matching internal development work with cooperative ventures with commercial and not-for-profit suppliers of high-quality software and equipment. In this, Ladok has had the active encouragement of its member universities and of the government agencies responsible for higher education in Sweden.

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[1]Project Manager, University of Umea, Sweden
E-mail: sonbed(at)adm.umu.se

[2]Academic Registrar, University of Uppsala, Sweden

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SYSTEM DEVELOPMENT FOR HIGHER EDUCATION AND RESEARCH ASSESSORS SELECTION

Irmantas Aleliunas

Introduction

The assessment of higher education and research is quite a new thing in Lithuania. In order to avoid the subjective assessment, it is necessary to create the system of assessors selection. The computerisation of the system of assessors selection is highly appreciated. In this case it would help not only selection of assessors, but also management of peer reviews.

Keywords

The assessment of higher education and research, the system of assessors selection, management of peer reviews, the database of reserve of assessors.

Management of higher education and research assessors

In order to reach the best accuracy and reliability of the quality assessment in higher education and research, it is necessary: to direct aims; to distinguish conditions where aims should be reached; to make action plans; to take necessary measures for carrying out the action plans; to regulate actions according to variable conditions.

These requirements could be realised in the stages of management process. The process of management is divided into management functions, according to those stages. Results of higher education and research peer reviews depend on performance of management functions. In order to increase the efficiency of assessors management it is necessary to create a computerised system of assessors management.

Forming of assessors reserve

Assessors are recommended into reserve by science and higher education councils, Lithuania Science Council, Lithuanian of Science, councils or administration boards of trade unions, chiefs of ministries or other institutions.

Data about a candidate are offered in a special form. This form should be signed by a candidate and an offering institution.

An assessor can be eliminated from the reserve if he does not correspond to requirements made.

Problems

However, several problems exist. It is important to choose right criterions of selection. The system of selection of assessors may decrease subjectivity but subjectivity depends not only on personal opinion of assessors. Lithuania is a small country and it is difficult to find assessors without any relations to the institution to be assessed. High requirements for receiving efficient decisions put great demands for the effective using of information resources. One of the reasons to make the right solution is to perfect the collection of information and creating of information security tools. It is important to create the right selection techniques as well. Serious problem is that results of peer reviews are verified only after a long time period.

Requirements to the reserve of higher education and research assessors

Peer reviews are carried out by groups of assessors. The group of assessors contains from three to five persons. One of them is the head of the group. It is possible to invite assessors from abroad too. The reserve of assessors is divided into two parts. The first part includes active researchers; the second one includes some politicians, businessmen, artists etc.

Main requirements to assessors selection system are these:

- Assessor can not be an employer of the institution to be assessed;
- At least one assessor from the active group of assessors reserve should be included into the branch of science to be assessed;
- The group of assessors should contain some assessors from different branches of science;
- One person active in social work and a person from the second part of assessors reserve should participate in the activities of institution or scientific collective peer review;
- Assessor have to know a foreign language if scientific work to be assessed is created in a foreign language;
- Assessor should have a scientific degree if he assesses scientific activities;
- In case activity of scientific area of subject or a study program is assessed, at least one assessor have to be from this area of subject and a half or more than a half of assessors have to be active in the same scientific or study field;
- One assessor of the group has to be active in social work if general scientific or higher education institutions assessment is performed;
- At least one assessor have to know requirements of professional qualification if he assesses a study program, providing professional qualifications.
- Only one assessor could be selected not from science or higher education institution.

Additional requirements to assessors are these:

- Number of assessors with higher qualification should be limited in groups (max. or min);
- Number of assessors from different regions should be limited (max. or min);
- Number of assessors from different scientific branches and reserve parts should be limited;
- Number of assessors from higher education and research institutions should be limited.

Desirable requirements to assessors are these:

- Frequency of using assessors should be even;
- Assessors whose assessment is better evaluated should be used more frequently.

Solution (a group of assessors) made by system can be omitted or filled up according to customer's wish. The group of assessors can be filed up according to desire of group or the head of the group. The group of assessors can invite an expert to solve specific problems.

Techniques of assessors selection

During selection it is important to conform the demands and the interests of an assessor and a customer. It depends on flexibility of the mechanism of an assessors selection. This mechanism should be a system which allows to evaluate:

- business skills;
- personal skills;

Business skills can be defined by commission according to system of points. However, this method needs a lot of experienced and competent people, which is expensive and in this case it is impossible to avoid subjectivity.

Method evaluating business skills according to specially prepared tests is also a very tedious work. This way of definition needs a lot of time to prepare and process results of tests, therefore, this way is better for sociological inquest. However it does not solve personnel management problems.

The selection and evaluating of assessors could be improved using professional-demographic methods, which allows to apply computers. This model would allow to describe and assess the experts themselves. The professional-demographic model (PDM) is a complex of indices such as personal indices (communication skills, reliability etc.) and business indices (scientific activities, pedagogical activities etc.) ones.

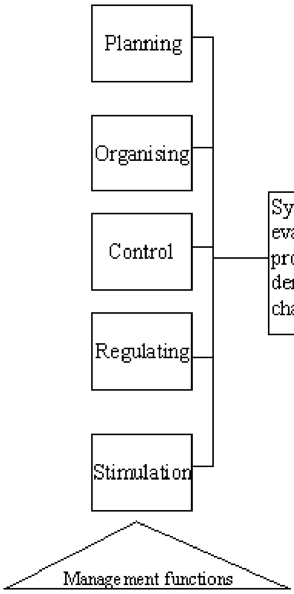

Figure 1. *PDM in relation with management functions*

Relations between the professional-demographic model and management functions could be examined in Figure 1.

Different characteristics of assessors are divided into two blocks which are business (professional) skills and personal characteristics.

Detailing the characteristics of assessors

The reserve of assessors is divided into parts. Assessors from different parts should have different business skills. Persons (scientists) from the first part of reserve should have the following business skills:

- Scientific activity (theoretical, experimental, organisational) should be active;
- Scientific activity (theoretical, experimental, organisational) should be resultative;
- Scientific activity (theoretical, experimental, organisational) should be irreproachable from the point of view of ethic of science.

Persons (public persons) from the second part of reserve should have the following business skills:

- Persons should be active in politics, culture, business, industry;
- Persons have to take an active interest to science and higher education;
- Persons should take an active interest in production of science and higher education;
- Persons should be acquainted with the foreign experience (was worked abroad, have relationships with foreign firms and organisations).

It is a pity that the model (including PDM) does not exist in practice which would allow perfectly evaluate personal characteristics. It is an especially big problem to evaluate personal characteristics of a new assessor. However, it is possible to define.

The most important personal characteristics of assessors are the following:

1. Intellect:
    - ability to observe, summarise, select and analyse facts;
    - logical thinking;
    - ability to generalise information.
2. Association and partnership:
    - respect for different opinions, ability to hear out, patience;
    - ability to make contacts easily;
    - ability to win confidence and respect;
    - politeness and good manners;
    - oral and written communication skills;
    - ability to motivate people and to create atmosphere of benevolence.
3. Intellectual and emotional maturity:
    - stability of actions and behaviour;
    - ability to resist from pressing and influences of other people;
    - ability to make independent conclusions.

4. Personal initiative:

- self-confidence;
- creativity;
- initiativity.

5. Ethics and conscientiousness:

- desire to help people;
- exceptional conscientiousness;
- knowing his own competence limits;
- recognition of own mistakes.

Person, having all these skills could become an absolutely ideal assessor, but as ideal people do not exist in reality. These skills are preferable for aspiration. Evaluation of these characteristics is a big problem. It is possible evaluate them testing people, but this method is not as good as it is described above in text. Besides that, a freshman assessor can be without some of these characteristics, because part of these characteristics can be cultivated only in practice when working.

Characteristics can be evaluated according the objective indices, therefore PDM is not completely perfect for entirely ideal employers, because it is difficult to estimate all the indices. The creation of selection systems lasts very long, therefore, indices may be accreted by the approaching method. Part of the characteristics are evaluated by scale system. However, different characteristics have different points of importance. It is necessary to multiply points by coefficients of importance.

On the other hand, using PDM we can realise additional requirements, because it is possible to evaluate the level of assessors activity. Three levels of assessors activity could be defined:

1) not active enough (null points),

2) active (one point),

3) very active (two points).

Besides, it is possible to evaluate quality of the assessors work. We can define the quality level of made peer review

in the following way:

1) unsatisfactory (null points),

2) satisfactory (one point),

3) good (two points),

4) excellent (three points).

It is possible to definite qualification of assessors according to these points. The system stimulating to do work of better quality, therefore, it is necessary to introduce assessors with this system. The system also makes management of peer reviews more effective.

Input data to the database of reserve of assessors

After the estimation of all earlier discussed things it is necessary to input the following data to the database of the reserve of assessors:

1) data about identification and education of persons,

2) data about their work experience,

3) data about their scientific activities during the last five years for the first part of the reserve of assessors and data about their interests in science and higher education for the second part of the reserve of assessors,

4) data about their activity as assessor,

5) data about the quality of peer reviews.

Once in two years assessors have to make corrections in personal data.

Benefit prognosis

The system of assessors selection allows to create assessors groups or to select single assessors, because the computerised program fulfils realise all requirements for composing the group of assessors. This system allows to use the reserve of assessors the most favourably. In this case subjectivity decreases, because selection is performed according to objective indices and mainly automatically. Data about the assessors is stored in the database, therefore, it is possible to receive full and concentrated information about assessors any time. This system allows us to manage peer reviews in more efficient way because PDM is used.

Implementation and maintenance

The system of assessors selection is a part of information system for assessment of higher education and research institutions. This system is under implementation in the Lithuanian Centre for Quality Assessment in Higher Education. The administration of the database of the reserve of assessors is performed by the group of the systematisation and information.

Conclusions

It is obvious that finding a perfect model and techniques for the selection of the assessors is a hard task. However, PDM could serve as good model for creation of the computerised system of assessors selection. The main part of the system is a database, containing data about the assessors. The Lithuanian Centre for Quality Assessment in Higher Education implements this system in its work when selecting assessors for assessment of higher education and research institutions.

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SKVC
Suvalku g. 1
LT-2600 Vilnius
Lithuania
E-mail: irmant(at)skvc.ktl.mii.lt

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i3vreg. - education. An approach for an integrated university information system

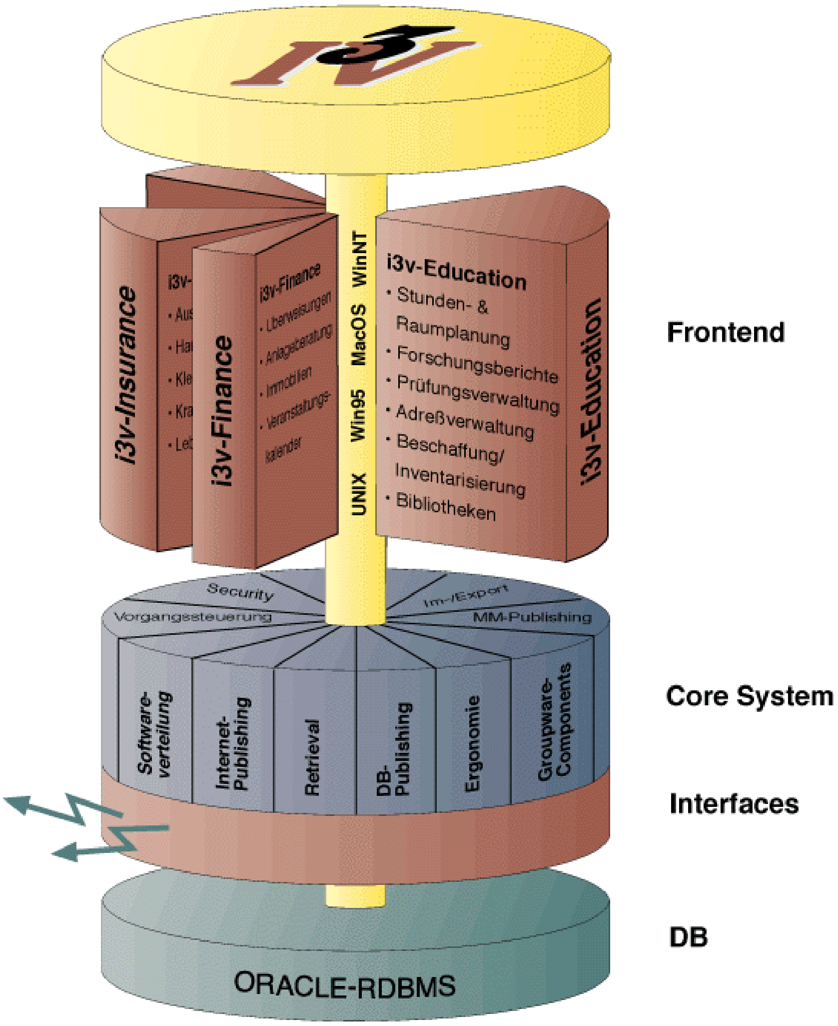
Ulrich Kammerer

1. i3vreg. and its features

i3vreg. stands as an abbreviation for ,,Integrierte Institutionelle Informations Verarbeitung". It is an architecture for designing and implementing highly efficient administrative information systems. Its basis was developed at the University of Karlsruhe in the years 1989 to 1993 and became a commercially available product when i3vreg.-technology was transferred to the GINIT GmbH in 1994.

2. i3vreg.'s architecture

i3vreg.'s architecture features three layers: the database-layer, the coresystem-layer and the application-layer. It is available for all relevant hardware- and OS-platforms, e.g. all the Windows derivates, MacOS 7.x, OS/2 in WinMode and several UNIX-derivates. On all platforms, the user interface is exactly the same, so training, initial period and user support are minimized and the integration of new applications or changes in hardware equipment are nearly transparent to the customer.



2.1 Database-layer

In the i3vreg.-database-layer all informations are stored within an integrated, totally interlinked data-model. The data stored in this extremely complex model is of very high quality. One of the main reasons for this quality is that all the data is stored absolutely redundancy free. This means, that each entry is stored only at one dedicated location within the database. All business processes are able to use it in their own contexts. Contextsecuring constraints ensure that data is stored and combined consistently, depending on the needs of the different applications. Of course security is provided on database-level and interacts tightly with the following layers.

2.2 Coresystem-layer

The coresystem-layer includes all the functions which are common to all i3vreg.-applications. Some of the most important functions are the following:

2.2.1 Automatic database-connectivity

Automatic database-connectivity means that all database-specific functions are hidden not only from the user but also from the administrator. All database activities, beginning with the insertion of new users, granting of privileges, construction of queries etc. are formulated transparently within the graphical i3vreg.-user-interface. As a result it is not neccessary for any i3vreg.-user to work with database manipulation languages like SQL at any time.

2.2.2 Highly flexible retrieval-routines

For all its applications i3vreg. provides a set of well suited retrieval-mechanisms focusing on different aspects. Those are "query by example", attribute-independant full-text retrieval, date of change dependant retrieval, logically-extended retrieval using arbitrary complex expressions and the i3vreg.-hypertext-retrieval which yields all entries similar to a selected aspect of an object.

2.2.3 Contextsensitive interlinking of all the data stored within i3vreg.

Based on the fully integrated and highly normalized i3vreg.-database, the user can browse through all the data stored within i3vreg. very easily because links are provided and maintained automatically, interconnecting data on a high level of quality throughout the whole system. This feature is especially helpful when retrieving information with unsharp requirements out of large databases.

2.2.4 Software-distribution

As a main point when running a large software-system for a broad variety of users it is absolutely necessary that software-distribution is realized in a manner which does not bind much of the anyway restricted manpower dedicated to system administration.

For these purposes i3vreg. provides the software-distribution-technology i3vreg.-UpdateOnDemand, which ensures that all the applications respectively their different modules are updated transparently to the user when he makes use of them.

In spite of this highly complex task, the system administrator only has to give consent on different granularity levels to the "publishing" of new releases and i3vreg.-UpdateOnDemand will realize all further steps fully automatically for him, regardless of the number of connected clients or platforms involved.

2.2.5 Platform-independency

One of the most critical factors for the success of a university information system is that it has to support all the platforms which are used by the staff. This is because of the fact that many of the users involved in the different processes order their one and only machine mainly for their daily research and teaching but not for administrative purposes.

Besides the different Windows-derivates, the UNIX platform for scientific faculties and the Macintosh platform, which is mainly used for areas like architecture, design and graphics, have to be supported. As everyone must have the chance to be involved in business processes concerning him, a successful long term approach can only be platform-independent.

2.2.6 Database- and internet-publishing

Another important aspect are the publishing capabilities of i3vreg.. Because of the diminishing public fundings, more and more universities are forced to implement improved activities for marketing and public relations. This results in the need for all kinds of more or less complex reports. On the one hand, these are high-quality print-reports which present the activities of the university as a whole, specialized reports based on different themes which show the overall competence of the university in a specific field and on the other hand the need for a clearly structured and easy to use representation of the university's activities in the WWW.

For all these purposes, the i3vreg.-coresystem provides publishers which are automating those tasks for the whole university. The i3vreg.-database-publisher delivers individual reports as input for the final editorial work of print-products. Supplementing this the i3vreg.-internet-publisher presents all or arbitrary selections of the highly interconnected data stored in i3vreg. in an individualized layout within the WWW.

2.2.7 Self-service concepts

Because of different new emerging technologies like chipcards self-service concepts become more an more relevant for university administration. Chipcard-technology enable new concepts of business processes in universities to be realized. Examples are the payment of all kinds of fees by electronic cash (in libraries, cafeteria, enrollments, etc.), the definition of legally binding actions using digital signatures (registration for tests and possible cancellation of it, official journey accounting, signature for test results) and many more.

In 1994 GINIT firstly prepared i3vreg. for the use of chipcard-technology and in the years 1995 to 1997 GINIT was one of the active members of the UniversCard-consortium, involving higher education, industry and politics, which defined the requirements to a chipcard to be used as a standard in universities.

Because of these long-term-activities i3vreg. is well suited for the use of chipcards within its applications and combines the benefits of the chipcard-use with the benefits of a fully integrated information system to the university.

2.2.8 Groupware- and workflow-integration

For different applications groupware- and workflow-aspects have to be integrated.

Groupware is called this way because it is mainly designed for sharing information among members of a group. In this logic i3vreg. structures its users into groups which are working together on the same business processes and data. Further every group has the possibility to contact non-groupmembers via integrated e-mail, in which the collected information necessary for the nonmember can be sent directly out of i3vreg..

In other cases, there is a need for workflow-computing as there are many persons involved in a specific process. For those cases i3vreg. provides dedicated workflows for such applications to support all involved users in an appropriate manner.

2.2.9 Security and administration of user-rights

It is absolutely clear, that an integrated university information system has to provide high security-standards. On the side of secure communication i3vreg. provides the possibility to encrypt the nettraffic and to use digital signatures for providing authentic data for legally binding actions. On the side of access-security i3vreg. provides mechanisms for defining user-access in a truly fine granularity. These access-mechanisms guarantee that unauthorized access is impossible and every user can only search and update the part of data for which he is authorized by the system administration.

2.2.10 Interfaces to others

The coresystem contains an additional layer in which interfaces to systems produced by others or the university itself can be built in. This provides the possibility to combine different products into one integrated solution for the whole university.

2.3 Application-layer

The application-layer contains all the i3vreg.-applications of the product line(s) chosen by the customer. All those applications are strictly designed in a modular fashion, so that they can work together in nearly every combination.

Based on this overall architecture several productlines for different branches exist. The largest of these is the one presented here, i3vreg.-education, an integrated solution for almost all the administrative business processes of an university.

The following chapters illustrate the applications available within i3vreg.-education today.

2.3.1 University model

This model allows to define and successfully integrate any organizational structure of an university. According to this organizational model all i3vreg.-applications are automatically structured and fit exactly to the specific needs of the university. Based on the common organizational model generic user-privileges are defined so that system administration becomes quite easy and almost effortless.

2.3.2 Curriculum-planning and room-reservation

This i3vreg.-application provides a fully decentralized approach for curriculum-planning and roomreservation. Because of its architecture a nearly 100% automation of this process can be achieved. Additionally this application successfully prevents collisions of roomreservations and events for every single student.

Furthermore this application offers a vast amount of possible printouts. Those reach from printing of the curriculum catalogue, room-reservation-plans, timetables for students and lecturers up to maintenance and configuration information for the cleaning staff and the housekeeper to prepare every room optimally for an event. In addition it is possible to control houseelectrics accordingly.

2.3.3 Announcement, administration and surveilance of the course of studies

With this application it is possible to handle the announcement, the administration and the surveilance of diploma theses, seminars, tests, examinations etc. It gives full support for the complete workflow for all persons involved in this business process. Those are the researchers, the students, the examining board and all the involved secretaries and administrators in the universities organization.

Of course the neccessary output in paper is provided as an integral part. Supplementing this application a student's registration for tests, practical studies and seminars can be realized using cryptoprocessor-chipcards.

In the near future an application for the administration of examination regulations for the decentralized parts of an university will be available. It will effectively support all the involved parties including, of course, the student himself.

Naturally this application will support interfaces to existing systems so that an integration of existing software solutions will be possible.

2.3.4 Libraries

i3vreg.-Library supports the management and day-to-day-work of university libraries by endorsing the whole integrated business process. Starting out with the order, purchase process, inventory and catalogueing of the monographies it also organizes all steps in the field of lending, provides powerful decentralized literature- and magazin inquiry topped with reservation capabilites from every i3vreg.-Client.

Further on, i3vreg.-Library support decentralized libraries with abitrary many sublibraries. It is possible to define user-groups with individual lending-time-models, admonitory models, etc.

The integration with national-library-based catalogues assures that the local library-staff can simply download the catalogue-entry into the local database rather than retyping it.

2.3.5 Addressmanagement

As another relevant application i3vreg. provides its addressmanagement. With this application it is possible to organize all the addresses which are needed in the university in private and public address-books. It is possible to define as many distribution lists as are needed. Every address can simultaneously be part in any of those lists.

Furthermore the formatting of the addresses is absolutely flexible and supported by individual auto-formatting capabilities.

2.3.6 Automation of the ordering, acquisition and inventory process

The i3vreg.-applications in this field provide an, in large parts, automatized ordering and acquisition process. Depending on the process-model of the single university it is possible to support decentralized, centralized or mixed acquisition policies. In all cases the bookkeeping activities can be initiated when the goods are delivered and mostly all the activities which have to be done for the inventory management are done in an automatism.

An overview over all the selling-partners, the inventory, etc. is supported as well as the automated printing of orders etc.

2.3.7 Administration of research projects and technology transfer

This i3vreg.-application provides full support on the administration of research projects and their attractive representation in an uniform WWW-presentation. All research projects can be arranged according to different criterias like content, methods, involved researchers, etc. The administration of papers and their integration into collective publications such as yearbooks is assisted by wizard technology to guarantee for bibliographical correct citations.

This package makes it much easier to get in contact with sponsors and to support technology transfer from university into the industry which both become extremly relevant for universities competing with each other more and more in the future.

2.3.8 Accounting for computing centers

With i3vreg.-accounting it is possible for a computing center to define arbitrary complex tariff models for its services. Based on these tariff models the consumption can be individually accounted to each customer.

It is possible to define interfaces to different resource-use-log-files on which the tariff model bases its calculations.

The invoices can be transferred automatically to the bookkeeping-software used in the specific university so that the whole accounting process can be automated further on.

A trouble-ticketing-system will be fully integrated into the accounting system in the near future so that the helpdesk/hotline of a computing center can deliver the best support to its customers.

3. Cooperations and further development

Several universities and institutes cooperate with us to incorporate new components into i3vreg.-education. Some of those projects are mentioned below.

- Cost- and Efficiency-Controlling for universities with the University of Mannheim
- Realization of a complete system for administration of examination regulations for the decentralized parts of an university with Prof. Stucky, chairman of the German Society for Informatics GI, and his AIFB
- Integration of library-catalogues and CD-ROM-archives with the library of the University of Karlsruhe

As i3vreg. is a complete solution to higher education customers, it is consequently open for partners developping solutions for additional higher-education-specific domains in form of further cooperations.

Last but not least all the new and emerging technologies are continuously integrated into i3vreg.-technology if they bring advantages to the i3vreg.-community. This ensures that all users are equipped with an always state-of-the-art software-infrastructure.

GINIT GmbH,
Vincenz-Priessnitz-Str. 1,
76131 Karlsruhe, Germany
URL: http://www.ginit.de
Email: info(at)ginit.de

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Ping: an electronic interface for the Swedish universities

Peter Lundberg, Staffan Gustafsson

In this document we describe the "Ping"-system, a public interface to the Swedish University admittance system using WWW-technology and smart cards, enabling us to perform various services both to our regular users, current students and applicants. Examples of current services are an ability to check ones results, changing addresses in the system and ordering certificates of merits. The system is being developed in three stages, currently the first stage is under installation. This, of course, is a very brief description.

Originally the name Ping was derived from the UNIX-command "ping" which is used to check if a host on a network is available for communication or not.

The purpose of the Ping-project:

Starting out from an initial, experimental system, at the Royal Institute of technology (KTH), the LADOK-group is currently developing a general-purpose transaction handler. The transaction handler will be able to "pass along" transactions to its peers at other LADOK-installations. With this ability we will be able to implicitly "join" together all the databases at the different universities in Sweden, thereby simplifying local admission, improving the support for administrators and students, and providing information for applicants.

Short description of LADOK:

LADOK is a computer based student admission and documentation system for a university or university college. It focuses on administration of undergraduate and graduate students. The system is locally deployed and managed by the institutions

The LADOK system has a mutual core, identical for all LADOK system installations in Sweden. The core consists of a structure of database tables, computer programs and terminal screen routines. Every institution decides what parts of the core to be used at the institution and it is also possible to use locally developed addendum's. The LADOK-system can therefore be viewed upon as a large "smorgasbord" where the institution can choose which parts to use.

The LADOK-system consists of two major parts, the admission system and the documentation system. They are integrated and share data, e.g. name, address and other facts about applicants and students. A third part, handling documentation of graduate students, is newly added to the LADOK system core. Undergraduate studies are handled within two major concepts, courses and study programs. The first has its focus on students and single courses and the second of students following a specified study program, normally 3- 4 years study.

The system files contain information for student identification, general eligibility for university studies, admission to courses and study programs, registration on courses per semester, course data, credit points from courses, awarded degrees and international studies.

The LADOK system mainly focuses on student admission and documentation, planning and follow-up. The system is designed to be used by all Swedish state financed institutions of higher education and has its focus on the departmental level. Users of the LADOK system at an institution can be found at all levels:

- university board and administration
- faculty or school heads
- departments
- students

Data from LADOK are exported to the ministry of education and other agencies for follow-up purposes. An important objective of LADOK is to prepare the annual invoice to the government for studies on the undergraduate level at an institution.

The LADOK system is owned by a consortium of 49 institutions in higher education in

Sweden. Software maintenance for the LADOK system core is conducted by a maintenance group at the University of Umeå. Local system usage is the responsibility of the institution, who pays for servers, networking, terminal equipment and local support.

The system is currently facing a major revision that aims for easier user interface and new functionality including a strong focus on security issues. Today, the system is used by approx. 2.000 simultaneously on-line users but it has to be prepared for a large growth in number of users inside institutions and, of course, there are more than 300.000 students waiting for better service with WWW, touch-tone telephone systems and explicit student applications.

The IDOL-project:

The IDOL-project (Swedish for ID-Oriented solutions) is an ongoing project where several Swedish organizations gathered around a common specification of a smart card which is to be used as a means of identification in Sweden. Some of these are:

- The national telephone company (Telia)
- The national mail company (Posten) who issues the smart cards.
- The national railway company (SJ)

The card consists of both a chip and a picture, which means that it can be used as both an electronic and a visual means of identification.

On behalf of The Royal institute of technology in Stockholm the LADOK-group was asked to design and construct one part of an application enabling student access for approximately 6000 students.

The application consisted of three parts;

One part handling the direct interface to the student and his/her smart card (Telia's responsibility
One part handling the catalogue services for the identification process (Posten's responsibility)
One part handling the transactions between the student and the database (our responsibility)

The services currently provided to the students are;

1. checking registrations to courses
2. checking results
3. checking and changing ones addresses
4. ordering certificates.

The system has been in action for nearly seven months and has been the source of much knowledge. During this period we have had approximately 45000 database accesses. The "slow" periods during weekends and Christmas makes an average of 300 accesses per weekday.

In summary:

The most popular service is the possibility to check registrations, and we feel that we have evidence to say that the students have a strong interest to check their status in the system and use the services provided. It is still to early to say in which extent they will use the system to obtain certificates since the system has not been working across the summer.

The project provided us with a possibility to build a transaction-handler that operates with a secure protocol. The security in the system is high enough for us to let the students make changes on their own data. We therefore feel that we can use the model to evolve the system into a more general mechanism where students can take part in a large administrative system both for retrieving their own data and feeding the system with changes and (for example) applications.

Advantages of an electronic interface:

The advantages of an electronic interface to the admittance-system are not as obvious as they might seem.

Possible advantages might be expressed in the following terms;

Savings: The possible economical savings that the system can result in are at present marginal at best. The organization must keep the same kind of record of their students no matter if the system exists or not, and must be ready to provide the same kind of service. If we were able to develop the system to handle more student input the savings would probably be large, mostly because the time from application to acceptance / rejection could be shortened and the cost of personnel could be reduced.

Public-relations / service: As the system works today the only service that is completely new to the organization is the possibility to change addresses, I think that we can see an increased openness in the admittance- system as beneficial in terms of public-relations but measuring the benefit in good service against a possible cost in bad student service is difficult at best. One service that we think would be greatly appreciated is a possibility for applicants to feed the systems with high-school grades to find out weather the are qualified for taking a certain course/courses or not.

Record-keeping: From the technician's point of view, using the system should result in a more correct database since students will be able to check and in some extent change the data describing them.

Problems with an electronic interface:

Technically we have had few problems in designing and constructing the application. There are, however some indisputable problems concerning the installing of a system like the one in KTH in a larger scale. This has to do with the general infrastructure situation.

The cost per student in a system like this is at present very much to high to make it realistic to escalate the system to extend the entire nation. At present the cost per student is approximately $150.

My estimation is that it will take three to five years before we have an infrastructure within the Swedish Universities that is so developed that we can use it to develop services that will force the students to use smart cards. Of course "Stand alone" solutions will be developed just like in KTH bot not in a national perspective. However, until then we still have to provide service to the students and must find secure ways to authenticate users across the Internet.

Principal changes evolving from IDOL to PING:

Working within IDOL we learned that the system can handle input to the database in a secure way and that this is where the real benefits of an electronic interface are. A request that arose during the development was that the system should be able to forward questions to its peers. Therefore we have these main issues that will be addressed in the Ping-system.

The system shall;

- Be able to use several ways to authenticate users.
- Provide the same services as the system being used at KTH.
- Develop services focused on student input.
- Provide services to high-school students by testing their grades.
- Provide a seamless interface between different universities by being able to retrieve information from several LADOK-installations.

The last item on the list is by far the most important. An example on this is the typical scenario of a student administrator asking LADOK for the results of a student. With the help of the Ping-system the same kind of question could be put to all LADOK-installations thereby providing the administrator with a complete picture of a students situation. In Sweden it is not uncommon for students to change university within their education and so we expect this function to be of great value.

Some strategic design-decisions

The first and most important design decision we had to make was that if information is to be retrieved from various locations later to be used in decisions we have to be able to save the data locally together with an electronic seal describing where they came from and when they were retrieved. This is done by creating duplicate tables for certain data expanded with the information described above. The idea is that if we have a table "courses" which describes the local results of a student we also have a table "Xcourses" which describes Xternal results at a certain point in time. At present this concerns six tables in LADOK, and yes, the association to the X-files are obvious.

The second important design d is that we must take responsibility for all the three parts of the application except from the basic catalogue-services, which we hope, will be provided by several companies in Sweden. This is necessary since we want to be able to use several schemas to authenticate users.

This decision has meant that we must develop our own ID-server, as well as our own client-application. The ID-server is currently (may 31) in a stage of rapid development. The target platform is Windows NT.

For the client-application the obvious user interface today is WWW / JAVA. This is not because JAVA is the "hip" language of today, but because it gives us three certain obvious advantages.

1. The awesome problem of distributing software to 300 000 students is almost eliminated if we can use a JAVA applet.
2. Handling the problem of different versions is also more or less solved since there will not be any old software installed anywhere.
3. There are some problems with JAVA running in different browsers on different platforms. Using JAVA does not solve the problems, but they are minimized.
4. Internet gives us the widest possible exposure of the system, providing us with the possibility to use the system towards high-school graduates.

Technical premises:

It is beyond the scope of this document to give a precise technical specification of the system, some basic issues however are these:

- The system is prepared to authenticate users through smart cards, a tacacs functionality (userid / password) and internal LADOK-id's / passwords.
- Information will be passed between client and server using DES- encryption.
- A University authenticating itself to another installation will use a public/secret key pair.
- A student authenticating itself to an installation will receive a RSA-generated key to pass an encrypted session key between client and server.
- The client will not contain any secrets, if anyone would go through the problems of writing an own client so be it, the protocol will be public.
- The time for a single transaction is approximately 0.5 seconds and we aim to be able to scan all installations within 30 seconds.
- The local ID-server will have functionality to exclude specific transactions, for example those that means that changes will be done to the database.

The development process:

The system will be developed / launched in three stages:

Stage 1: The first stage will contain basic functionality to facilitate the admission of students. We intend to focus on the possibility to exchange high-school grades, and previous university merits. This will be performed as batch operations with a very low level of interaction. This service is more a step in preparing the applications before the final admission can be performed.

This stage is currently under final testing

Stage 2: The second stage will focus upon improving the support to the student administrators. We intend to provide the student administrators with functionality to check and confirm merits between different universities thereby giving a more complete picture of a student's current status.

This stage will go into a testing phase at the end of the summer.

Stage 3: The third stage will focus upon student services, the services that will be provided will first of all be the same that are being used at KTH and later extend to more Input-oriented functions.

In which extent student services can be of the same "inter-university" kind as those of the administrator's remains to be seen, this has to do with how the security problems are solved.

This basic student functionality will be tested at the University of Umeå during the autumn of -97.

During the autumn we will also develop a public service which will provide high-school students the possibility of testing their grades for general and specific qualification. We also aim to provide a service that will answer the question, "would these grade have qualified me for a specific course last year?" These two services are perhaps the most exciting of all, still we are only at the beginning of what we can achieve with a general-purpose transaction handler like Ping.

LADOK-gruppen,
University of Umeå
901 87 Umeå, Sweden

E-mail: peter.lundberg(at)ladok.umu.se
staffan.gustavsson(at)ladok.umu.se

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Vers un management assisté par réseau

Robert Marty, Jean Xech

Nous choisissons d'introduire notre problématique en citant Daniel Parrochia dans son ouvrage "Philosophie des réseaux". En effet, les quelques lignes ci-dessous introduisent d'emblée une dimension dramatique qui, nous semble-t'il, est attaché à tout changement profond dans les pratiques sociales. Les évolutions technologiques rapides voire brutales que nous connaissons sont à l'évidence de ce type.

"Fonctionnellement, écrit Parrochia, chaque fois, la mise en réseau réalise une économie. Une telle constatation fait loi : la liaison n'est pas le malheur : ont gagne à s'unir, c'est-à-dire à se déposséder. Allègement de masse, diminution des charges, minimisation des distances, gains de surface, puissance ou compréhension, etc... Contrairement à ce qu'on croit, c'est le local - la "racine" - qui, très largement, aliène. C'est l'isolement et la réclusion qui tuent" .

D'un certain point de vue donc l'administrateur de réseau et avec lui le service informatique peuvent être perçus comme celui ou ceux par lesquels le malheur arrive. Vecteur d'un progrès technologique plus ou moins accepté, plus ou moins redouté -car il va bouleverser les pratiques quotidiennes et les rapports sociaux-, le service informatique va devoir assumer d'importantes tensions. Agent du changement technologique il est concerné au premier chef par les transformations des rapports sociaux qu'il induit et il se trouve de ce fait projeté au centre de la sphère des relations politiques et sociales de l'institution dont il est aussi un acteur. D'agent impliqué à distance il devient l'un des acteurs principaux du changement institutionnel. De sa capacité à résoudre des questions cruciales auxquelles il n'est pas nécessairement préparé vont dépendre la réussite ou l'échec des adaptations nécessaires de notre institution aux défis toujours renouvelés de la modernité .

Notre propos sera donc de tenter de saisir très d'un même mouvement de pensée changement technologique et changement institutionnel car ils ne peuvent être pensés séparément sous peine de diverger jusqu'à séparation complète génératrice de paralysies et de conflits.

Notre thèse c'est que l'arrivée ou la généralisation d'un réseau dans une institution relativement fermée comme la notre contraint l'ensemble des agents et des acteurs du chargement à assumer collectivement le passage de la gestion au management. Il s'agit bien d'un saut qualitatif sur fond de bouleversement des habitudes acquises, de remises en question, de redéfinition des statuts et des rôles.

Notre présence ici en binôme traduit dans le fait la reconnaissance de la nécessité à priori de recoller la compétence technologique de l'ingénieur et les capacités analytiques, régulatrices et d'aide à la décision disponibles dans les sciences humaines. En d'autres termes, l'enjeu principal est le passage d'un réseau de machines ou d'adresses IP à un réseau d'agents d'une institution , c'est-à-dire un réseau de personnes dont les statuts et les rôles sont déjà distribués.

La sociologie des organisations a pour coutume de distinguer l'organigramme - la dévolution instituée des pouvoirs dans une structure hiérarchique - et le sociogramme - le jeu des relations réelles de pouvoir entre personnes groupes formels ou informels qui déterminent réellement les prises de décision et leur mise en oeuvre. Le réseau, par sa capacité à mettre en relation les personnes tout en ignorant l'organigramme s'inscrit d'emblée dans le sociogramme qu'il dope littéralement face à un organigramme rigide et peu préparé. Il crée de ce fait une tension institutionnelle qui fera nécessairement problème à un moment ou à un autre. Il convient donc de mettre en place les moyens intellectuels et les procédures pour faire face de façon positive à ce type de situation. A la traditionnelle " informatique de gestion" on devra dont se préparer à substituer une "informatique de management" dont le réseau, avec ses fonctionnalités multiples (courrier électronique, serveur Web, serveur de listes et de documents, de logiciels, de didacticiels multimédia, etc....) sera la figure emblématique

Pour aborder ce passage obligé il est nécessaire, comme dans toute démarche rationnelle, de fonder son intervention sur une bonne conceptualisation de l'existant capable d'accueillir, en la maîtrisant, la perturbation amenée par l'arrivée ou la montée en puissance du réseau. La bonne approche, nous semble t'il, consiste à expliciter la réticularité de l'institution telle qu'elle s'est établie dans le temps en distinguant une réticularité institutionnalisée (les relations administratives hiérarchiques explicites de l'organigramme) et une réticularité instituée (relations établies implicitement, sous-jacentes, à base d'alliances et de rejets de divers groupes plus ou moins constitués et de relations interpersonnelles). A ces deux réticularités on opposera dans un premier temps la réticularité du réseau comme réticularité instituante. Elle est instituante dans le sens suivant emprunté à la socianalyse (analyse institutionnelle en situation d'intervention) : le réseau informatique, en permettant la communication instantanée de point a point, donc de personne à personne court-circuite les flux d'information déjà-la; il procure des accès immédiats à des informations jusque là difficiles à obtenir ou dont la vitesse de circulation était si faible que l'information était obsolète à son arrivée (par exemple, les comptes-rendus des instances de décision) ; il permet des réactions quasi instantanées et massives à tout événement important; il facilite la communication entre groupes formels ou informels qui retrouvent de la vigueur en s'organisant mieux, etc.... Nouveaux chemins, courts-circuits, instantanéité, accélération : le graphe des relations individu - individu, individu - groupe, groupe - groupe, groupe - institution est radicalement modifié. Nouvelles conduites et nouveaux rapports induisent un déséquilibre qui enclenche une dynamique : l'institution est concernée dans les fondements mêmes de son mode de fonctionnement. Que le nouvel équilibre soit plus favorable à l'exécution des missions d'enseignement et de recherche qui sont la finalité ultime de nos établissements n'est pas une évidence à priori même si certains peuvent penser que le réseau par ses vertus propres pourra résoudre magiquement tous les problèmes. Les acteurs de ces changements produisent alors une sociologie empirique spontanée ; les comportements qu'elle détermine peuvent aboutir à créer une situation chaotique, cause d'un rejet d'autant plus massif du réseau que, pour beaucoup, elle sera le cadre d'une première expérience. En exportant dans ce champ les concepts de la socianalyse nous nous efforcerons d'anticiper et de situer le débat au plus prés de nos vécus quotidiens.

1. L'institutionnalisé de la réticularité : organigramme et hiérarchie.

La science administrative, cette branche de la sociologie des organisations qui applique à l'administration publique les méthodes forgées à l'origine dans les grandes entreprises a depuis longtemps intégré le fait que le fonctionnement d'une organisation quelle qu'elle soit ne peut être compris si l'on ne prend en compte que les lois et règlements explicites qui la gouvernent. Certes, ces derniers sont opérationnels mais les niveaux d'analyse qu'ils autorisent doivent être complétés, voire corrigés par une analyse des relations informelles que l'on peut décrypter dans les motivations personnelles, les comportements, les stratégies des acteurs et des groupes en présence. On sait bien que leurs intérêts et leurs objectifs ne coïncident pas nécessairement avec les buts affichés de l'organisation. Michel Crozier a bien montré comment les caractéristiques essentielles du fonctionnement de l'administration française - impersonnalité des règles, centralisation des décisions, isolement des catégories hiérarchiques - favorisaient le développement de pouvoirs parallèles et produisaient l'émergence d'un "cercle vicieux bureaucratique". Il a ainsi mis en lumière une certaine incapacité à s'adapter aux changements autrement que par crises successives.

1.1 Les comportements individuels des agents.

Ils sont bien identifiés et peuvent être considérés comme des produits du système. En général, les agents considèrent qu'ils ne sont que des rouages d'une hiérarchie dont ils ne perçoivent pas les motivations réelles. La multiplication des niveaux intermédiaires, la dilution des responsabilités au fur et à mesure qu'on s'éloigne des centres de décisions induisent beaucoup d'entre eux à "ouvrir le parapluie" en toutes circonstances. La personne se police elle-même pour apparaître seulement comme un agent. La prise de risque est l'exception, l'initiative cherche à se couvrir de toutes les garanties possibles avant de se mettre en oeuvre. La délégation de pouvoirs est rarement effective : difficile à donner, difficile à recevoir. Les communications sont limitées à l'horizon de chaque entité administrative ; l'arrivée de l'ordinateur conduit simplement à envisager la réalisation des tâches quotidiennes d'une autre façon, en conservant les mêmes principes.

1.2 Les conduites de groupe : facultés, départements, laboratoires, services .

Les conduites de groupe sont caractérisées, par analogie avec l'esprit de corps, par ce qu'on peut appeler l'esprit de catégorie. Chaque groupe cherche à "bétonner" ses positions, ce qui interdit toute initiative transversale et conduit à la multiplication des stratégies de prise de position à tous les niveaux de la structure administrative (notamment à l'occasion des élections) et à une forte crispation sur les acquis. L'ajustement des personnels en fonction des changements survenus dans les filières, l'ajustement des moyens (locaux et crédits) sont autant d'occasions de guerroyer. La collaboration avec d'autres groupes perçus comme des concurrents potentiels est écartée à priori; le blocage peut devenir la règle. Les groupes communiquent très peu entre eux et l'ordinateur est pour l'essentiel consacré à la gestion des affaires courantes du groupe. La rigidité de l'ensemble s'inscrit dans la hiérarchie : université - faculté - département - laboratoire reconnu - équipe d'université.

1.3 Les organes de direction : conseils et commissions

Le rôle des organes de direction est particulièrement difficile. D'une part ils doivent exécuter une politique définie au niveau national qui se manifeste sous forme de décrets, circulaires, dotations de fonctionnement, attributions de postes, etc.... D'autre part ils sont confrontés à la pression de la base qui fait remonter exigences et besoins. La pratique des plans quadriennaux a malgré tout pacifié les rapports ; le sentiment du contrat à remplir et la concentration des affrontements sur la période de la négociation du contrat on considérablement réduit les tensions en moyenne. Cependant la structure pyramidale contraint à faire cascader les décisions et l'information ; sauter un niveau intermédiaire même non concerné peut ouvrir un conflit. Les organes de direction communiquent généralement par circulaires, comptes-rendus, bulletins d'information, tous moyens grevés par l'inertie de la filière de duplication et de diffusion interne. L'ordinateur et le réseau y sont généralement perçus au mieux comme devant procurer des gains de productivité sur les tâches habituelles (et donc réduire les tensions sur les demandes de poste de IATOSS principalement) au pire comme une couche supplémentaire à gérer.

Il apparaît donc que la place assignée à l'informatique dans ce moment de la réticularité de l'institution correspond à la classique informatique de gestion. Les relations inter-instances sont matérialisées dans des connexions caractéristiques de l' informatique centralisée dont on sait que, de toute façon elle subsistera.

2. L'institué de la réticularité : groupes de pression et syndicats d'intérêts communs.

Il est clair que si le fonctionnement de notre institution était uniquement déterminé par le réseau et le type de relations que nous venons de décrire le blocage serait quasi-permanent et remplir nos mission serait une gageure. On sait bien que s'il n'en est pas ainsi c'est parce que l'organigramme est doublé d'un sociogramme qui se prête par ailleurs à une lecture nettement moins aisée.

2.1 Les attitudes individuelles.

La personne ne se réduit par, fort heureusement, à l'agent et, si l'agent fonctionne, la personne vit. Selon ses motivations, son histoire, les hasards de l'existence aussi, chacun est partie prenante dans l'institution d'un réseau de relations interpersonnelles assez stables qui se prolonge au-delà des simples relations de travail. Ces rapports extra - professionnels souvent conviviaux constituent un réseau par lequel circulent quantité d'informations inexprimables dans des relations de type administratif. Ces flux d'information se concentrent dans des noeuds qui correspondent à des personnes (souvent identifiées comme des "leaders d'opinion") qui occupent des positions privilégiées dans le sociogramme (des positions d'autorité, à distinguer des positions de pouvoir, sans que l'une exclue l'autre).

2.2 Les groupes informels.

Ils sont pour la plupart l'expression de la transversalité de l'institution : syndicats, associations de toute nature, lobbys, groupes de pression circonstanciels (par exemple réunions éphémères de catégories pour obtenir des avantages contre d'autres catégories).Ils communiquent difficilement car ils sont éclatés sur les campus et ils doivent trouver des plages de réunion quand ce n'est pas des lieux de réunion,... Ils communiquent traditionnellement par le courrier intérieur ou grâce au dévouement de "chevilles ouvrières" (de plus en plus rares, sauf en cas de crise avec mobilisation intense). Ils concourent fortement à la mise en place des groupes dirigeants et participent souvent à la direction informelle de l'institution.

2.3 Le fonctionnement réel du pouvoir : réunions non statutaires et apartés.

Les organismes officiels (Conseil d'administration, conseil scientifique, conseil des études et de la vie universitaire, commissions de spécialistes, etc....) réunissent du fait des règles de représentation plus ou moins proportionnelles des personnes qui participent à des groupes informels aux intérêts divergents. Ces groupes ne peuvent y apparaître au grand jour. L'élaboration de leurs stratégies nécessite des procédures d'information mutuelle. Quelquefois le téléphone suffit mais ce moyen est trés en deça des possibilités offertes par l'e-mail et, bientôt, par la téléconférence dont on peut se demander si, lorsqu'elle sera généralisée, elle ne deviendra pas le mode privilégié de communication informelle.

En définitive, la réticularité institutionnalisée et son complément indispensable la réticularité instituée décrivent le déjà-la, la situation qui préexiste à l'arrivée du réseau. Avec ce dernier nous passons nécessairement dans l'instituant, en précisant bien que ce terme ne doit pas d'emblée être pris avec une connotation positive.

3. Le réseau comme analyseur.

3.1 Les conduites adaptatives des agents/personnes

Relevons l'ensemble des attitudes psychologiques que l'on observe généralement lorsqu'une institution est confrontée au fait technologique. On peut les classer en trois catégories caractérisées par :

- la frilosité voire la méfiance qui conduit à pratique de la gestion dans laquelle le support informatique n'est qu'une couche supplémentaire tolérée et maintenue à distance;
- le transfert : les gestionnaires utilisent le support informatique en relève ou en substitution des supports traditionnels (par exemple, la circulaire électronique prend la place de la circulaire papier, la gestion de l'occupation des salles de cours se fait en temps réel, etc...)
- l'anticipation réaliste : elle recherche dans les nouvelles possibilités technologiques l'occasion de dépasser les pratiques existantes, elle guette et favorise les pratiques émergentes positives afin de concourir pour le mieux aux missions traditionnelles de l'établissement.

Il est clair à priori que les attitudes réelles balanceront suivant les moments et les premier résultats observés entre ces trois pôles. Il est clair aussi que l'un des enjeux principaux au seul souci de la justification des investissements réalisés, est notre capacité à imaginer et à mettre en oeuvre les dispositifs institutionnels, qui peuvent favoriser l'émergence des changements positifs que l'on peut raisonnablement espérer.

3.2 Les groupes formels et informels face au réseau.

Les groupes institutionnels trouveront certainement des avantages dans l'utilisation du réseau : meilleure communication (en qualité et en quantité), moins de réunions contraignantes par l'utilisation du groupware et de la visioconférence, plus grande facilité pour gérer à distance. Cependant ce sont les groupes informels qui devraient être les plus importants bénéficiaires, car le réseau lève presque toutes les contraintes qui limitent aujourd'hui leur puissance d'intervention. Par exemple, la moindre information, la plus petite rumeur même peuvent être communiquées instantanément par multi- adressage à l'ensemble du groupe qui peut réagir dans l'instant et la diffuser aussitôt à d'autres groupes ou à tous. Une diffusion qui nécessitait de huit à quinze jours pour produire ses effets dans l'informel se fait en 24 heures, peut-être moins. Les circuits classiques qui dépendaient du hasard des rencontres sur le campus, dans les couloirs ou dans les réunions officielles sont remplacées par des circuits presque instantanés et de plus, les cibles sont atteintes avec une précision et une exhaustivité maximales.

À l'égard de ses groupes le réseau produit un déséquilibre qui accroît la tension par exacerbation de l'activité communicante; en gros, on peut dire que les montées en tension seront considérablement plus fortes.

3.3 L'institution : que faire avec le réseau?

Les organes de direction sont donc confrontés à une nouvelle donne informationnelle qui par nature échappe à tout contrôle et se prête peu à une analyse réfléchie étant donné la fluidité, l'instantanété et l'étendue des modifications. La temporalité de la communication n'est plus du tout la même. Certes les directions peuvent bénéficier et même de façon privilégiée de l'instrument, mais encore faut-il s'adapter rapidement sinon les avantages des personnes et des groupes "branchés" risquent de devenir exorbitants. Elles peuvent se trouver dans la situation désagréable de courir aprés l'événement, d'être les dernieres informées, d'autant plus que les liaisons vers l'extérieur subissent aussi les mêmes transformations (l'interconnexion physique des réseaux est aussi l'interconnexion des réseaux informels).

En somme la nouvelle donne c'est que la réticularité instituée prend le pas sur la réticularité institutionnalisée; il faudra donc que les directions se donnent les moyens de maîtriser les configurations émergentes de pouvoir et surtout d'autorité.

4. La solution Intranet .

De quels outils - en plus des capacités individuelles et collectives d'analyse- disposent les directions pour gérer la nouvelle donne ? Il est exclu de réduire les formidables possibilités d'évolution apportées par le réseau en bridant les fonctionnalités de façon réglementaire. Certains seront peut-être tentés, cela serait dommage. La réponse est à la fois technologique et pragmatique : c'est selon nous la mise en place progressive et pilotée politiquement d'un Intranet/Extranet qui permettra non seulement de réduire les tension institutionnelles mes surtout de les utiliser pour améliorer singulièrement la réussite collective.

En effet, l'Intranet permet de souder dans le même concept l'institutionnalisé et l'institué : le premier peut accroître sa visibilité institutionnelle, fluidifier l'information, expliquer ses décisions en évitant les malentendus, couper les ailes aux rumeurs dans l'instant ; le second peut s'y projeter - car c'est sont intérêt- dans la mesure où tout groupe ayant des visées sur le pouvoir à vocation à convaincre l'ensemble des acteurs du bien fondé de ses objectifs. L'Intranet et son complément l'Extranet, en permettant à chacun de participer à tout instant à la vie de l'établissement (même les "turbo-profs"seront intégrés) peuvent devenir de merveilleux outils de gestion intégrée et dynamique du dit et du non-dit,du manifeste et du caché.

5. Conclusion : du cryptisme à l'agorisme.

Avec le réseau se repose le vieux débat sur les formes de l'exercice du pouvoir et/ou de l'autorité. Chacun de nous, chaque groupe formel ou informel doit choisir entre rester entre-soi, se calfeutrer dans les certitudes partagées par un petit cercle (cryptisme) ou s'ouvrir, communiquer à tout vent, prendre des risques, s'exposer à la critique (agorisme). Le réseau, nous semble t'il, pousse vers l'agorisme de façon inéluctable ; il permet de capter l'énergie de l'informel pour régénérer les parties ossifiées de structures un peu trop pérennes ; à travers l'Intranet il permet d'afficher en permanence l'état et l'évolution de nos établissements ; enfin et peut-être surtout, il est un moyen privilégié d'instaurer cette transparence et cette démocratie dans la gestion tant de fois évoquées dans les professions de foi.

Université de Perpignan, 52, Avenue de Villeneuve, 66 860 Perpignan Cedex, France
E-mail: marty(at)univ-perp.fr, Jean.Xech(at)univ-perp.fr

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Preservation of the Electronic Assets of a University

T Alex Reid

Oxford University is a highly devolved institution, with nearly 100 departments, 40+ colleges and many other academic and administrative units. Its form of governance allows considerable autonomy to these various entities (indeed, the colleges are separate legal and financial organisations). Furthermore, the University is housed in numerous buildings distributed throughout the city.

This environment has always presented special challenges to the orderly and effective development, acceptance and implementation of IT strategy. For instance, the University has invested in a substantial FDDI backbone network which now reaches all these units, connecting over 200 Ethernets, and with about 15,000 computers attached. Computing facilities are thus highly distributed, and also highly diverse. All major brands of Unix workstation are represented, and personal computers include DOS, Windows3.1, Windows95, WindowsNT, OS/2 and MacOS. As befits such an environment, IT support is also well-distributed. Central support, meanwhile, is responsible for supporting core services like the network and providing backup to the distributed support staff.

The IT Strategy of the University (accessible at http://info.ox.ac.uk/it/strategy) seeks to ensure that this diversity works harmoniously, that there is central provision of services of strategic importance and where it makes sound economic sense to do so, and that sensible standards are promoted throughout the University. The result at Oxford is a rich computing environment, but which avoids the excesses of anarchy and duplication.

2. The Problem of Electronic Assets

Against the setting described above, the University, in common with all others, is faced with a staggering increase in the quantity and variety of electronic information. Some of this is ephemeral, so its storage, management and preservation is of no great concern. A very substantial proportion of it is, however, of immense value, not just to its creator/owner, nor just to those local or international colleagues involved in related work, but often to posterity.

The problem of making important university information accessible to others, in time and space, has been solved in the past by a combination of formal publications (meeting minutes, research reports, proceedings, journals, books, etc), and formal storage arrangements (departmental and central filing systems, libraries, archives, etc). This system itself is straining under the load of the exploding amount of information being produced and published, especially in the scientific world.

To this we are now adding, at an enormous rate, information in electronic form. In many cases, this is duplicating the conventional printed or visual form, and in others it is substituting for it. In other cases again, however, it is information not only in a new form, but sometimes of a totally new kind.

Not only do we have few paradigms for managing this electronic information (since we are able to carry so few across from our experience with conventional media - which themselves took centuries to develop), but we have been slow to recognise the existence, importance and vulnerability of some of this information.

There are several dimensions to the storage of this information. There is its durability; its appeal (how widespread is the interest in it?); its size; its vulnerability; its popularity (the frequency with which it is accessed); and its rarity.

These dimensions create a vast array of situations and policies which must be implemented, including ensuring an effective backup regime is operating; preservation of electronic information beyond the current media and our lifetimes; building suitable metadata files; and dealing with the vexing question of formats which will survive current software and hardware platforms.

Among the many types of electronic data we need to safeguard are scientific research results which are often extremely expensive, sometimes impossible, to recreate;

electronic images of rare and sensitive documents; even the Web pages we are creating, into which much intellectual effort is being poured.

3. Elements of the Solution

The solution to at least some of these problems at Oxford was perceived to be a very large central file store to which all users had access across the network. Issues of economics dictated that this must be a hierarchical store, ie one with a hierarchy of media. Given the environment at Oxford, it was also clear that this must be a client-server system, and capable of supporting thousands of clients, from a wide range of vendors. It also had to provide a range of functions, including backup, archive, ftp storage, and file migration.

Designing an effective backup regime is not as simple as it sounds. We define backup to be the process of making a duplicate copy of a file for storage in a different place, so that in the event of damage to the original, it is possible to revert to the backup copy. One needs to recognise that some files undergo constant revision, so it may be necessary to keep copies of a multiplicity of revisions. It is not cost-effective to keep copies of all revisions for ever, and some arrangement must be made to delete backup copies when the original really is no longer required. The system therefore needs to have the capability of setting appropriate parameters to cope with different regimens (eg numbers of versions to keep, amount of time to keep them after the original dies, etc).

An archived file is distinguished from a backup by the fact that its retention is totally independent of the original. Indeed, the operation of archiving is more like a "move" than a copy, and the whole point of making an archived copy is that it should be retained indefinitely (ie regardless of the fate of the original).

File migration is the process whereby local file stores "overflow" onto a much larger file store. Migrated files would not stay on the local system, but would remain in the local directory so that they could still be found. Ideally, migration should occur only when space on the local system reaches a critical threshold, and normally the least-used and/or largest files should be migrated. Recovery should be transparent (apart from a tolerable delay). Once again, it must be possible to implement a variety of policies through options and parameter settings.

Ftp storage is a manually-operated case of file migration, in which the process is handled by direct action of the user. The lack of automation gives greater control over file location, but does require extra effort. It also requires direct user access to the server.

A further option which can be considered is NFS-mounting of files. We decided not to seek this capability in its present form, since without (say) a Kerberos environment it could be quite insecure, and file space management at the central store could be difficult, and unless due care is taken use of files held in this way could put a heavy load on the network.

Other very important factors required of the system are performance, reliability, availability and data integrity. The server needs to have adequate performance to cope with substantial numbers of clients, to transfer data to and from the server without delay, and to locate and deliver files from its hierarchy of media in a rapid fashion. Reliability of course is an important requirement, as is availability, in such a populous and diverse environment. Data integrity is, of course, the most vital requirement of all, with provision for ensuring data is free from attack, is moved and stored without error, and safe from a catastrophic failure of the whole system.

It goes without saying that capacity, ease of use, expansibility, conformance with standards, etc were also important considerations.

Funds were allocated in early 1995, and a 2-stage tendering process initiated. The first stage used a Request for Information as a means of testing the feasibility (in functional and in economic terms) of the project, and of informing vendors of our needs, and in turn of shaping the requirements according to what was reasonable. Formal tenders were then called, in line with European Procurement Guidelines.

4. The System in Practice

A system from IBM was chosen, and delivered during 1995. Itfirst went into productive use in mid-1995. It is based on dual RS/6000 computers, and employs an integrated suite of software, known as Adstar Data Storage Management (ADSM), and has a large automated tape silo. One unit acts as the storage manager, providing backup, archive and ftp services direct to clients. The other acts as a file server, migrating files between media as needed.

Overall, we have been very pleased with the system, which has now been in production for two years, especially its functionality. It has been especially gratifying how well the system has appeared and functioned to end users on a wide range of platforms. We have to say, however, that the solution did not work out as we had anticipated, in a number of ways.

Our first priority had been to provide some form of "unlimited disk space" service. In ADSM this would be implemented through file migration; however, we found that the migration software was not available at the time of installation, and in any case implementing such a scheme would have presented us with a number of difficult policy decisions. Archiving, like migration, also needed careful consideration, preferably based upon some non-operational experience. On the other hand, the backup facilities of ADSM very attractive - they were fully-integrated into the system, and clients were available for all major platforms in use at Oxford. The ftp service was also perfectly satisfactory. Accordingly, we decided to introduce the backup service and the ftp service first.

Secondly, we quickly found that the load placed on the system by so many backup clients was so great that the system could barely cope. Typically, personal systems are backed up weekly, to a set schedule, and on an incremental basis, while departmental servers are backed up more frequently. Traffic volumes now exceed 250 GBytes/week. Only constant attention, administrative effort, pressure upon IBM, and additional resources has enabled the system to keep pace with this demand.

Thirdly, we had expected a turn-key solution, which would function with very little attention, apart from some ongoing tuning and once options had been selected and initial parameters set. However, we have also found, possibly because we have been pushing the technology to its limits, that a high level of system errors has been encountered (most in software, but we have also encountered a surprising number of tape drive faults). This has put considerable pressure on the 2.5 staff responsible for caring for the HFS, and has meant delays in rolling out new services because of the preoccupation at times with keeping it operational.

The fewest difficulties have been encountered with the ftp service, which has consistently provided satisfactory service, though the relatively small number of users has meant that we could anticipate and control demand to some extent, and adjust accordingly.

We are now able to offer an archive service. At this stage we have only accommodated projects of importance to the whole University. And we are now also gradually rolling out the migration service.

We have been very conscious of the limitations of previous archiving arrangements in use at Oxford (and probably at most universities), whereby users could offload files from their local systems with no limit on time and space. Our current "archive" holdings are therefore likely to be very largely of zero value, but we must faithfully preserve them. Accordingly, we have redefined the term "archive" to reflect more accurately its use by archivists, and established a university committee to develop suitable policies about who can archive material, how much they can archive, and for how long (see http://info.ox.ac.uk/oucs/services/archiving/archive-policy.html). For people who wish to store material which has been deemed to be not of general interest, we will charge for the privilege of retaining it in perpetuity at the rate of about £20/GByte pa (covering regeneration of the data and replacement of the system when required), and we also provide a CD-ROM writing service.

5. Future Developments and Requirements

We are hopeful that both the level of system errors and performance deficiencies will be eliminated before long, and some progress is being made on that front. Regardless of the impact of these expected performance improvements, it is clear that we will not be able to roll out the backup service to all 15,000 clients using only the existing system. In reality, this was never likely to have been possible. Instead, ADSM is intended to support a hierarchy of collaborating servers. "Regional" or departmental ADSM servers will provide first-line file services, which will then pass on their data, in consolidated fashion, to the main system.

Arrangements have just been put into place to make a third copy of the data held in the system which will be stored in fire-proof safes at a location some 10 miles away. A reciprocal agreement is also in place (informal at this stage) to have access to a similar system installed at De Montfort University, should any disaster result in the whole system becoming inoperable.

Of course, the current system will only have a limited lifetime, but we expect to migrate to future developments of the system as they emerge and as the existing system needs replacing or upgrading (whether from the same supplier or another), and the University is expected formally to commit to that shortly. The ramifications of being able to make meaningful use of this data in the very long term which are being considered by the Computer Archive Group, including metadata, data format and hardware and software obsolescence. Clearly, current standards, like SGML and JPEG, should be employed wherever possible, and a regimen for updating the data held in these formats when they are upgraded will need to be developed.

We have made little progress on implementing a system to provide metadata, and have been disappointed at the lack of offerings from suppliers in this area. However, we are aware of national and international efforts to explore this area, which are being pursued in connection with major digitisation projects being conducted within the UK as part of the eLib project, as well in the USA, Australia and elsewhere. Indeed, we are collaborating with the University Library and external partners in several small projects in this area.

We are also exploring further implications and implementation strategies of additional "migration" services, believing that this is a service which may well only be offered to departmental servers.

In the longer term, we envisage (rather, we hope!) that an environment will gradually emerge in which there would be a uniform view of files right across the University, with a range of storage and access options, and which will support all the functions and more that we are seeking in this present system. Perhaps DFS/DCE will bring this, and we await such developments with interest.

IT at Oxford University,
Oxford University Computing Services,
13 Banbury Road, Oxford OX2 6NN, United Kingdom
E-mail: alex.reid(at)oucs.ox.ac.uk

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Data Warehouses and Executive Information Systems - Ignoring the Hype

Doreen Stevenson

What is a Data Warehouse?

A data warehouse is a repository of information specifically designed to make the extraction and analysis of data simple and efficient. Traditional production systems, such as a Student Information System, are designed to optimise transactional processing. The features which increase the efficiency of these systems are generally those which also make it difficult to extract data simply and without major impact on production databases. For example, in order to optimise update operations in a production system data redundancy is minimised. This makes extracting data complex because it is necessary to access and link a number of tables to retrieve the required data. This linking also creates a severe load on the production databases.

Data warehouses enable information to be collected from a number of sources and stored in a central area effectively integrating systems which may be quite disparate in nature. They are designed to optimise the extraction rather than the input of data. They are generally read-only and may be updated less frequently than operational systems. In order to boost performance and increase ease of access there may be significant data replication.

Why Develop a Data Warehouse?

A high proportion of data warehouses fail. Often this is because they have been developed for the wrong reasons. A data warehouse is not simply an interesting IT challenge - it is not even mainly that. The most important principle in data warehousing is that the project should be driven by a need to produce results for the end user and not by a desire to create a sophisticated IT system.

At the University of Queensland the Management Information Section (MIS) which is part of the Planning Secretariat began developing a data warehouse at the end of 1995.

The Section, then known as the Statistical Information Section, was not an IT section. It was a user rather than a developer of systems. The decision to develop a data warehouse arose from an urgent need to access data easily and efficiently. When a fairly simple query caused the payroll run to collapse it became clear that some action was necessary. The decision that the MIS should undertake the development was based on the Section's understanding of the outcomes required.

The project has been challenging but it has also been exciting and most of all, it has been fun. Not because of the IT aspects, although these have been interesting, but because of the interaction with users and their positive responses. User excitement and gratitude can be extremely seductive. The higher education environment often produces operational systems which are not particularly well regarded by users. Much of this is to do with lack of resources either for the systems themselves or for IT staff development. A data warehouse can stand outside this and avoid many of the constraints of the operational systems. It also provides an ideal environment for IT staff to focus on the business needs of the university and to gain a wider understanding of its activities and goals.

Ignoring the Hype

Many organisations have valid concerns about the potential costs of developing a data warehouse. It is common to read articles where managers justify not undertaking such development for financial reasons. There is a lot of hype in the IT industry generated mainly by software and hardware developers. Reactions to this hype tend to fall at two ends of the spectrum. Some managers get confused and become overwhelmed. They simply walk away. It all looks too difficult and certainly too expensive both in terms of staff and of hardware and software resources. Others become excited - at last, something interesting to add to the IT strategic plan. They either throw resources at it or spend a long time evaluating expensive software tools for data extraction, data validation, meta data storage etc. They prepare lengthy business plans and needs analyses for the organisation. In the meantime users' real needs are unmet and they remain disempowered.

Ignore the hype! Data warehousing is an area where the limited resources in the higher education environment can actually work in our favour. Most universities in Australia and Europe cannot afford to expend large sums on `non-essential' IT systems unless they are sure that they are going to bring real benefits to the organisation. It compels us to focus upon outcomes and upon user needs.

The Wooden Bridge Approach

Shortly after we began to `roll-out' the first release of our student data collection on the data warehouse MIS staff attended a seminar on data warehousing run by Digital Computing. The speaker, David Brisbane, has been involved in data warehousing consultancy for a number of years. David dealt with a range of issues but particularly stressed what he called `the wooden bridge approach'. As he put it `there is no point in building the Sydney Harbour Bridge if users do not like the view when they get to the other side'.

I would like to use the wooden bridge theme to explain what I believe to be some of the critical success factors in the development of a data warehouse.

***Design**

It may appear paradoxical but the best way to satisfy user needs is not to undertake an extensive user needs analysis before commencing development of a data warehouse. Such analyses tend to be lengthy and may raise unrealistic expectations. It is more productive to develop a prototype and get user reaction before the first release. Although it is important to keep integration issues in mind do not attempt to develop an organisation-wide data warehouse from the outset. Choose an area in which there is a real business need.

Since the MIS was both a major user as well as a developer of the data collections within the data warehouse the Section had a reasonably good understanding of user needs. We started with the student data collection because we knew that this was an important area for Faculties and Departments and it was one with which we were familiar. Only when we had developed a prototype did we invite comment from users. It was easier to get productive feedback when we were able to demonstrate how the system would work.

***Construction**

In order to keep the process as simple as possible and to provide value to the user within an acceptable timeframe it is better initially to use software and database systems with which you are familiar. One of the most important features of a successful data warehouse is an efficient method of data transfer from the production systems. This is particularly important for those data collections which are updated frequently. If you use the same operating system and database on the data warehouse as are currently used on your other major systems you have the benefit of a simpler transfer process as well as available skills in database administration and other areas. If your systems have software that is disparate or not suitable for a data warehouse then you may need to introduce a new database or operating system but it is better to avoid this in the initial development where possible. Similarly it is not necessary to purchase an expensive extraction tool.

***Support**

Strong support is one of the most critical success factors in data warehousing. There are a number of areas from which this support is important:

Senior Executives

It is vital to have a `sponsor' from the Senior Executive, preferably someone with funding responsibility. In our case since MIS is part of the Planning Secretariat and reports directly to the Secretary and Registrar we are able to keep him up-to-date with progress. Where it has been necessary to get support for an initiative that has funding or policy implications it has been possible to do this quickly. The Planning Secretariat also works closely with the Vice-Chancellor's senior executive staff. This means that the MIS is informed of the policy directions of the University and related information requirements which can be fed directly into the data warehouse development.

Owners of the Data

Developing a data warehouse must be handled with care and sensitivity. Owners of the data are likely to have concerns about confidentiality and security issues. It is important to involve them as much as possible in the development process. They can provide valuable advice on data availability and on user needs. At the University of Queensland the IT support for the operational systems has been devolved to the appropriate administrative area (for example the student systems support group is part of Student Administration). MIS has involved the owners in different ways according to the resources available. With the development of our research data collection we provided the IT resources to extract and manipulate the data from a fairly old Rbase system while the Office of Research Services put a lot of effort into replacing missing data and revising their procedures to accommodate better the extraction of data at unit record level. With staff data the Director of Personnel Services provided IT resources to work with us on the development of this collection. This has proved successful both from a system and staff development point of view. Both Offices feel some ownership of the data collections.

Central IT or Planning Area

While I believe that the user/developer model has the best chance of success many universities administrative structures may not lend themselves to this approach.

If the data warehouse development is to be undertaken by a central IT area it must be user driven. This will involve a close working relationship with the planning area or other appropriate group. In the reverse case, as in our situation, it is important for the planning area not to work in isolation from other IT groups. In addition to keeping aware of developments likely to impact upon the data warehouse we receive advice and support on issues such as database administration and capacity planning.

Users

While a data warehouse has the potential to bring great benefit to an organisation it is a non-essential system. If users do not see value in it they will not support it. It is important that they feel a sense of ownership.

Rather than have a formal release of the system we had a number of informal demonstrations. We contacted individual Faculties and invited representatives from each of their departments to a demonstration with an upper limit of 12 on the attendees at each session. At these sessions we explained briefly what a data warehouse was and showed them what it could do. The message that we tried to convey was that this was a system designed by users for users. Their input was essential. The sessions were as interactive as possible. We had six of these sessions and many visits from Heads, Deans and other staff where we would sit and discuss their requirements over a cup of coffee. Users constantly ring or e-mail us with feedback or to seek advice. User groups have also been established.

***Easy Access**

If it is not easy to access information on the data warehouse users will either ignore it or, more likely, will ring up expecting you to provide the answers for them. The interface to the data warehouse should be intuitive and user-friendly for a wide range of non-IT staff. It should also be flexible and accommodate ad-hoc queries.

We chose Business Objectsô, an ad-hoc query and reporting tool, as our interface because of its user-friendly nature and functionality.

Much of this advice is not new: the importance of prototyping and reiteration, the need for the data warehouse to be user rather than IT driven, and to have support from the top as well as from the owners of the data. But perhaps, as we did initially, you may dismiss it as obvious and search for some other more complicated and more expensive formula. If you concentrate on the fundamentals you will find that the project gains its own momentum and you will have at least the early stages of a successful data warehouse enabling you to make an informed judgement on whether additional resources are necessary and how they should be spent.

What is an Executive Information System?

An Executive Information System (EIS) allows senior management and other staff to access a wide range of summarised data electronically. It is generally a stand-alone system but may use data automatically extracted from a data warehouse. Its most important design features are ease of use and visual impact. It should be intuitive so that managers can use it with little or no training. Many of these systems will have drill-down and slice and dice capabilities similar to more comprehensive decision support systems (DSS) designed for planning and other administrative staff. While a DSS may trade-off some ease of use for increased functionality it is important that this is not the case with an EIS. An EIS has to be extremely easy to use and will probably have to be tailor-made for the purpose.

Why Develop an Executive Information System?

Most senior executives want `value-added' reports provided either in hard copy or electronically. They need and expect advice on data and trends. This can be provided much more simply than by designing an EIS for the purpose. A Planning Officer can use an On-line Analytical Processing (OLAP) or other tool to extract and manipulate data and then incorporate this into a report. Reports can be set up using a tool like Business Objectsô and e-mailed regularly or posted to a Web-site.

If you develop an EIS you face the challenge of designing a system which is suitable for use by executives but which must provide sufficient additional benefit to the organisation to justify the cost of development and of ongoing maintenance.

The University of Queensland EIS has been developed using Microsoft Accessô with a Visual Basicô interface. The screens are attractive but not elaborate. The Home Page which has the University crest surrounded by an arch of six individual arches is appealing for its visual impact as well as its simplicity. One senior executive likes it so much that he keeps it on his screen as a background. Maps showing students' permanent domicile and country of birth have been added. Data access is easy and flexible with an on-line help facility and a glossary of definitions.

I could spend some time discussing executive information systems in greater detail. Unfortunately space is limited so I have chosen to focus on data warehouses. While a successful data warehouse can give an organisation a competitive edge an EIS is the icing on the cake. If resources are limited forget about developing a system for executives. They and the university will benefit much more from a well-designed data warehouse with supporting commercial reporting tools. Above all, whatever you develop, focus on outcomes and ignore the hype.

Secretary and Registrar's Office
The University of Queensland
Queensland 4074, Australia
E-mail:d. stevenson(at)mailbox.uq.edu.au

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Managing Information For Managers

John Townsend

1. Executive Summary

In Autumn 1996 Edge Hill embarked on a pilot project to use GroupWare and Intranet technologies to manage preparation and provision of access to documentation and corporate data for the Senior Management Group (SMG) and some School Board meetings, and the subsequent publication of such information to the wider College community.

Justification for the project was based on: existing 3 year corporate objectives to move to an electronic information base and continue to embed IT as a tool to support learning, teaching, research, management, administration and operation; the

need to provide easier and earlier access to documents for SMG; a desire to reduce the volume of printing required for SMG meetings; provision of a single source and repository for all documents required by SMG; a desire to provide better

access to SMG documents for all staff and students.

The following describes the information management process that Senior Managers followed during the pilot, with brief reference to the technology, and outlines the benefits obtained, the main issues that have arisen during implementation, and the lessons that will inform future planned roll-out across the organisation. It will highlight: the persistence of paper and associated ways of working; the critical role of staff development in relation to unforeseen areas; the message that the technology must be kept simple, but is peripheral to the real change; the way that changes in the process lead to questioning of the value of everything involved in the process, from information to the role of meetings and management structures themselves; the key lesson that the benefits arise not from the application of the technology but from the changes in working practices that it enables.

2. Background

The Information Management Pilot was set up in Autumn 1996 in order to contribute towards meeting two Objectives from the Strategic Plan for 1996/7- 1999/2000;

5.1 `Pilot an Application of Document Processing'

3.3 `Introduce and monitor internal communications strategy'

The specific aims of the Pilot were to:

- Review how information was currently circulated and stored within Edge Hill
- Propose ways in which current practice could be improved through a more effective use of IT systems
- Review current IT systems regarding access and usage and identify any skills training required.
- Identify possible performance indicators for use within any new Information Management System proposed.

As part of the Pilot two committees agreed to participate in collating, circulating and storing their papers in an electronic rather than paper form; School Board of Management and Social Sciences and SMG.

The Pilot was based on the use of software and hardware already available within Edge Hill, consisting primarily of the Microsoft Office Suite for the production of original documents, Novell GroupWise 4 for submission, collation and distribution, and standard DOS/Windows directory structures for storage. Latterly as phase 2 is developing Netscape is being used as the front end to all facilities, using various viewers to access documents, and moving towards full indexing and search facilities.

Some additional IT training has been provided to SMG members and their Personal Assistants by Computer Services and Guidelines were produced by the Quality Unit and

Computer Services and circulated to those staff submitting and receiving SMG documents.

3. Operation

The School Board of the School of Management and Social Sciences held three meetings during 1996/7 which all used electronic means for the submission, storage and circulation of documents (wherever possible). SMG held 13 meeting between January and June 1997 which used electronic means for the submission, circulation and storage of documents (wherever possible). SMG processed a total of 114 documents. Every School and Service area within the institution submitted at least one document to SMG using the electronic system. As a result a range of staff beyond SMG members and their PAs were involved in the pilot including Departmental Secretaries (who submitted Academic planning documents), School Administrative Officers and administrative staff from the Modular Programmes Office, Personnel, Marketing and Educational Liaison. All staff using the system were provided with Guidelines on request. Supplementary one-to-one guidance and advice was provided by the Quality Unit and MIS Help desk.

The two committees used a slightly different approach to information management;

School Board

- Internal documents were submitted via email to the secretar
- External documents or those not available as electronic documents were either scanned or circulated separately as hard copies
- The Secretary formulated the agenda, referenced the documents and collated them into one single Word document
- The Word document was then circulated to Boards members as a Groupwise attachment
- Board Members printed their own document

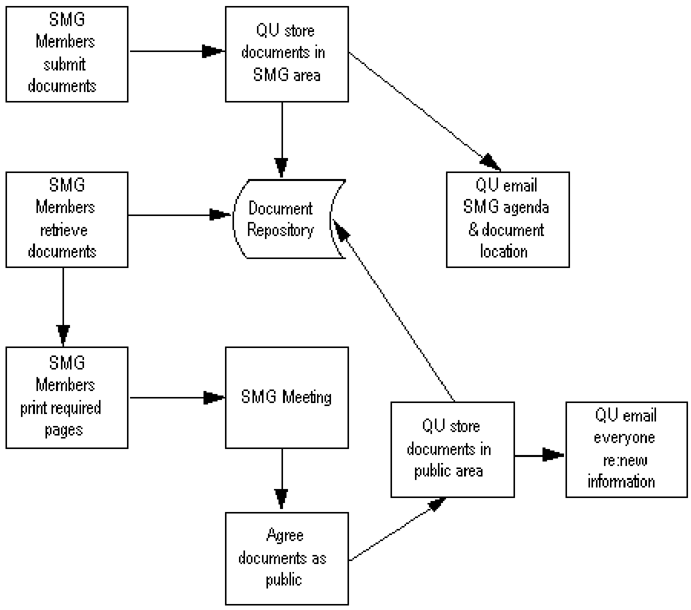
SMG

- Internal documents were submitted via email to the SMG Pilot Groupwise address
- External documents were submitted as hard copies and scanned centrally
- The Quality Unit formulated the agenda and referenced the documents
- The Agenda and documents were saved onto a Shared Directory on the network which is accessible to all SMG members and their PAs.
- The documents were available as either separate documents or within one single `meeting' file.
- The Quality Unit advised SMG members by email when documents were available for the next meeting, citing only the document locations.
- SMG members accessed all relevant documents for a meeting, and printed as necessary

Essentially in this model SMG used more of a pull approach to the technology, where more responsibility was placed on individuals to go and 'get' the documents, rather than in the School Board model where the documents were printed as attachments.

The following process model describes the approach adopted in relation to SMG.

SMG Document Management Pilot
Process Model 1/97



Key : QU = Quality Unit, the department responsible for managing the documentation.

SMG = Senior Management Group, the University College's senior management team

It should be noted that this model includes a recent revision, which is the storing of documents as agreed at SMG meetings in a public area accessible by all staff; agendas are also now accessible to all staff prior to meetings.

4. Benefits

- Improved speed of circulation of documents to members (where documents have been submitted within the deadline SMG members have normally had access to documents in the shared directory within 5 hours)
- Improvement of access and reliability in storing and circulating documents (the system now forms the basis for setting up and maintaining an up to date electronic bank of policy papers)
- Improved awareness of available IT capability in the Institution and therefore the possibilities for its use in other areas (Personnel are currently considering making information available on the network)
- Improved capacity to disseminate committee documents to non-committee members within the Institution through either Groupwise or Shared Directory (as a result confirmed SMG agendas and minutes are now available to all staff within a shared directory)

5. Issues

- The need to adopt a common format, header and layout for internal documents to make collating and storing documents more efficient.
- The need to address the shift in staff resources required in the Information Management process between Print Unit, School Offices and Quality Unit who collate and circulate and store documents and other staff who submit and print documents.
- Local' printing of documents by committee members - this has raised a variety of issues including the following; gaps in IT awareness/skills, difficulties in access to printers, awareness by members of need to print documents in advance of the meeting, concern regarding the cost of printing documents `locally' within Schools/Service Area and Subjects rather than centrally without related shift in printing budget.
- Limited use of the flexibility of the electronic format by some committee members who are not reading/scanning documents prior to printing and therefore not being selective in what they print.
- A general need for more training in IT skills for both teaching and non-teaching staff in Windows, Word, Excel and Groupwise
- The need for a more user-friendly interface for staff accessing documents

6. Lessons

The overall conclusion of the pilot project has been that the benefits that may accrue from the application of such technologies in managing information for managers arise not from the technology itself, but from the changes in working practices that application of the technology enables. Those managers who used the technology according to the principles of the pilot - accessing information prior to meetings, printing only what was required for meetings - gained the most benefits. Others who simply printed everything, achieved little but a change in the location of where the printing took place.

Particular areas to be taken on board in the next phase of development, rollout across the organisation, are as follows:

Push v. Pull. Traditionally, Edge Hill has deployed a push method of providing information both for meetings and in general. Typically, a pile of paper, of lesser or greater size, arrives on a member of staff's desk, and they then read it as and when. There is no onus on the individual to 'get' the information - in theory, if they need it, it will arrive; neither is there any particular expertise required on the part of the recipient, other than the ability to read and interpret. Under the new pull method, an individual is simply made aware that some information that may be relevant to them, either for a specific meeting or more generally, is now accessible on the network. The onus is then on the individual to access the information, evaluate its relevance, and print all, part or none of it as they see fit. This move from push to pull has a number of implications, some of which are addressed below.

Training in electronic as opposed to paper document preparation. Edge Hill has an extensive staff IT training programme, and most staff engaged in the pilot had participated in this at some time. However, what the pilot revealed was that staff had really only learnt to produce paper documents and had developed various strategies for doing this which involved drafting, redrafting, test printing and so forth. Now that they had to produce documents for circulation to others electronically, a number of gaps in skill and understanding emerged.

The Persistence of Paper. The attachment of individuals to paper should not be underestimated or demeaned, and there are a number of persistent behaviours that derive from it. Whether these behaviours result from the technology, or whether the technology is chosen to fit these behaviours, would require more extensive analysis. They can however be characterised as follows:

- **Haven't got time/taking it home/reading it over the weekend.** Typically here a set of documents, usually for a meeting, is printed in its entirety, the grounds for this being that the individual, usually a senior manager, doesn't have time to read them at work. This undermines the principle the project is trying to promote, which is the on-line scanning of documents prior to printing. Significantly, those individuals who have derived most benefit from the pilot have changed their working practices to include time for scanning prior to meetings, and have begun to print only short sections of documents as required. Various 'technical' solutions to this have been sought, including suggesting portable equipment and modems for all senior managers, and promoting the use of executive summaries for all documents to encourage the individual printing of these only, the theory being that a full set of documents can then be lodged with the secretary of the meeting for reference. It should be noted that these solutions require at least the scanning of documents prior to the meeting - which leads on to
- **Reading them during the meeting.** Some staff reported a major difficulty with printers as being that they were shared and everyone tried to use them just before the meeting. Assuming that papers for meetings are actually intended to be read, this suggests the meeting as the time for reading them. A cynic might suggest that this would at least provide the individuals with something to do; however making another assumption, that the purpose of meetings is to discuss pertinent issues and then arrive at some actions, or put another way, that at the end of a meeting there should at least be the potential for the world, or at least some small part of it, to be in some way different from how it was before, reading papers for a meeting at the meeting would not seem to be the best way of preparing for or contributing to the meeting. This leads to the next major implication of the project.

Application of the critical faculties - or, why do I need this junk? A further unanticipated result of the pilot, particularly amongst those who were guided by its principles, has been increased criticism of the value of documents, meetings and even management structures. Where the arrival of a pile of paper, to be scanned, read, binned or whatever as required prior to a meeting, is something with which all managers are familiar, the need to exercise some additional skill in accessing on-line documents, together with encouragement to read and reflect on them prior to meetings, encourages individuals to be more critical of the content of the documents, divorced as they are from the authority invested in the printed word. It is a short step from this to questioning: the need to attend meetings to discuss irrelevant documents; the need for managers who wish to produce and discuss irrelevant documents to attend anything at all; the way we do things around here. As stated above, the true benefits of application of technology to managing information for managers will only be realised when managers change the way they work for the benefit of the organisation. It will be interested to see if this occurs as the technology is further embedded during the next stage of the project.

7. Footnote

MIMEO - Managing Information for Managers - the Electronic Office

Following a successful application for government funding, the project, renamed as above, will be expanded over the next 18 months, both to build on progress to date, and also to incorporate workflow and access to corporate data, invest more resources in analysis of user requirements and user feedback, and investigate more fully similar applications of technology in other sectors, environments and countries.

Head of Computer Services
Edge Hill University College,
St Helens Road, Ormskirk,
Lancashire L39 4QP,UK
E-mail: townsend(at)admin.ehche.ac.uk

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Implementation of University Information Systems

Ivan Vrana

Concept of integrated university information system

It is no surprise that the need for an information support is felt in universities, similarly like in other enterprises. There exist many rational reasons, why management of universities wants to keep path with a technological development, wants to take advantage of the new communication facilities of computers and wants to take a strategic gain of being on the leading edge of this process.

High expectation of the university managers in a potential benefit offered by the information systems contradicts with a generally poor historical experience of using ? information systems" at universities. Understanding of the historical experience is an important factor for starting any new activities in this field.

Selection of some important notes (without any ambitions for completeness) will be listed here in order to mention reasons, why the problems in university management arise, to show possible solutions and to outline the way from the problem statement to its solution:

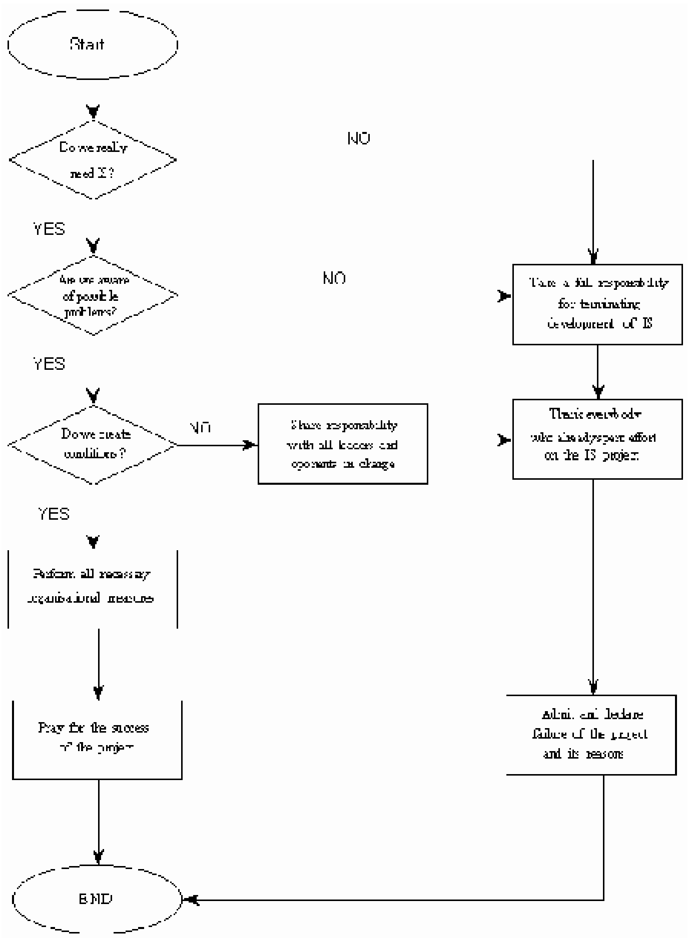
- Lack of relevant information concerning the mission critical activities of the university (e.g. education process, research, finances, etc.) is an obstacle of effective management in many universities. Because of this reason, effectiveness of the university management is not only reduced but it can be even disabled, in some cases.
- Relevant information is needed about global and detailed features of the managed unit should be available to managers for management regardless whether the university / faculty / department level.
- Availability The information delivered to managers of the should be up-to-date, accurate, reliable, etc., for an efficient management.
- Lack of the above mentioned information causes a reduced efficiency of the university management and may approach a collapse.
- A very important resource of management-suitable information can be gained from the administration of individual activities of the university mission: education , research, finances, public relations, library, etc.
- Properly designed information systems can enable an efficient administration which, in turn, makes an efficient management possible. Components of current information systems usually support individual isolated university activities, but these components should also communicate and co-operate to each other in order to assure a unique interpretation of data.
- The integrated university information system (IUIS) can only make this goal possible. It also makes the maintenance of the system and its further development easier. The data maintenance and update is easier, more reliable and cheaper, with the IUIS, too.
- Because of the same historical reasons, the situation in majority of universities can be characterised by these facts:
- There exist some isolated non-compatible modules of information systems supporting limited functionality of university activities.
- These modules arose spontaneously (not systematically), sometimes as a product of ?fans" who wanted to improve their small particular task.
- All these modules have just a limited scope from the point of view of the organisational, territorial and functional structure of the university.
- They don?t communicate to each-other,. tThere is little or no documentation to them which makes their maintenance and advancing difficult or impossible.
- Development was done without a basic professional knowledge in developing information systems and it reminds ?reinventing a wheel" very often.
- This is why many universities try to develop their IUIS in order to improve their management.
- Development and implementation of the IUIS should consider a set of rules and principles which influence a success or a failure. Many general conditions for success are often violated or simply neglected. Majority of these IUIS projects fail because of the lack of expertise in this branch. Besides financial losses and frustration of people such a failure also results in a considerably reduced effectiveness of management in a university, faculty and department level.

Everybody feels (except of the top managers, sometimes) that a more systematic and co-ordinated solution is needed. But how to get it? This is a topic of the present paper.

Where to start

Before starting any activities in building information system, the top managers should answer several questions. The following decision diagram contains the typical questions to be answered and their consequences:

The correct and honest answer to these questions (not telling lies into ones own pocket) is vital in order to avoid later disappointment and confusions.



From beginning, the university management should be aware that the project will be accompanied by problems: general & university specific. They should be also aware of risks of the project and of the high probability of the failure unless special measures are taken. That is why the questions

- do we really need an information system?
- are we aware of risks of such a project?
- are we willing to create adequate conditions for the project?

must be considered with a great attention.

Control of the project

An efficient control of the project can considerably reduce risks of the failure of the project. The following aspects form a vital part of control:

- Creating and (constant) defence of the concepts and principles. Project management should always expect plenty of attacks to the foundations of the project.
- Decisions about self development or external supplier of the system.
- Choice of a suitable life-cycle type: waterfall, iterative, prototyping,...
- Attention to early phases of the life-cycle (e.g. information strategy planning, analysis, etc.). Mistakes from these phases are very expensive later.
- Scheduling implementation of individual components according to priorities of the university.
- Co-ordination of suppliers with users.
- Organisation provisions (as deep as an operative control).
- Reliable system of checking and monitoring progress, problems and making corrections.

Many models exist, of how to accomplish control of the IUIS project in the certain university environment. The most typical models of control in the university environment are listed below:

A. Project management is neither a part of the top university management, nor the top faculty management. It only has a position of some service unit.
B. Project manager is a member of the top management of the university in the post of a vice-rector.
C. Project management consists of a vice-rector at the university level and is

extended by vice-deans at the faculty level.

D. The new control structure is created in parallel to standard (understandable) organisational structures (as in C), creating non-typical organisational structure at the university.

The most critical aspects of success:

A lot of articles has been published concerning influence of individual aspects to the success of the IS projects. We shall mention those aspects which are typical for the university environment.

- Project management co-operates with well educated university managers and employees. This seems to imply a good understanding of general principles by managers, at least. But contrary, we must expect a bad understanding, resistance and little co-operation of managers and users in various posts. Introduction of a new system enforces introduction of an order to all activities concerned. It is necessary to clean the Augean stables before the system can serve. Generally, people don?t like order, regardless whether educated or not.
- Everybody should be aware that the magic system (supplier) doesn?t exist.
- A certain (high) priority must be assigned to implementation of IS within other university/faculty/department activities. University management must make everybody sure that building of IUIS is a short term priority though not being the long-term mission of the university.
- Some people play a key role for a success of the project in individual phases of the system life-cycle. It is a foolish mistake to expect serious results built only on enthusiasm of people. Motivation and responsibility of key persons is vital.
- Good planning and checking is important in order to make individual tasks co-ordinated and feasible.
- Selection of the suitable hardware, operating system, database management system and networking is vital from the point of view of security, reliability, robustness, etc.
- University as well as project management should expect problems - they will occur. Insist on a specific description of the problems; this is the only way for a quick recovery.
- Management must understand reasons for problems and resistance and try to foresee and avoid them.
- There exists many aspects which contribute to success or failure of the project of IUIS. Contribution of main individual aspects to success is given by a following Table 1:

Contribution %	Aspect
40	political decisions and support
25	organisation
20	quality of the system (functionality, performance, ...)
10	interface
5	others

Table 1

Feasibility of the project

The type of selected (or enforced) model of control has a direct influence on the feasibility of the entire project. Let us consider a simple linear feasibility model

$$A = \sum_{i=1}^{9} a_i$$; (1)

where

$$a_i = W_i \alpha / 100$$; i=1,2,....,9 (2)

for the feasibility of the control type A and similarly also for B, C and D. We denoted weights of individual factors by W, contribution of the model to an accomplishment of the factor by a (or b ,g , d , respectively), total impact of the given factor in the model by a (or b, c, d, respectively) and the entire feasibility by A (or B, C, D). The feasibility expressed in this way is also proportional to the ability to control the project.

The following Table 2 shows how feasible the project is with respect to four typical alternatives of control. We can see that some models of control make the project more hazardous than feasible. We can see from this table, that ability of control is very sensitive on the way how control structures are penetrated to both: top management of the university as well as the top management of all faculties. Besides the fact that project managers should be a part of the top management of university and faculties, the form of this representation is also very important. The greater use of the standard control structures (vice-rector, vice-dean), the more legible such a control is for all academic environment and, as a result, the more influence and efficiency of control can be gained. At the other hand, any artificially created control structures prove themselves to be ineffective which reduces feasibility of the project and brings additional risks.

Conclusion

As soon as the university management decided to implement integrated university information system, this management carries a full responsibility for the success of the project. There are several aspects which can decide between its success or failure. Selection of the adequate type of the project control is one of these critical aspects. Failure in guaranteeing an efficient control makes the project unfeasible. Fortunately, there exist forms of control which can make the project feasible, as shown in the present article.

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"Using Information in Electronic Age", Manchester 16-17 December 1996.

			Type of model: A			B		C		D	
Factor	**Weight %**	**Index**	**Weight**	**Contribution %**	**Total**	**Contribution %**	**Total**	**Contribution %**	**Total**	**Contribution %**	**Total**
		i	**W**	**a**	**a**	**d**	**d**	**b**	**b**	**g**	**c**
Political willingness	40										
University management		1	0,16	10	0,016	30	0,048	50	0,08	70	0,112
Faculty management		2	0,2	5	0,01	5	0,01	10	0,02	70	0,14
Academic senatus		3	0,04	10	0,004	30	0,012	50	0,02	70	0,028
Organisat. aspects	25										
University		4	0,075	30	0,022	70	0,0525	90	0,0675	95	0,07125
Faculty		5	0,125	5	0,006	5	0,00625	20	0,025	95	0,11875
Network management		6	0,05	30	0,015	40	0,02	50	0,025	95	0,0475
System quality	20	7	0,2	80	0,16	80	0,16	80	0,16	80	0,16
Interface	10	8	0,1	70	0,07	70	0,07	70	0,07	70	0,07
Others	5	9	0,05	90	0,045	90	0,045	90	0,045	90	0,045
TOTAL			1		0,348		0,42375		0,5125		0,7925

Table 2: *The project feasibility with respect to four typical alternatives of control*

Czech University of Agriculture Prague, Czech Republic
E-mail: vrana@pef.czu.cz

Executive Secretary
Jean-François Desnos - e-mail: jfdesnos(at)orange.fr

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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Construire les usages: Dynamique d'usage des applications télématiques dans les unités de recherche scientifiques

[1]Luc WILKIN, [2]Jacques MORIAU

INTRODUCTION

Les développements récents de la télématique conduisent à un appel de plus en plus pressant pour que soient mis en place des réseaux électroniques de support à la recherche scientifique. Si l'utilisation de tels moyens n'est pas neuve (les scientifiques utilisent depuis longtemps les ressources d'échange de données ou de consultation de banques de données), le recours à ceux-ci de manière plus structurée, plus systématique et plus massive est, en revanche, de plus en plus à l'ordre du jour.

L'argument qui sous-tend ce mouvement est familier : l'accroissement de l'accès à des ressources d'informations coûteuses et disséminées à l'échelle mondiale ne peut être que bénéfique tant du point de vue de l'efficience que de celui de l'efficacité du travail scientifique. Plus récemment, l'apparition de nouvelles technologies de communication comme la téléconférence, les systèmes de conférence électronique, les " collaborative systems ", les " group decision support systems " apportent la promesse de synergies entre équipes qui, autrement, n'auraient guère l'occasion ou les moyens de se rencontrer et de travailler ensemble.

Si nombre de scientifiques proclament que l'usage de la télématique a dès à présent augmenté leur efficacité et changé la nature de leur travail, peu d'études à notre connaissance ont cherché à analyser les conditions d'acceptation et d'utilisation de la télématique dans le travail des chercheurs1.

Dans les pages qui suivent, nous nous proposons de présenter succinctement un cadre théorique d'analyse de la dynamique des usages des technologies de réseaux dans les unités de recherche scientifique. Dans un deuxième temps, nous présentons quelques données issues d'une enquête menée au sein de plusieurs équipes de recherche tant dans le domaine des sciences exactes ou appliquées que dans celui des sciences humaines.

UN CADRE THEORIQUE D'ANALYSE

Poser la question des dynamiques d'usage des applications télématiques dans le cadre spécifique de la recherche universitaire impose, à notre sens, de répondre à quelques questions préalables. Parmi celles-ci, citons les plus importantes : quel modèle sociologique choisir pour étudier les relations entre le technique et le social et comment définir la pratique scientifique? Sans entrer ici dans le détail des réponses qui peuvent y être apportées, disons simplement que, dans notre approche, l'utilisateur final constitue une préoccupation principale. C'est la façon dont ce dernier va se comporter face à l'innovation technique qui nous semble déterminante. C'est dans des situations de travail concrètes que se posent les choix engageant des relations, définissant des pratiques qui mènent peu à peu à des irréversibilités. Il est donc de toute première importance de prendre en compte la façon dont la multiplicité des actions individuelles interagissent.

Par ailleurs, nous écartons les explications selon lesquelles des attributs particuliers (par quoi il faut entendre les variables socio-démographiques habituellement utilisées) de chaque individu constituent un facteur suffisant de compréhension des usages. Au contraire, nos analyses nous conduisent à privilégier la dimension collective des faits que nous observons dans les laboratoires et les équipes de recherche et donc à emprunter la voie proposée par les courants d'étude proche de l'interactionnisme.

Ce paradigme permet en effet de lier plusieurs processus qui nous semblent essentiels. L'interactionnisme met en avant l'idée que les unités d'étude appropriées se situent au niveau des interactions entre les acteurs sociaux. Le social naît des situations d'interaction que nouent les acteurs. Ainsi qu'un des pères fondateurs de ce courant l'exprime2 : " Society exists where a number of individuals enter into interaction. This interaction always arises on the basis of certain drives or for the sake of certain purposes. Erotic, religious, or merely associative impulses ; and purposes of defense, attack, play, gain, aid or instruction - these and countless others cause man to live with other men, to act for them, with them, against them, and thus to correlate his conditions with theirs. In brief, he influences and is influenced by them. ".

L'interaction naît donc de la confrontation de plusieurs intentionnalités. Il s'agit de prendre en compte les autres dans la réalisation de l'action. Ceci nous amène à un deuxième point de méthode : l'interaction se réalise dans l'action, dans les pratiques. C'est ici que la question de l'articulation des pratiques de l'acteur à celle de l'organisation nous semble importante car si l'on considère l'organisation à la fois comme acteur à part entière et, d'autre part, comme contexte de l'action, il convient de préciser quelques points.

La place du contexte doit être repensée : il ne s'agit pas ici d'un contexte extérieur aux acteurs qui jouerait le rôle de toile de fond ou même de réservoir de ressources, il s'agit d'un contexte organisé qui émerge en même temps que l'action prend forme3 . Dans notre perspective, action et contexte se constituent corrélativement. Ainsi, en ce qui concerne les outils télématiques, il s'agit de voir que ces derniers ne naissent pas ex abrupto, qu'ils n'arrivent pas in nihilo. Il doivent au contraire, petit à petit, s'imposer comme des possibles, forcer des inerties, s'insérer dans des structures existantes afin de s'y faire une place, si place il y a.

Ce que l'analyse sociologique peut apporter à la compréhension de ces mouvements dynamiques, c'est comment des investissements politiques, sociaux et techniques produisent une géographie et une économie des hommes, des institutions, des règles, des actions et des objets. Il existe dès lors une démarcation entre contenu et contexte de même que la composition de ces derniers n'est pas prédéterminée, ni par la forme spécifique de la technologie (déterminisme technique), ni par l'existence de groupes sociaux pré-constitué (déterminisme social). En d'autres termes encore, il faut garder à l'esprit que la frontière entre contenu et contexte, technique et organisationnel ne doit pas être tracée a priori par l'analyste mais doit advenir des négociations entre acteurs. Comme l'affirment Huff et Finholt : " Since we are familiar with the technical issues of electronic mail, it is easy to think that these are what will determine its success : faster transmission, better interfaces, more flexible standards, more reliable networks, etc., are what will really make electronic mail use take off. For some technologies, this may be true (...). But most computing technologies will fall in between. For this large majority of computing artifacts, then, it will be essential to understand both the technical issues and the social contexts before we can understand their success. "4.

Pour abonder dans ce sens, citons encore Friedberg qui résume mieux que nous ne pourrions le faire nous-mêmes, la dialectique à l'oeuvre : " Etudier la dimension organisationnelle de l'action sociale conduit à considérer la structuration de tout contexte d'action comme une solution chaque fois spécifique que des acteurs, relativement autonomes et agissant dans les contraintes générales d'une rationalité limitée, ont trouvée pour régler leur coopération conflictuelle et pour gérer leur interdépendance stratégique. Cette solution est contingente au sens radical du terme. Elle dépend des caractéristiques techniques, économiques, sociales et culturelles qui constituent en quelque sorte la pré-structuration du contexte en question... Aucune loi universelle, aucun déterminisme et aucun principe abstrait ne peuvent donc en expliquer la forme et la dynamique spécifique. Cette explication ne peut qu'être elle même locale, c'est-à-dire fondée sur la connaissance empirique des conduites réelles des acteurs et des conditions spécifiques de leur coopération prévalant dans ce contexte particulier "5.

L'enjeu est d'identifier ce contexte d'action et son processus de construction. De ce point de vue, l'étude des dynamiques d'usage des applications télématiques revient à mettre à jour des processus généraux de réorganisation des pratiques scientifiques.

A nos yeux, un réseau télématique comme objet technique, possède un haut niveau de flexibilité interprétative6. Il représente donc des choses différentes pour des acteurs ou des groupes différents, il s'intègre dans des pratiques différentes, il est qualifié différemment.

A présent, quels peuvent être les éléments susceptibles de constituer la structuration du champ permettant de différencier les usages des applications télématiques dans le contexte particulier de la recherche scientifique ?

DONNEES D'ENQUETE

Nos enquêtes de terrain nous conduisent à définir les facteurs qui suivent :

- la structuration de la discipline;
- l'organisation du travail de recherche;
- l'institutionnalisation des relations de travail;

- l'utilisateur final.

La structuration de la discipline fait référence à un certain nombre de traits distinctifs des disciplines scientifiques. Trop souvent, en effet, la question des usages est traitée comme si les disciplines scientifiques constituaient un ensemble homogène.

Les interviews7 nous conduisent à retenir comme élément important la nature de l'objet de la discipline. Deux pôles peuvent ici être plus particulièrement distingués : des disciplines ayant un objet " universel " et des disciplines ayant un objet " spécifique ". Par objet " universel ", nous entendons des objets dont la présence et les manifestations de cette présence se retrouvent de façon semblable dans l'univers connu. Ceci implique également des systèmes d'explication unifiés (des paradigmes), des théories et des méthodes partagées par tous les scientifiques travaillant sur ces objets. Il s'agit principalement des objets relevant des sciences dures, telle que la physique des particules. En revanche, la spécificité de l'objet se rapporte à des objets limités par nature dans leur présence et dans leurs manifestations. Cette limitation entraîne des systèmes d'explications particuliers ainsi que des théories et des méthodes spécifiques, comme c'est le cas, par exemple, dans des disciplines telle que l'histoire ou certaines branches de l'économie.

Un deuxième élément est relatif au niveau de centralisation / décentralisation géographique de l'activité. Ce trait se rapporte à la plus ou moins grande dispersion géographique des chercheurs travaillant sur le même objet. Il est lié au trait précédent dans la mesure ou nous constatons que les chercheurs travaillant sur des objets " universels " ont tendance à être plus dispersés.

Un troisième élément a trait aux rapports entretenus entre la discipline et le champ économique (financement de la recherche, partenariat, possibilité de prises de brevets, etc). Enfin, nos enquêtes font émerger un quatrième élément, à savoir l'évolution lente ou rapide de la discipline qui peut s'appréhender à travers, par exemple, le rythme des publications ou le nombre de revues.

L'organisation du travail de recherche se réfère à la prédominance du travail individuel par opposition au travail collectif, les modalités de coordination entre chercheurs, le type de relation et de communication qui prévaut dans la discipline entre pairs ou entre individus de statuts différents. Nos enquêtes montrent sur ce point de substantielles différences d'une discipline à l'autre.

Quant au niveau utilisateur, citons quelques éléments discriminants : position dans la trajectoire professionnelle, formation de base, légitimité du chercheur dans son domaine, etc.

La place manque pour mettre en évidence les " profils " d'usage qui résultent de tous ces éléments. Deux exemples permettront toutefois d'illustrer notre propos.

Si l'on aborde la question du recours au réseau sous l'angle du fonctionnement du champ scientifique et de la discipline, le chercheur que nous avons interviewé en PSYCHO8 n'éprouve pas le besoin d'un recours intensif au réseau dans son domaine privilégié de recherche : il connaît les quelques chercheurs légitimes et les sources autorisées. Il utilise par conséquent plus particulièrement le courrier électronique pour échanger avec ces chercheurs. Si, dans le cas présent, le réseau n'est pas envisagé comme source première d'informations, il reste cependant un moyen de communication important (E-Mail).

Un autre chercheur de DEMO HISTO9 est amené à réaliser un travail quantitatif (constitution de bases de données démographiques) et doit par conséquent recourir à l'outil informatique à des fins de traitements statistiques sur des masses de données importantes.

Il n'y a pas à proprement parler de problématique similaire en psychologie de la connaissance, domaine privilégié du chercheur PSYCHO : sans doute y a-t-il partage et échanges quant aux paradigmes d'expériences. Mais il n'y a pas de pratique de constitution de bases de données. Les résultats du travail scientifique de la discipline sont déjà le fruit d'un premier construit scientifique : constitution d'hypothèses, mise au point de test destinés à les éprouver et vérification par l'expérimentation - qui est le propre de la psychologie expérimentale. Sans doute cela rapproche-t-il la psychologie expérimentale des sciences " dures ".

Tel n'est pas le cas en démographie historique. Les données dont il est question ici ne sont pas les résultats d'une expérimentation. Il s'agit de données historiques relatives à des populations particulières. Des bases de données sont extraites, les reproduire expérimentalement n'a pas de sens. Ce travail constitue déjà un enjeu en lui-même au sein de la discipline, de même que ses résultats.

Ces deux exemples, brièvement évoqués ici, illustrent à quel point des problématiques différentes et, plus généralement, la nature du travail scientifique propre à la discipline est à l'origine de recours différenciés. Il s'agit là d'une hypothèse (parmi d'autres) que nous testons plus avant dans le cadre des autres facteurs que nous avons dès à présent dégagés.

NOTES ET REFERENCES

1. Parmi quelques études disponibles, citons à titre d'exemple : Hesse, B.W., Sproull, L.S., Kiesler, S. and Walsh, J.P., " Returns to Science ", Communications of the ACM, Vol.36 (August 1993), 90-101 ; Ruhleder, K., " Rich and Lean Representation of Information for Knowledge Work : The Role of Computing Packages in the Work of Classical Scholars ", ACM Transactions on Information Systems, Vol.12 (April 1994), 208-230 ainsi que Walsh, J.P. and Bayma, T., " Computer Networks and Scientific Work ", Social Studies of Science, Vol.26 (1996), 661-703.

2. Simmel, G., On individuality and Social Forms : Selected Writings (Chicago, University of Chicago Press, 1971), 23.

3. Sur l'importance du contexte entendu dans un sens large, notre position est proche de celle défendue par Kling, R., " Behind the Terminal : The Critical Role of Computing Infrastructure in Effective Information Systems' Development and Use ", in Cotterman, W. and Senn, J., Challenges and Strategies for Research in Systems Development (New York, John Wilmey, 1992), 153-201.

4. Huff, Ch. and Finholt, Th., Social Issues in Computing (New York, MacGraw-Hill, 1994), 3

5. Friedberg, E., Le Pouvoir et la Règle (Paris, Seuil, 1993), 19.

6. Cf. Lea, M. O'Shea, T. and Fung, P., " Constructing the Networked Organization : Content and Context in the Development of Electronic Communications ", Organization Science, Vol.6, ndeg.4 (July-August 1995), 462-478.

7. A ce stade, nos interviews concernent une soixantaine de chercheurs représentant un très large éventail de disciplines dans tous les domaines. Une enquête plus systématique est en cours d'exécution, portant sur quelques deux cents chercheurs.

8. Nous indiquons de la sorte les " cas " que nous avons étudiés. PSYCHO désigne un chercheur interviewé au sein d'une Faculté de Psychologie.

9. Chercheur, unité de démographie historique.

Groupe de Recherche en Informatique et Sciences Humaines, Université Libre de Bruxelles,50, Av. F.D. Roosevelt, 1050 Bruxelles, Belgium

[1] e-mail: wilkin(at)is3.ulb.ac.be,

[2] e-mail: jmoriau(at)resulb.ulb.ac.be

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Information System for Application Procedure for Registration in Higher Education in Slovenia

Rok Rupnik, Marko Bajec, Marjan Krisper

HIGHER EDUCATION IN SLOVENIA

Slovenia is a small country with population of two million people. Candidates that want to study on higher level have to choose from one of the two Slovenian Universities. The oldest University is situated in Ljubljana, the capital of Slovenia. There are approximately 35,000 students registered each year. The other one is in Maribor. Approximately 12,000 students register and about 1,800 students graduate from this university each year. The establishment of the third Slovenian University on the coast of Slovenia is foreseen in the near future.

APPLICATION PROCEDURE FOR REGISTRATION IN HIGHER EDUCATION

Since 1995 there has been a new application procedure for registration in higher education in Slovenia. The former procedure had disadvantages and was not considered as appropriate any more. Common characteristic of both is that the majority of candidates apply before they finish secondary school and don't know how successful they will finish it. For example: candidates apply in the beginning of March; secondary school scholastic year finishes at the end of June; scholastic year in higher education begins in October.

2.1 Former application procedure

In the former application procedure there were two parts: centralised part and decentralised part. In a centralised part all applications were sent to admission service where data from application forms were captured into a database. After the analytical report was done applications were delivered to the departments. That was the beginning of the second phase, where candidates could apply for entrance examination on 5 additional programs. This means that one candidate could be on more than one list of accepted candidates. Good candidates were on many lists; some didn't appear on any. Because the candidates who were on more than one list could wait for quite a long time for decision, there were updated lists published even more than once a day. This was very confusing for the majority of candidates.

2.2 The new application procedure

Preference among options is an important characteristic of the new procedure. Candidates must name programs in the preferred order on the application form already, not in the later steps of procedure. They are allowed to name up to three programs, which are called options.

Capturing data from application forms

All the data from application forms must first be captured into a database.

Analysis of the application

The analytical admission reports are done according to the first option of all candidates. Programs that have more applications than the study places available can become limited programs, others become unlimited. Each of the programs that can become limited actually becomes limited by the approval of Ministry of Education and formal approval of the government.

Determination of exams

The government approval determines the next step of the procedure. The limited and unlimited options have to be determined. First option of a candidate becomes limited, if it fulfils one of the following conditions:

- the program of the first option is limited
- the program of the first option is unlimited, but according to qualifications candidate must pass either the capability tests or other additional tests

Other options of the candidate become limited, if his first option is limited, otherwise they become surplus. For all the limited options the candidates must be put on lists for capability tests and additional tests if it is a option for a program, for which registration demands determine so.

Capturing of marks

The following kind of marks must be captured:

- Marks of candidates, which have finished secondary school in the past and had to enclose all their certificates with the application form. This is a manual procedure and is done twice. The second capture controls the first one and so the probability of mistakes is practically zero.
- Marks of capability tests and additional tests, which are delivered from departments in form of ASCII file.
- Marks of candidates, that are finishing secondary school in the current scholastic year. These marks are delivered from the National examinations centre in form of ASCII file.

Calculation procedure

For each program and type of final exam (bachelor's degree or internal final examination) there are entrance qualifications and weights for marks for which candidate gets points. Because there are six different scales of marks, the calculation procedure must transform each mark from its original scale to the mark in scale from 0-100. Setting of flags and searching for maximums are also part of this procedure.

Selection procedure

Selection procedure is the main characteristic of new application procedure and is the step, where both procedures differ mostly. It tries to place candidate on his most preferred program, for which he fulfils all the qualifications and has enough points according to his competitives whereas the places available for each program must be considered.

3. INFORMATION SYSTEM FOR APPLICATION PROCEDURE

The information system for application procedure supports all the activities from preparation of all the required code tables and catalogues up to selection procedure. The complexity of application procedure is a result of the fact that it is a centralised system for all the various faculties, art academies and university colleges which have different qualifications. This results in a complex information system.

The most important mission of information system is to assure the consideration of all the qualifications. They are implemented in data model, so the code is independent. The most critical procedures, that information system supports are calculation and selection procedure. Interphase test method was developed for the purpose of testing their function.

Information system was developed two years ago, renovated last year and is now being maintained. In the last year there were some changes in the procedure that exceed the maintenance, so we now talk about renovation and maintenance of the information system. In the next sections the evolution of the information system will be described.

3.1 Development of information system

Information system was developed in time pressure and shortage of time. Because of that we were many times forced to pick up decisions and move steps that guarantied success in time available, what didn't mean, that they were optimal or good.

We had to begin with selection of hardware and software for production system and development. For both admission services (each university has its own) we choosed PC platform, two better PC's for servers and 11 PC's for clients. On both servers we installed operating system Novell NetWare and Database server Oracle 7.0. Operating system for clients was DOS and the development tools were Oracle client tools: SQL Forms, SQL Menu, and SQL Reports. As CASE tool we used SilverRun. Each admission service had it's own LAN, networks were not connected. Two unconnected servers caused many problems during the whole procedure.

The main consequence of time pressure was the partial development of information system. There wasn't enough time to make analysis in the beginning to get the full picture of the system. In every moment of development we were working only on activities to support the current checkpoint of application procedure. To get to current checkpoint and support needed activities we made additions to process and data model and implemented it. Information system was not developed according to information engineering methodology. We could say that information system was not developed but was composed.

Because of partial development some mistakes committed in early stages arose at the end. Especially some default values of flags and some segments of data model were the problem. That was the source of many problems in the last step of procedure.

3.2 Renovation of information system

The first step of renovation was setting conditions for the continuation of work on this project. The most important among them was the purchase of powerful UNIX Workstation for the central database server. The experience with two unconnected servers and with combination Oracle-NetWare was inappropriate, so we decided to work on UNIX operating system which is the native operating system platform for ORACLE database.

In the second year there were some changes in the application procedure. They were the result of analysis done by all the actors involved in it. This was one of the strongest reasons for renovation. From technical point of view there were following reasons for renovation of the information system:

- Functional reasons: Information system was operating correctly, but because of its partial development its use was complicated.
- Technological reasons: Information system was operating in DOS. In the same year ORACLE announced, that the development of development tools for DOS has stopped. Information system became technologically old over night.

We decided for the following renovation, which was done in two phases:

- First phase: Classical reverse engineering phase to gain the business model was not needed because of the changes in the application procedure and functional reasons for renovation. In this phase we only analysed the information system, especially the data model.
- Second phase: It was a forward engineering phase, where we developed new information system in Windows environment using new Oracle tools. The development was based on documentation of information system, analyses done in the first phase, changed application procedure and experience gained during the development.

3.3 Experience with information system

Users are very satisfied with information system. Working in GUI environment is much nicer than working in character one. ORACLE Designer and Developer are composed of tools that enable the development of complex forms and reports which give user a great support.

Information system also supports significant improvement in the application procedure. This is communication with candidates. Candidates get mail at least twice during the procedure. After capturing of application forms data candidates get mail with their data in the database. The aim of the first mail is to verify the data because mistakes appear during capturing. It gives candidates the possibility to mail back any noticed irregular data in the database. Candidates get second mail when the selection procedure is finished. They are informed about the program they are accepted in with all the explanations. Since such a communication has been adopted, there are much less telephone calls to admission service from candidates, because they get feedback.

4. VISION FOR THE FUTURE

From our experience with the information system and the application procedure as well, we believe that there are some opportunities to improve the whole system. We suggest:

- Changes in application procedure and
- Changes of the IS in technical manner

4.1 Changes in application procedure

One of the major problems that we are dealing with now is that candidates apply at the University before they actually know about their success in graduation as well as what kind of secondary school diploma they will attain. Therefore, all plausible procedures have to be carried out until candidates actually graduate.

We believe that it would be better to divide application procedure in two separated parts. In the first part candidates would only specify data which would not depend on future outcomes, such as graduation success and success in bachelor's degree. Special forms would have to be prepared to acquire this. Received data would be captured into database. Reports would be produced and send back to the candidates in order to check inserted data is correct. A blank form would be included, where candidates would choose their options as soon as they would finish secondary school and bachelor's degree.

Receiving information about candidate's success in bachelor's degree plays very important role in the application procedure. At the point we come to the second part. Now we have all the data needed to start with calculations and other activities need to be done to finalise the application procedure.

Benefits

- We avoid predicting all procedures possible according to the future outcomes. We only deal with the information available at the moment.
- The second part is carried out only for those candidates that would actually pass graduation and bachelor's degree!
- After consideration based on graduation results and results of bachelor's degree, candidates could rationally decide where to apply!

4.2 Usage of new technology

Capturing the data from application forms is a process, which lasts at least four weeks. Small group of people does the coding. Database filling based on codes is much easier and faster. Despite of this, there at least ten people must do the work. Expenses and duration of the process call for better solutions. We recommend two possible alternatives:

- The use of IOCR technology to capture the data
- Usage of Internet based solutions

4.2.1 Usage of IOCR technology

Optical character recognition (OCR) technology enables converting printed or scanned documents into computer-editable text. Intelligent OCR is improved technology which provides new features that increase the accuracy, and throughput for converting printed or scanned documents into computer-editable text. The technology behind this innovative approach to OCR is predictive optical word recognition.

Using I-OCR technology to capture data from application forms would reduce expenses. According to technical details about I-OCR technology, we expect the whole process would not last more then few days.

4.2.2 Usage of innovative Internet based solutions

Idea about using Internet solution to capture data from application forms is even more attractive then usage of an IOCR technology. Every secondary school in Slovenia has access to the Internet. Candidates could then apply at the University using a WWW application. The applying process would be controlled by elected teachers that would be prepared to take responsibility. Internet could be used as communication channel between candidates and Admission Service. There would certainly be a small group of the candidates that have had graduated in the past. We would have to enable those candidates to access the Internet and use the WWW application.

Advantages:

- Reduced costs
- Using WWW application candidates would not be able to enter incorrect records
- Coding would be unnecessary
- Data would be inserted directly into database
- Communication between candidates and Admission Service would be cheaper and faster

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University of Ljubljana,
Faculty of Computer and Information Science,
Laboratory of information systems and database systems,
Ljubljana, Slovenia
E-mail: rok.rupnik(at)fri.uni-lj.si
E-mail: marko.bajec(at)fri.uni-lj.si
E-mail: marjan.krisper(at)fri.uni-lj.si

President
Jan Madey - e-mail: president.eunis(at)uw.edu.pl

Webmaster
Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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Ref: 022702

Computer based System for Students Admission and Students Records Information System at the Lithuanian University of Agriculture

Stasys Martišius

Introduction

Lithuanian University of Agriculture (LUA) is the only higher school in Lithuania training agricultural specialists. Total amount of students in five faculties is about 4500. The staff - 31 professors, 216 associate professors, 112 senior assistants, 67 assistants, 50 researches and 700 supporting and administrative staff. LUA library has about 570000 books. LUA campus is in 10 km. south-west from Kaunas center. There are five buildings for teaching purposes, student campus and teachers settlement. University computers are connected into LAN. We have four NOVELL, two NT, one LINUX and one UNIX servers. LAN has access to INTERNET via leased telephone line. Our traffic to INTERNET is noticeable in information exchange among higher schools situated in Kaunas. We are not satisfied with slow connection to INTERNET and 2Mb/s radio-link is being installed.

Computer based System for Students Admission

LUA students admission office started using computer based system four years ago. At first we purchased a programme from Kaunas University of Technology and used it for two years. After some changes in admission rules we created our own module using similar database stucture.

Student admission rules are on the web: http://WWW.LZUA.LT/ . Admission period begins in December and continues till July. Aplications, and other documents are accepted by post. Principles of preliminary admission system were tested at Kaunas University of Technology and appeared to be the best ones. There are three competitions during admission period. Each competition takes place after the end of secondary school trimester when subject marks for the last two years and the trimester marks are evaluated. Pupils invited to study after the first competition are free from the second and third competitions. Having failed in the first competition pupils can participate in following competitions with the new trimester marks. Each time about one third of students are invited.

Record of applicant's database contains personal information (family, name, person code, home address), secondary school name and address, speciality, the average mark, marks in special subjects, competition number and some additional information.

The system can print answers to aplicants about their admission or failing (picture 1) and competition list for each speciality (picture 2). There is a possibility to print statistical data, too.

Data about the enrolled students is transfeered to students records system.

Students Records Information System

First-year students are grouped according to their speciality,and foreign language. Every student can change his/her status in the University himself/herself or according to the initiative of faculty administration. All student status alterations (promotion, expel, academic vacations, etc.) are reported by Rector's or Dean's orders.

Every student has the compulsory study program combined from compulsory study modules for his speciality, and a set of electives included into individual study plan. The main reqirement is that the full-time student has to get marks for 20 credit sum (1credit equals 40 academic hours) during one term.

The databases structure and managing programme have been developed according to the above requirements .

Record of students database contains personal information, faculty, speciality, form of studies (full-time or by correspondence), level of studies (Bachelor, Masters), average mark of the last examination session, sum of scholarship.

All student status alterations are entered into Order database. Orders must meet fixed requirements. Order database contains student identification code, date, type code and free text of the order.

Study module database record contains identification code and description of the module, number of academic hours alloted for lectures, self-training, laboratory and practical works.

Individual study plan database contains student identification code, year of studies, number of term, all information about module of studies and examination results or examination delay date.

The system can print lists of students groups (picture 3), students in academic leave and grant-holders.

Study module database information can be printed in the form of study guide for wide use.

Information about individual study plans and examination marks enable us to calculate average mark which determines sum of scholarship, and prepare documents for book-keeping department. It is possibe to print list of students who have chosen the same study module (picture 4), and to know which modules are popular and which can be withdrown from study programmes. After examination sesion marks can be printed in certain form.

The system based on DOS and FOXPRO LAN is under continuous development.

Lithuanian University of Agriculture,
Informatics department, Kaunas-Akademija,
LT-4324 Lithuania
E-mail: smart(at)nora.lzua.lt

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Trends in High Performance Computing

Victor Alessandrini

The impact of the evolution of current CMOS technologies on high performance computiong is discussed, with particuler emphasis on large high-end systems. The merits and limitations of RISC based parallel systemas are underlined, and it is argued that parallel architectures with vector processing capabilities will probably continue to influence large scale computational physics and chemistry in the future. Some strategic actions adopted at IDRIS/CNRS are presented.

IDRIS/CNRS, Bat. 506, BP 167, 91403 Orsay Cedex, France

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Development of Information Technology at the University of Latvia (State of the Art and Projects)

Harijs Bondars, Maris Treimanis

Objectives of the development of information technology at UL

University of Latvia (UL) has the highest number of students compared to other higher education establishments in Latvia. There are more than 16 000 students, 2 760 employees, 36 majors, 60 laboratories, 12 scientific institutes, 12 faculties, etc.in UL. The development of information technology at the University of Latvia is guided by four main objectives:

- To use computers and INTERNET resources in the educational process at UL (every graduate of the university has to be computer literate, and to be able to use INTERNET resources and computer software in the student's field of study);
- To provide services for scientific institutes and laboratories (these institutions participate in the educational process of graduate students);
- To take part in the development of the Latvian Schools Computer Network - SKOLANET;
- To develop the University's information and administrative computer systems.

These goals can be achieved only by developing a sophisticated system of servers and communications.

Latvian Academic Computer Network - LANET

In June of 1993, the Latvian Academic Network LANET was created at the University of Latvia, with financial assistance from the German government and the Sores Foundation. LANET is aggregate of computing hardware, telecommunications hardware, software, development environment, file systems and experts that provides full INTERNET service to users. LANET also offers to its users training and consultation, provides them with sophisticated computing resources, and manages local or sub-networks, keeping in mind the specific needs of each of them.

The LANET center was created to achieve effective utilization of computing and networking hardware within UL. It is actively involved in the education of students as well as in creation of the necessary environment for scientific work at UL. It provides all UL students and staff with computing hardware resources and INTERNET access. The LANET center also helps to create and run networks within other institutions of higher education in Latvia; to plan, create, and run the project of SKOLANET (a computer network of high schools in Latvia) and educate teachers about INTERNET resources; as well as to develop and maintain the UL management information system.

LANET users

LANET services are used by all departments, laboratories, libraries, institutions, and administration of UL, Riga's Technical University, Latvian Academy of Sports, Latvian Music Academy, Riga's University of Aviation, University of Vidzeme, Institute of Organic Synthesis, Institute of Computer Science, Nuclear Reactor, several schools of Riga, six Valmiera's schools, twenty schools in Kuldiga and its region, four Cesis's schools, some other high schools of Latvia, Parliament of Latvia, Ministry of Science and Education of Latvia, and some other organizations. As of now, there are more than 3000 directly registered users at LANET center (most of them are students and staff of UL). The LANET center organizes education programs, lectures and other educational events for schoolteachers and users of the academic network.

All registered LANET users can utilize not only the INTERNET resources but also other resources of the LANET node like servers.

LANET hardware and software.

LANET consists of the following technical components: the main node, FDDI optical ring, hardware that allows to connect user's local networks to the optical ring, and leased phone lines that allow to connect local networks to the LANET main node in on-line mode, local INTERNET servers, and dial-up phone lines. LANET connection to INTERNET is done through the Latvian Telecommunications Company - Lattelekom. The program System View is used for LANET network management.

The capacity of LANET is determined by the system of servers at LANET and by communications networks. That is why we paid much attention to server system development. Issues about the server system became vital to us when in 1996 we exchanged an IBM donated mainframe 4381 with two processors for a UNIX based four processor server RISC/6000 model G30. At the beginning, the G30 had the necessary capacity, but the growing number of users (over 2000) of INTERNET pushed us to consider more sophisticated and powerful servers for LANET needs. The need to acquire a bigger server was determined also by an objective of UL - to provide its students and staff with an opportunity to use INTERNET services and other computer resources in their daily work (there are more than 16 000 students at UL); by usage in education of software that requires enormous amounts of computer resources (Oracle, DB2, SPSS, Lotus Notes, GIS, WWW, and others); by the growing number of personal computers and local networks; by the increasing speed of connections to LANET (connections to FDDI ring and 128 kb/s connections using leased lines); etc. Comparing many possible solutions, we came to the conclusion that the best choice would be an IBM RISC/6000 model SP. The advantages of the solution using IBM RISC/6000 SP server and high speed communications lines are: a) the ability to administer the network, b) centralized file and date base storage, c) there is no necessity to have separate servers with local computers. These advantages are important because network and date base administrators should be highly qualified and well-paid specialists and it is easier to administer a centralized database as well.

Besides the main server of LANET's main node, there are also other servers that perform specific tasks. In particular, the SUN computer should be pointed out because it is used as a server for SUN users. This server contains files with all necessary software for SUNs and is available to any user (see fig. 1).

LANET subnet - Latvian school computer network SKOLANET.

The “natural” place for creation and development of school computer network is LANET. There are several reasons why we have come to this conclusion. First, the University of Latvia has a long tradition of cooperation with Latvian schools. Second, UL has experience in creating academic networks because it has developed its own - LANET. Since its foundation, LANET center connects schools to its computer network, services computer networks and networking hardware, registers students and teachers from high schools, provides them with log-ins and passwords, with e-mail and file storage, provaide consultation them, helps to select and purchase hardware and software, installs hardware and software, educates teachers and students, etc.

Schools can access INTERNET resources in three ways. First, schools can access the LANET center in dial-up mode using regular phone lines. Dial-up mode is the most common connection mode among schools. There are 114 registered teachers who work in dial-up mode at the LANET center. Second, students and teachers can access INTERNET from INTERNET classes in the University of Latvia. Last year about 170 teachers and students used this option regularly. Third, schools can access the LANET center using leased line connections in on-line mode. Currently there are 7 schools in Valmiera, Cesis, and Kuldiga connected via leased lines to the LANET center.

Informative-Administrative computer system of UL (LUIS).

Two years ago UL started to create its new Informative-administrative system. The system is being developed by using sophisticated IT technology. Currently there have been created and run LUIS base modules. The modules run all necessary registers (students, teachers, majors, etc.) and corresponding servers. Components of LUIS are being used by UL administration, faculties and other structures. Functional possibilities of LUIS are being broadened in order to facilitate functionality of traditional informative-administrative system.

Oracle Case* Method and Oracle Case tools (Designer /2000, Developer/2000, and others) are used to create LUIS.

UL professors, teachers, and students are developing this project.

Information technology project of the Ministry of Science and Education of

Latvia

Educational system in Latvia is huge and complicated. Every citizen of Latvia gets in touch with the system directly or indirectly. The system covers all country and realizes many different functions like education, scientific experiments, planning, control, etc. the functions are being performed in different type of organizations like schools, municipalities and ministries.

In the educational system, information technology is being used in very limited ways. There has been started development of informatization infrastructure in the educational system. The infrastructure is upgraded constantly. Effective utilization of the infrastructure is slowed down by lack of educational programs, methodology and software. The reasons of the pure utilization of existing infrastructure are the lack of co-ordination in developing information technology in educational system and the low priority to develop the infrastructure.

Ministry of Education and science ordered to specialists from UL to perform strategic analysis of the educational system. Also, the specialists were asked to develop requirements of complex and complete informatization of the system. These requirements are analogical to the requirements developed by the U.S. National Coordinating Committee on Technology in Education and Training. ("The National Information Infrastructure: Requirements foe Education and Training" , March 25,1994). UL and IBM-Latvia offer a complex solution to the problem.

Realization of the project will computerize education system, its management and services. The development of the information systems infrastructure is subject to several preconditions: it has to be developed on the basis on modern science and technology; common infrastructures have to be used for the various functionality's (education, administration, informative cervices), existing infrastructures of the education system have to be used if they correspond to the objectives and needs of the project; integration of science and education has to taken into account.

Project foresees installation of hardware only to the educated and informed user how to run the hardware and software. It means that the first step is to develop software and educate users, and only then the hardware can be introduced.

In this project we propose to use ATM technology, rather than FDDI. Both types of networks will coexist in the initial phases of the project. In collaboration with Lattelekom (Apollo), favorable conditions have been obtained for INTERNET access and LATNET developments between towns where Universities are located. In further collaboration with Lattelekom we hope to form ATM links between these sites.

The project has to be finished by the year 2000.

University of Latvia
Raina b. 19., Riga, LV1586 Latvia
E-mail: hb(at)lanet.lv, mt(at)lanet.lv

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Les divers Aspects de l'Administration de Réseau: Exemple du Réseau OSIRIS

P.Guterl, A.Cote, P.Gris, JJ.Pansiot

Le Centre Réseau et Communication a en charge le réseau informatique inter campus Osiris, qui regroupe les trois universités, les centres de recherche et les écoles d'ingénieurs de Strasbourg,.

Les missions confiées au CRC sont de 4 ordres:

- L'administration du réseau.
- Les services réseau pour les utilisateurs.
- La gestion de l'information.
- Le support technique pour les problèmes liés au réseau.

Le réseau Osiris est constitué de deux anneaux fddi servant de backbone, d'une vingtaine de routeurs pour les noeuds d'interconnexions, et environ 200 concentrateurs desservant environ 5000 machines connectées.

Pour assurer la meilleure qualité de service possible dans ces 4 domaines, il a fallu mettre en place des infrastructures permettant de superviser le réseau, gérer les services et l'information et répondre aux demandes des utilisateurs. Nous allons décrire comment et avec quels outils l'administration de réseau a été mise en place.

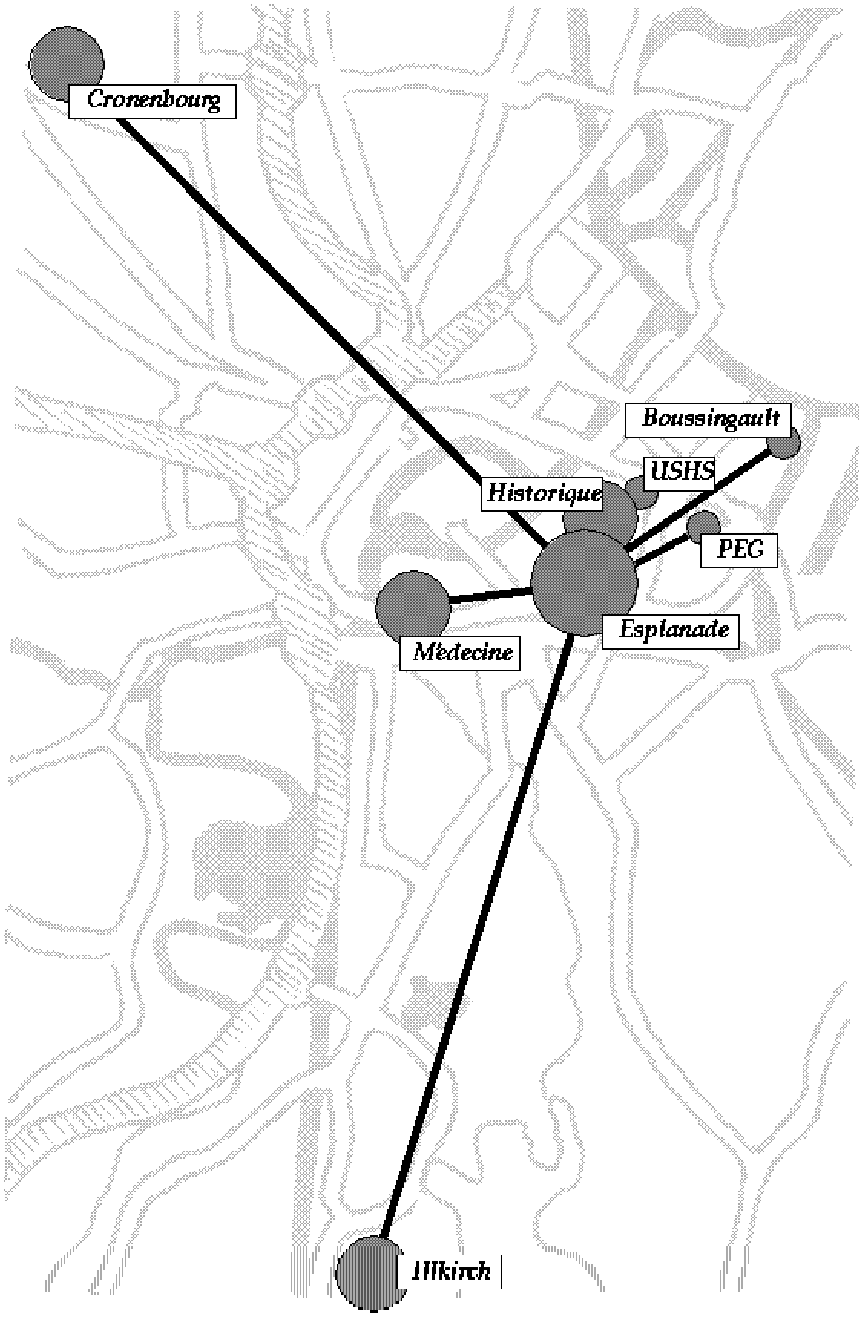
La gestion du réseau recouvre plusieurs aspects:

- la conception.
- La mise en oeuvre.
- Les tâches de fonctionnement:
- Surveiller et anticiper.
- Dépanner.
- Aspects statistiques nécessaires à l'évolution du réseau.

Les objets à administrer dans un réseau sont les supports physiques, les équipements actifs, les services applicatifs (dns, messagerie...) et les applications réseau (telnet, ftp..). Cette supervision est réalisée grâce à des programmes spécifiques, à un logiciel d'administration (Sun Net Manager), et le logiciel Optivity. La base de données, qui sert à gérer le serveur de noms du domaine, stocke les caractéristiques des équipements.

Présentation du Réseau OSIRIS.

Le réseau Osiris existant



Echelle : 1000m

Figure 1: *Plan de situation général des principaux campus strasbourgeois du réseau Osiris*

Le réseau Osiris est constitué de 10 campus répartis sur l'ensemble de la communauté urbaine de Strasbourg. Ceux-ci sont raccordés par des fibres optiques, 5 liaisons spécialisées et 3 faisceaux hertziens. Les 10 campus représentent 80 bâtiments et l'on dénombre 6000 machines connectées par 127 sous réseaux Ethernet.

Infrastructure physique actuelle du réseau Osiris

Sur cette infrastructure sont véhiculés différents protocoles réseaux dont le principal est TCP/IP mais aussi IPX, Appletalk.

Actuellement, un sous-réseau correspond à une entité telle qu'un laboratoire de recherche, ou un service administratif.

Lorsque le réseau a atteint une certaine dimension, il est impératif d'avoir à jour l'ensemble des schémas au niveau du câblage, pour suivre le cheminement des câbles jusqu'à la tête de réseau dans les bâtiments. Pour avoir une mise à jour la plus fréquente, on a mis à disposition des correspondants réseau les schémas sous forme de fichiers pdf, à travers un serveur W3.

Surveillance des Applications

Un programme teste, de manière périodique les applications sensibles tel le sendmail, le dns, le serveur W3 en simulant une application cliente. En cas de dysfonctionnement, un message est envoyé à une personne de permanence, et suivant les cas, l'application est relancée de manière automatique.

Surveillance de la Connectivité

Un programme dénommé " pingpong " permet de tester la connectivité avec l'utilitaire fping dérivé du programme unix ping. Pour garder une cohérence, les machines cibles sont enregistrées dans une table de la base de données du serveur de noms. Lorsqu'une machine ne répond pas à la requête, un message est transmis à une personne de permanence, qui prendra les dispositions nécessaires en cas de besoin.

Cohérence de l'Espace d'Adressage IP

Un des problèmes, fréquemment rencontrés par les utilisateurs, en particulier dans le monde de la micro-informatique concerne la duplication d'adresse ip due a l'appropriation sauvage d'une adresse ip. Dans ce but, on lit périodiquement les tables arp des routeurs par une requête snmp, et le couple d'adresse (ethernet, ip) est comparé aux valeurs des tables stockées dans la base. En cas d'incohérence, (machine non déclarée, modification de l'adresse ip), les données sont stockées dans une table. En consultant les tables via l'interface W3, cela permet de résoudre facilement les conflits d'adressage, en cas de problème.

La Station de Management

La surveillance des machines

La station d'administration sert à la surveillance de machines sensibles grâce au générateur d'événements, on peut ainsi surveiller les divers éléments des serveurs (l'espace disque, l'utilisation de la cpu). Certains équipements génèrent des alarmes snmp lors de l'apparition de problèmes, on peut ainsi prévenir les responsables lors de l'arrivée des alarmes.

La surveillance du réseau

Le logiciel de gestion Optivity permet de gérer les concentrateurs Synoptics et les routeurs. Il est basé sur la plate-forme d'administration Sun Net Manager. On peut ainsi surveiller les paramètres tels que le % d'utilisation du réseau, ou le taux d'erreurs. Des seuils ont été positionnés sur les équipements pour déceler des dysfonctionnements. Les remontées des alarmes propriétaires sont traitées de manière particulière, permettant une agrégation des types d'alarmes et par équipement.

Toutes les alarmes, envoyées par les équipements, n'ayant pas le même niveau d'urgence, un pré-traitement du message d'alarme envoyé par la station d'administration est nécessaire. Seuls les messages "urgent" sont envoyés au gestionnaire.

L'aspect statistique est réalisé grâce à un programme[Mémoire CNAM 1994 M.Dufaut] basé sur les variables SNMP des équipements, la collecte étant réalisée par la couche API de Sun Net Manager, et les données stockées dans une base de données. Les courbes sont éditées quotidiennement ou hebdomadairement.

Centre Réseau Communication,
Université Louis Pasteur,
7 rue Descartes, 67084 Strasbourg, France
E-mail: Patrick.Guterl(at)crc.u-strasbg.fr

Anna Pacholak - e-mail: a.pacholak(at)uw.edu.pl

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Organisation d'un Centre de Réseau pour le Support Technique aux Utilisateurs

P.Guterl, S.Behr, R.Biechel, A.Cote, S.Gillmeth, P.Gris , S.Ley, M.Mayer, F.Ostre, JJ.Pansiot

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- Les services réseau pour les utilisateurs.
- La gestion de l'information.
- L'assistance technique pour les probl&è;mes liés au réseau.

Nous décrirons l'organisation du service d'assistance "svp-osiris".

PRESENTATION DU RESEAU OSIRIS.

Le réseau Osiris existant

BECOME A MEMBER
- Join Eunis
- Application form for institutions/organizations
- Application form for Corporate membership
- Application form for personal members
- Member's data change

RESOURCES
- Distribution lists
- Publications
- Newsletters
- Information Network
- Archives

ORGANIZATION
- Statutes
- Board of Directors
- Executive Secretary
- Past Presidents
- Members

EVENTS
- EUNIS Congresses
- Rectors' Conferences
- Elite Award
- Jens Dørup Award

ACTIVITIES
- Task Forces
- Groningen Declaration
- International Exchange Programme
- Partnership
- Best Practices

Search...

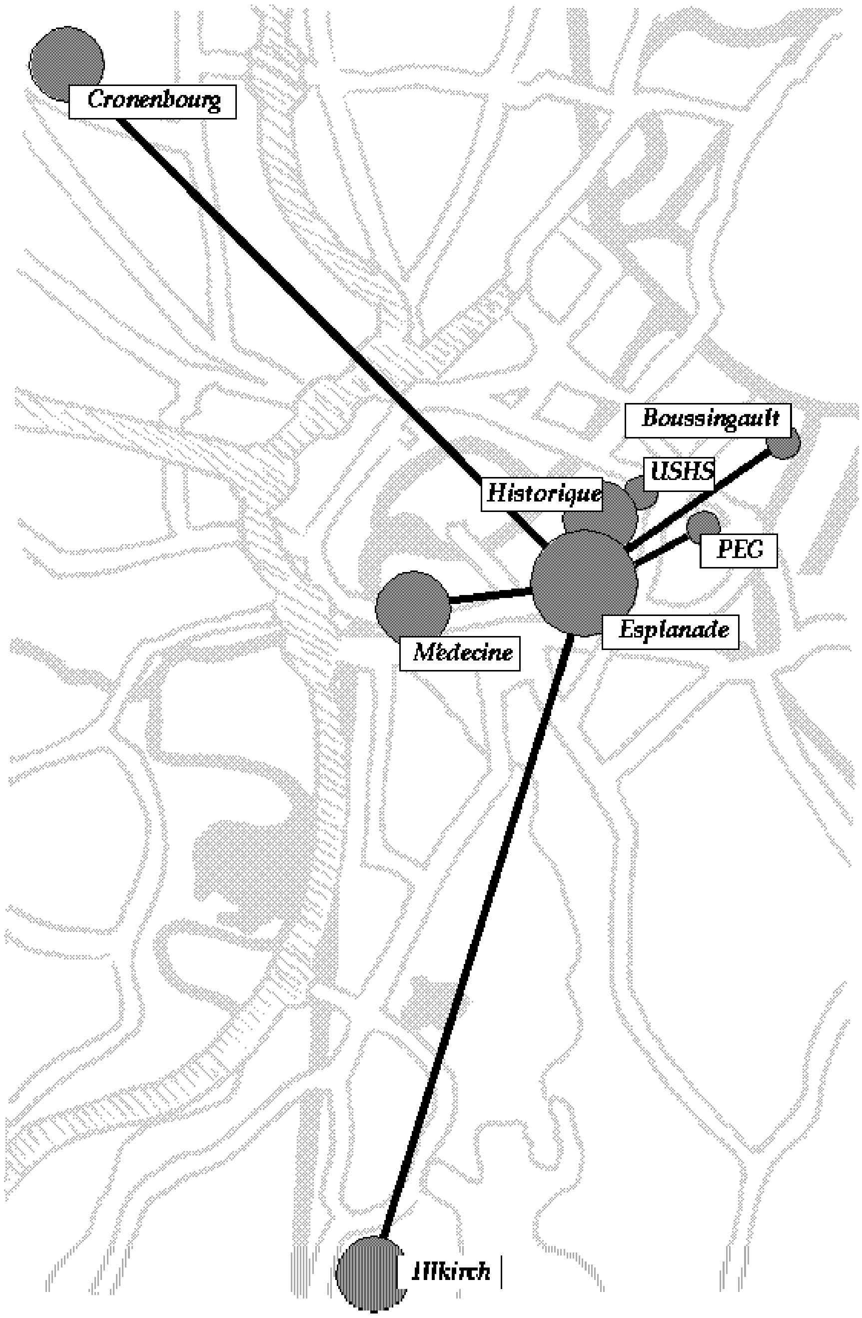
REGISTERED ACCESS FOR EUNIS MEMBERS' REPRESENTATIVE

User Name

Password

Remember Me

Forgot your password?
Forgot your username?
Create an account



Echelle : 1000m

Figure 1: Plan de situation général des principaux campus strasbourgeois du réseau Osiris

Le réseau Osiris est constitué de 10 campus répartis sur l'ensemble de la communauté urbaine de Strasbourg. Ceux-ci sont raccordés par des fibres optiques, 5 liaisons spécialisées et 3 faisceaux hertziens. Les 10 campus représentent 80 batiments et l'on dénombre 6000 machines connectées par 127 sous réseaux Ethernet.

Infrastructure physique actuelle du réseau Osiris

Sur cette infrastructure sont véhiculés différents protocoles réseaux dont le principal est TCP/IP mais aussi IPX, Appletalk.

Actuellement, un sous-réseau correspond à une entité telle qu'un laboratoire de recherche, ou un service administratif.

DESCRIPTION DU SERVICE D'ASSISTANCE SVP-OSIRIS.

De part la taille du réseau Osiris et pour assurer la meilleure qualité de service possible dans les 4 domaines cités ci-dessus, il a fallu mettre en place des infrastructures permettant de superviser le réseau, gérer les services et répondre aux demandes des utilisateurs. Le pivot de cette organisation est le service de permanence "svp-osiris ", qui est assuré, sur une période hebdomadaire, par les personnes du CRC. La fréquence pour assurer ce service est bimestrielle. Un numéro de téléphone unique et une adresse électronique générique svp-osiris@u-strasbg.fr ont été diffusés à l'ensemble des utilisateurs du réseau Osiris. Ce système permet aux autres personnes de ne pas Ítre trop souvent sollicités pour des problèmes mineurs. Chaque personne du service, ayant un domaine de compétence spécifique, peut intervenir en cas de problèmes graves. L'écueil à éviter, c'est que l'utilisateur continue par la suite à s'adresser à la personne qui était de permanence au moment où son problème est apparu. Après une période d'adaptation, les utilisateurs ont pris l'habitude de solliciter le service de permanence. La diversité des problèmes a nécessité de développer un certain nombre d'applications qui permettent soit de rechercher des informations, consulter des documents ou intervenir à distance. Cet ensemble est basé sur trois logiciels:

- Un serveur privé W3,
- Une base de données SGBD (Sybase),
- Une plate-forme d'administration réseau Sun Net Manager.

Les outils sont accessibles à travers un browser W3. Les applications seront détaillées dans les chapitres où sont décrits les services correspondants.

Le système de roulement, ainsi que la diversité des problèmes à traiter a entraóné la mise en place d'un outil de suivi des incidents. Après une étude de marché, il s'est avéré plus avantageux de développer une application propriétaire qui se base sur le SGBD, les offres du marché étant sur-dimensionées par rapport à nos besoins.

Le principe est que pour chaque domaine, il existe un responsable au CRC. La personne de permanence enregistre le problème, et le responsable est prévenu par mail qu'un incident concernant ces attributions vient d'Ítre ouvert. Une liste des incidents est automatiquement éditée en fin de semaine.

En résumé le fonctionnement de "svp-osiris" lors d'un appel d'un utilisateur est le suivant: quand un utilisateur soumet un problème, la personne de permanence essaie en fonction du type de problème (réseau, e-mail, dns) de le résoudre à l'aide des documents en ligne, ou de l'historique des problèmes, sinon l'incident est répertorie dans la base de données a l'aide d'un logiciel de gestion des incidents. Lorsque l'incident est enregistré, les personnes, ayant les meilleures compétences, sont automatiquement prévenues par e-mail. La première version a été développée sous X motif, la deuxième version utilise un browser W3, ainsi que le langage Javascript pour vérifier la validité des données.

La dispersion géographique ainsi que la taille du réseau nous a amené à mettre en place un système d'informations basé sur des correspondants réseau qui gère un ou plusieurs sous réseaux. On a délégué à ces personnes la gestion de la partie locale de l'adressage, elles peuvent intervenir pour des problèmes simples et sont nos interlocuteurs privilégiés en cas de problème réseau.

Description des services gérés par le CRC

Le service de noms (DNS)

Pour la gestion du domaine u-strasbg.fr, le serveur de noms (dns) est le service essentiel pour le domaine.

La gestion du serveur de noms est faite à partir des données stockées dans la base de données. Les valeurs sont saisies à travers des masques grâce à des applications de type L4G. L'application permet d'enregistrer les différentes options d'un serveur de noms (A, CNAME, MX), et de cette manière on évite les problèmes de duplication de noms ou d'alias et d'adressage IP et on assure une cohérence des données. Un programme écrit en C génère les fichiers spécifiques au serveur de noms et réinitialise le programme in.named.

Pour éviter les problèmes liés à l'adressage IP, les correspondants réseau gèrent l'adressage locale des sous réseaux. Grâce à cette organisation, nous avons un interlocuteur, qui distribue les adresses IP aux personnes désirant connecter un équipement, qui vérifie que les nouveaux équipements sont conformes et ne risquent pas de créer des perturbations sur le réseau. La procédure de déclaration d'adresse IP est à l'initiative du correspondant réseau qui envoie un formulaire de déclaration pré défini par messagerie électronique à la permanence. Les données sont saisies à travers le masque, et lorsque la nouvelle machine est insérée dans le serveur de noms, un message d'acquittement est renvoyé à l'expéditeur. Cette procédure a éliminé les erreurs dues aux incohérences dans les fichiers du serveur de noms, et aux duplications des données. La déclaration de la machine peut se faire sous 24 heures. Grâce aux informations stockées dans la base, la personne de permanence, en cas de besoin, peut retrouver la topologie du réseau à partir de l'adresse ip d'une machine (localisation du sous réseau, interface du routeur concerné ...). Le résultat d'une requÍte de recherche renvoie en plus des caractéristiques d'une machine (nom, adresse ip) son numéro ethernet ainsi que le nom de sous réseau sur lequel elle est connectée ainsi que le nom du routeur et le numéro de son interface. On peut ainsi facilement localiser l'équipement.

Un des problèmes, fréquemment rencontrés par les utilisateurs, en particulier dans le monde de la micro-informatique concerne la duplication d'adresse ip due a l'appropriation sauvage d'une adresse ip. Dans ce but, on lit périodiquement les tables arp des routeurs par une requÍte snmp, et le couple d'adresse (ethernet, ip) est comparé aux valeurs des tables stockées dans la base. En cas d'incohérence (machine non déclarée, modification de l'adresse ip), les données sont stockées dans une table. En consultant les tables via l'interface W3, cela permet de résoudre facilement les conflits d'adressage..

LA MESSAGERIE

En tant que gestionnaire du réseau Osiris, nous avons en charge l'ensemble de la messagerie, tant au niveau du

mailhost du domaine u-strasbg.fr, que de la gestion des boótes aux lettres. La gestion du mailhost relève des fonctions classiques (règles d'écriture dans le sendmail.cf en fonction des caractéristiques locales, gestions des queues de messages..).

Le parc des machines connectées est dominé par les micro-ordinateurs de type PC/Macintosh qui ne sont pas adaptés pour le service de messagerie puisqu'ils ne sont pas en service de manière permanente. Nous avons mis en place un service de boites aux lettres, qui permet à aux personnes remplissant les conditions de disposer d'une boite aux lettres sur le serveur de messagerie. Pour personnaliser ce service les adresses sont réécrites sous la forme Nom.Prenom@service-ulp.u-strasbg.fr. Pour faciliter la gestion, une application à travers W3 a été développée pour créer une boite aux lettres modifier certaines caractéristiques, ou supprimer un utilisateur. Gräce a ce système le responsable de service de messagerie est déchargé de cette fonction, qui est pris en charge par le service de permanence. Le problème majeur a été de développer des programmes permettant de modifier les fichiers sensibles en respectant les règles de sécurité. Le logiciel Eudora est installé sur les micro-ordinateurs, pour gérer la messagerie. La requëte la plus fréquente concerne la perte du mot de passe permettant d'accéder à la boóte aux lettres du serveur Unix. Celui-ci est régénéré automatiquement à travers une application et envoyé directement par messagerie à l'utilisateur.

L'ANNUAIRE

Le CRC a été chargé de la gestion de l'annuaire des personnels de l'Université. Une des caractéristiques de l'annuaire, est que les données sont modifiées très souvent. Pour éviter de mobiliser trop de ressources humaines pour les nouvelles insertions ou les mises à jour, la saisie des données sous un format pré défini sous Excel a été délégué aux entités de recherche. Les données sont insérées à partir d'une feuille Excel dans les tables de permanence. Les mises à jour peuvent ëtre réalisée par les personnes elle-mëme à travers le serveur W3, et l'authentification de la personne est basée sur la messagerie et sur un échange de clé. Cette clé est comparée à celle généré lors de la demande de modifications des cordonnées. L'annuaire peut ëtre consulte par divers moyens: W3, le client ph en particulier celui intégré dans Eudora, ainsi que par e-mail.

D'autres services nécessitent des opérations d'administration sur des stations Unix. L'ensemble des procédures a été automatisé via le serveur W3.

LA GESTION DES MESSAGES DE SVP-OSIRIS

Le nombre important de messages traités par la permanence, a nécessité une gestion en dupliquant les messages reçus et envoyés dans des fichiers par semaine. Cela permet en cas de litige de retrouver un échange de messages entre des utilisateurs et le service de permanence.

CONCLUSION

Cette organisation permet a un interlocuteur d'avoir un correspondant unique, pour les personnes du CRC, hors de la semaine de permanence, ne prendre ne compte que les problèmes importants, et ainsi pouvoir faire évoluer d'autres projets. Ce système permet également de centraliser les informations internes, ainsi qu'un certain nombre de documents.

Le revers peut être de ce succès est qu'on est de plus en plus sollicité pour des problèmes n'ayant qu'un lointain rapport avec la problématique réseau.

Centre Réseau Communication
Université Louis Pasteur,
7 rue Descartes, 67084 Strasbourg, France
E-mail: Patrick.Guterl(at)crc.u-strasbg.fr

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Les CRIs face aux nouveaux moyens de traitement de l'information

Gérard JEAN-FRANCOIS

1. Introduction

Un CRI (Centre de Ressources Informatiques) est un service commun d'un établissement d'enseignement supérieur, qui a pour mission principale de mettre en œuvre la politique informatique de l'établissement. Si on se réfère à l'évolution technologique, cette politique consistait dans les années 60 à mettre en œuvre une machine qui faisait du calcul scientifique, d'où l'appellation de " Centre de Calcul ".

Pour remplir ses objectifs, le CRI dispose de moyens matériels, logiciels et humains qu'il doit mettre à la disposition des utilisateurs dans essentiellement trois domaines : la recherche, la gestion et le soutien à la pédagogie. Il a très souvent un rôle de conseil pour les achats de matériel et de logiciel, un rôle de formation et d'information à destination des enseignants, chercheurs et des personnels. Lui est confiée très souvent aussi la responsabilité du réseau.

Nous sommes très loin du calcul scientifique et il semble logique de dire qu'aujourd'hui un CRI participe au traitement de l'information. Cette participation est variable d'un établissement à l'autre et intègre plus ou moins les nouvelles technologies qui apparaissent. L'objet de cet article est de faire un bilan de la situation et de proposer des pistes pour prendre en compte et organiser au mieux l'utilisation des nouvelles technologies. L'auteur bien entendu n'engage que lui-même.

2 .Traitement de l'information

Il n'est peut-être pas inutile de rappeler que le traitement de l'information, disponible souvent sous forme analogique, se fait sous forme numérique. Il faut noter aussi que cette information est véhiculée sur les réseaux dont la généralisation est indispensable. L'arrivée du réseau sur le poste de travail et l'émergence des réseaux hauts débits doit être prise en compte pour l'utilisation des nouvelles technologies ce qui entraîne du même coup l'abolition des distances et des délais d'acheminement.

Il existe deux catégories d'utilisateurs du traitement de l'information :

- ceux qui créent l'information à destination des autres
- ceux qui reçoivent l'information

Ces deux catégories sont par exemple dans le domaine de la pédagogie les enseignants et les enseignés. Pour la gestion et pour la recherche on est également dans la même situation et le schéma classique est le suivant :

- le but recherché est de diffuser des résultats sur différents supports (papier, CD-ROM, vidéo, électronique)
- ces résultats sont obtenus à partir de données disponibles sur des supports variés (papier, vidéo, électronique) qui constituent des documents qu'il faudra numériser.
- pour obtenir les résultats à partir des données il faut effectuer des traitements plus ou moins complexes. Certains sont très spécifiques par exemple traitement d'images satellitaires, d'autres sont banals et utilisés par tout le monde c'est le cas du traitement de texte.

Si on approfondi cette chaîne du traitement de l'information on s'aperçoit très vite que tous les domaines spécifiques ont en fait de nombreux points communs faisant appel aux mêmes compétences, deux exemples le prouveront.

Le téléphone : il est devenu tout numérique et les techniques utilisés dans les commutateurs ont d'énormes points communs avec celles utilisées dans les réseaux

La reprographie : il n'existe plus de duplicateurs à alcool mais tout simplement des appareils incluant scanner et imprimante laser qui peuvent être très facilement connectés au réseau, si bien qu'on en arrive à la gestion électronique des documents.

Pour résumer ce problème du traitement de l'information on peut affirmer, sans l'ombre d'un doute, que tous les domaines sont concernés : la pédagogie, la recherche,

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l'administration. IL faut aussi remarquer que l'utilisation du traitement de l'information a été sous utilisé dans des secteurs tels que les sciences humaines, la culture et aussi la communication.

Nous allons reprendre chaque étape du traitement de l'information et faire une liste non exhaustive des différents moyens utilisés.

3. Diffusion de l'information

Elle est faite dans un établissement d'enseignement supérieur par différents services (en réalité par tous les services) dont les principaux sont :

- le service de la communication
- le téléenseignement
- le laboratoire de langue
- le service publications
- le service de la documentation

Les vecteurs utilisés sont:

- le support papier sous toutes ses formes, notons au passage que l'édition papier fait appel à l'imprimerie, qui a elle aussi évolué et utilise maintenant l'informatique pour faire de la PAO (publication assistée par ordinateur). Est également concerné le service de reproduction déjà cité.
- le film
- la vidéo
- le rébreau sur lequel on diffuse la visio-conférence, les documents sous forme W3, le téléenseignement etc...
- le CD-ROM dont la réalisation sera détaillée plus loin.

Le constat global que l'on peut faire c'est que tout le monde a besoin de diffuser des supports. Pour réaliser ces supports chacun est amené à utiliser des techniques assez avancées par exemple le traitement d'image, mais chaque service n'utilise pas forcément le même logiciel de traitement d'image d'où une dispersion des compétences et surtout un manque de maîtrise des logiciels utilisés.

4. Acquisition des données

Il faut disposer de données sous forme numérique, or les données sont sous forme quelconque et sur des supports très variés :

- \- le support papier : si la reconnaissance optique de caractères est devenue courante, la numérisation d'images couleur en haute définition nécessite des matériels pas toujours disponibles.
- \- le support film n'est pas toujours simple dans la mesure où on peut avoir des documents sur des supports aux formats disparus.
- \- le support est l'objet lui-même : objet de fouille, objet de collection, objet d'art. Pour chaque cas il est nécessaire de trouver une solution adaptée car parfois l'objet est inaccessible et tout dépend du résultat que l'on veut obtenir. Dans ce genre de situation l'appareil photo numérique peut rendre service
- \- la vidéo nécessite des interfaces particulières ainsi que la numérisation du son.

Dans le domaine de l'acquisition de données, il est un support qui a priori ne pose pas de problème c'est le support électronique puisque l'information est déjà numérisée, pourtant on est en droit de se poser quelques questions sur les facilités d'accès à la documentation.

L'accessibilité à travers les réseaux à des bibliothèques électroniques contenant toutes sortes de documents pose d'énormes problèmes de recherche de l'information.

Les logiciels tels que les moteurs de recherche apparus sur le Web sont les prémices de l'évolution de la recherche documentaire.

5. Traitement de l'information

Reprenons l'exemple du traitement de texte basique : sa généralisation est certaine dans un avenir plus ou moins proche, d'autant que l'utilisateur moyen n'utilise qu'une faible partie des possibilités existantes. Compte tenu de l'évolution des interfaces utilisateurs qui deviennent de plus en plus conviviaux, on va s'orienter vers une plus grande autonomie des utilisateurs, à titre d'exemple : nombreux sont maintenant les chercheurs qui utilisent des logiciels de retouche d'image.

Reste le problème de l'optimisation du traitement.

Nous sommes face à une explosion de logiciels de traitement, certes ils sont conviviaux, mais faut-il investir dans l'approfondissement de leur utilisation ou faire appel à des compétences existant déjà dans l'établissement ?

6. Méthodologie et mise en œuvre

Pour mettre en œuvre les nouvelles technologies appliquées au traitement de l'information, on peut proposer la démarche suivante :

6.1. il est nécessaire de faire l'inventaire des ressources existant dans l'ensemble de l'établissement. Cet inventaire doit être accompagné d'une évaluation précise des compétences car on peut se trouver dans le cas d'un service qui déclare faire de la PAO alors qu'il utilise un banal traitement de texte.

L'inventaire doit porter sur le matériel, le logiciel, le personnel mais aussi sur le taux d'utilisation. Par la même occasion seront recensés les dysfonctionnements éventuels.

6.2. tout l'existant étant répertorié il est nécessaire de connaître les besoins c'est à dire les projets à venir.

6.3. pour faire l'adéquation entre les besoins et les moyens existants il faut le mettre en place une structure coordinatrice. Le mot structure ne veut pas dire service c'est plus " une fonction guichet " qui face à une demande va réagir en disant par exemple pour réaliser telle partie de votre projet vous vous adressez au service X et pour telle autre au service Y.

Cette structure peut conseiller la sous-traitance et peut éventuellement si elle en a les moyens jouer un rôle de planification.

6.4. réorganisation des services : en fonction de l'existant et des besoins, l'établissement peut être amené en fonction de ses orientations à modifier les objectifs des différents services. Pour les lacunes se posera le problème soit de sous traiter soit de créer de nouvelles fonctions cela doit rentrer dans un schéma directeur.

7. Place du CRI

Comme tous les services le CRI se verra assigner des objectifs rentrant dans le cadre de l'utilisation des nouvelles technologies pour le traitement de l'information. Pour cela on tiendra compte des compétences existantes ou susceptibles d'être acquises facilement. Il est une chose certaine c'est que de toute façon il existe un élément fédérateur le réseau.

C'est autour de lui qu'on peut organiser un ensemble de compétences réparties dans différents services tels que le CRI. Il faut veiller à ne pas avoir un émiettement de services mais au contraire un regroupement de fonctions dans quelques services de taille suffisamment grande afin d'assurer une continuité de services pendant les absences (formation, congés, maladie..).

8. Exemple du CD-ROM

Cet exemple est assez représentatif de l'utilisation des technologies du traitement de l'information et des CRIs se sont déjà trouvés confrontés à cette situation.

Le CD-ROM est un support comme un autre de diffusion de l'information. Nous ne nous étendrons pas sur la conception proprement dite du CD-ROM, c'est tout simplement un auteur qui veut transmettre ses connaissances. Un fois le thème et le contenu défini il faut passer à la réalisation.

Tout d'abord le CD-ROM doit être attrayant. En plus du sujet, il doit être facile d'emploi et beau, ce qui oblige à utiliser les techniques de communication qui vont faire appel à l'ergonomie pour l'interactivité et à la présentation homogène des informations (obligation d'une charte graphique). La nature des données est très variée citons : textes, graphiques, images, son, vidéo.

Il faut les numériser.

La numérisation va nécessiter pour chaque type de support un appareil particulier avec l'utilisation d'un logiciel spécifique.

Envisageons quelques cas qui peuvent se présenter.

Parmi les données se trouvent beaucoup de diapositives qui justifient l'achat d'un scanner. Qui va disposer de cet appareil ? le CRI ou le service audio-visuel ? Qui va l'utiliser ? L'utilisateur en libre service de façon imparfaite ou bien un technicien formé spécialement donc performant ?

Parmi les données se trouvent aussi quelques vues qu'il faut extraire d'un film vidéo tourné par exemple lors d'une expérience. Faut-il investir dans un équipement cher (matériel et logiciel) avec une formation spécifique pour une utilisation très épisodique ou bien faire appel à la sous-traitance ?

Les données étant numérisées il faut les traiter, par exemple retoucher les images. Est-ce l'auteur qui doit le faire ? Doit-on avoir à disposition un service de PAO (Publication Assistée par Ordinateur) ? Si la réponse est oui cette fonction est-elle assurée par l'imprimerie, le service communication, le service audio-visuel, le CRI ?

A L'aide de ce petit exemple on peut appréhender la complexité et le nombre des techniques à mettre en œuvre ainsi que la diversité des intervenants.

9. Conclusion

Pour traiter l'information il faut assurer de façon professionnelle certaines fonctions indispensables. L'établissement doit décider s'il les assume lui-même ou s'il les fait effectuer à l'extérieur.

Si la solution retenue est de réaliser soi-même certaines fonctions cela doit rentrer dans un schéma directeur précis et comporter des moyens financiers et humains.

CRI Université de Caen,
Esplanade de la Paix, 14032 Caen Cedex, France
E-mail: jean-francois(at)criuc.unicaen.fr

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Towards the re-integration of the University of Ljubljana information system

Viljan Mahnic

1.Introduction

At the EUNIS '96 Congress, Peter Mederly presented a paper describing some general characteristics of administrative computing at Central and Eastern European universities (Mederly [1]), viz. the prevalent use of personal computers, the still widespread use of the MS-DOS operating system, and the shortage of networked applications sharing a common data base, in spite of a substantial effort to build suitable computer networks. It was also noted that the majority of universities are aware of these deficiencies and are planning to start the development of a new information system within the next three years.

To a great extent the aforementioned conclusions also apply to the University of Ljubljana, which is the largest university in Slovenia. It has 26 member institutions (20 faculties, 3 academies, and 3 colleges), more than 40,000 students, the teaching and research personnel number more than 2,600, and the administrative staff about 1,250 (for details see Table 1). However, given the fact that in Slovenia (as well as in some other Central and Eastern European countries, e.g. in Slovakia) the faculties have substantial autonomy within their universities, and they often have their own policy regarding the usage of information technologies, the development of an integrated university information system is not only a difficult technical task, but requires a substantial organizational effort.

Table 1: Member institutions of the University of Ljubljana

Id	Faculty/Academy/College	Staff: Teaching & Research Full-time	Staff: Teaching & Research Part-time	Staff: Administrative	Students: Undergraduate	Students: Postgraduate
F1	Biotechnical	187	74	177	2702	163
F2	Economics	84	53	48	6503	351
F3	Architecture	49	4	21	838	14
F4	Civil Engineering and Geodesy	70	21	53	989	31
F5	Social Sciences	64	28	28	2588	130
F6	Electrical Engineering	104	0	72	1480	91
F7	Computer and Information Science	42	0	11	819	49
F8	Mathematics and Physics	79	8	40	624	54
F9	Chemistry and Chemical Technology	89	23	62	1320	72
F10	Pharmacy	31	7	23	739	1
F11	Natural Sciences and Engineering	72	15	57	1079	48
F12	Machine Engineering	113	26	94	1543	60
F13	Sport	52	17	41	664	28
F14	Arts	293	53	109	4890	238
F15	Medicine	271	0	174	1442	126
F16	Education	115	50	43	2669	17
F17	Law	27	10	15	1725	23
F18	Theology	37	2	12	492	12
F19	Veterinary	54	10	59	360	37
F20	Maritime Studies and Transport	30	41	13	1562	0
A21	Music	45	57	11	334	26
A22	Theatre, Radio, Film, and Television	28	13	19	106	2
A23	Fine Arts	40	9	19	272	32
C24	Social Work	17	13	9	677	0
C25	Health Care	44	25	40	1192	0
C26	Public Administration	17	13	7	3324	0

	2054		572					
					1257	40933		1605
T O T A L:		2626						
				3883			42538	

The aim of our paper is:

- to supplement Mederly's investigation with certain details in order to show that there are great differences between faculties within a single university that render the development of an integrated information system more difficult;
- to point out some experience that has proved useful in overcoming these difficulties in the course of building a unified student records information system at our university;
- to make some recommendations on how to achieve the reintegration of different parts of the system.

Accordingly, section 2 of our paper is devoted to a detailed analysis of the present situation in the following areas: the finance information system, the personnel information system, and the student records system. In section 3, some experience from the development of the student records information system is described, while section 4 makes proposals for future activities.

2. Analysis of the present situation

The analysis of the present situation is based on the results of a survey that included all member institutions of the University of Ljubljana. Each member institution completed a questionnaire which contained questions about applications within each of the aforementioned systems. For each application the following data had to be specified:

- operating environment (basic information about computer equipment and operating system)
- network environment (whether the application is running standalone or in a network)
- the source of the application (who supplied the required software)
- implementation environment, if known (e.g. Clipper, Oracle, C etc.)
- the connection among applications (whether different applications running in a network share a common database)

The survey revealed that only personal computers are used for administrative computing, and that DOS is still the prevalent operating system, although the computers are in most cases powerful enough to allow the use of Windows 3.1 or Windows 95 operating system. Such a situation is a consequence of the fact that most programs are written in Clipper or similar tools, which only allow the development of DOS applications. Novell NetWare is the prevalent network operating system, while some institutions use Windows-NT in combination with Windows 95 on individual workstations.

It also became evident that most applications (except in the student records information system) were bought as standard packages from different suppliers. However, these purchases were not co-coordinated and, consequently, we have a great number of different, mutually incompatible applications that are probably appropriate for individual member institutions, but can not be integrated into a coherent information system at the university level. It was found that in the finance information system alone 26 member institutions purchased software from 26 different suppliers, while 7 different suppliers supplied applications for the personnel information system.

Details of the information systems under examination are given in the following subsections.

2.1. The finance information system

Computers were first introduced in the finance information system. At present, all member institutions use several applications, typically general ledger, accounts receivable and accounts payable, pay-roll, and inventory system. Some institutions also run some other applications, e.g. research projects, invoicing, cash in hand, stock records etc.

However, the diversity of suppliers and incompatibility of applications is most evident in this area. While 5 member institutions succeeded in integrating all applications into a unified information system using a common database, a great number of them still use standalone applications. Moreover, at some institutions these applications are purchased from different suppliers and are written in different languages, thus making integration into a coherent system difficult or even impossible.

2.2 The personnel information system

Compared to the finance information system, the use of computers is far less intensive in the area of personnel records. Only 7 member institutions out of 26 use special applications for this purpose, while the remainder use computers mainly for the writing of documents using Word or WordStar. Two member institutions do not use computers at all.

A detailed examination of 7 institutions that use special applications for personnel records reveals the same deficiencies as in the area of the finance information system. Each member institution has bought the application software from a different supplier, most applications are standalone, and they do not share a common database with other applications.

2.3. The student records information system

The main characteristic of the student records information system (Mahnic & Vilfan [2]) is the use of unified software for all applications in this area (entrance examinations, enrolment, examination records, alumni records, various analyses and statistical surveys). Also, some institutions use programs for the maintenance of examination schedules and programs for the entry of examination applications. Examination applications are entered by students themselves, thus diminishing the work load of the institution administration.

All these applications were written in co-operation between the Faculty of Computer and Information Science and the University Computing Center with the support of EU Tempus program (project JEP 1852 "Computerization of Administration and Management in Higher Education", 1991-94). They run in a local area network of personal computers sharing a common database. However, some member institutions with a small number of students still use only one standalone computer for this purpose.

Although the implementation environment (i.e. Clipper) of the student records information system is now obsolete, the system itself represents an important step towards the reintegration of the university information system:

- a unified data model was established which provides for the comparability and compatibility of data from different member institutions, and simplifies the task of data synthesis at the university level;
- a unified software was developed for all member institutions in spite of the differences in their organization, administrative procedures etc.

3. Some experience from the development of the unified student records system

When we started the development of the unified student records system in 1991 the situation in this area was similar to the situation in the finance and personnel information systems: different member institutions used different applications, while quite a lot of them used computers only for the processing of enrolment data, but not for examination records, alumni records, entrance examination etc.

We were aware that the success of the project depended not only on technical factors, but also on organizational and psychological ones. Therefore, besides a systematic approach using corresponding methodology and CASE tools for the analysis and design of the new system, special attention was devoted to the establishment of corresponding co-operation between member institutions and confidence in the development team. At the beginning, a group of 6 member institutions signed an agreement to participate in the project. The group was sufficiently small to be manageable, but sufficiently heterogeneous to be representative of the university as a whole. In later phases of the project, when the first tangible results were evident, some institutions joined voluntarily, while other institutions adopted the corresponding applications after the successful completion of the project.

During the design of the new system, the utilization of experience of other institutions and initiatives in foreign countries was very important. By closely examining the Mac initiative in the United Kingdom (McDonough [3], Powell [4]), the German initiative for administrative computing in higher education (Frackmann [5], Frackmann [6]), and the information policy of Dutch university management (Schutte [7]), we recognized the importance of the development of unified software for several higher education institutions.

Using the principle of non-coercion, it became evident that customer satisfaction is the main guarantee that the new system will be successfully put into operation. For this reason, the new system had to offer better functionality than the old one, and a smooth conversion from the old system had to be assured. To retain user satisfaction we were sometimes forced to incorporate certain institution-specific solutions that had not been agreed by all the partners in the project. However, through the use of special installation parameters we achieved a degree of flexibility that enabled us to develop unified software for all member institutions in spite of differences in their administrative procedures, organization etc.

4. Recommendations for future activities

Given the present situation, the development of an integrated information system for the University of Ljubljana will be a difficult task. According to Vrana (Vrana [8]), the most important aspects which contribute to success or failure are political decisions and support (with a contribution of 40%) and organization (with a contribution of 25%).

Although the new legal framework laid the foundations for the reintegration of the university and gave the university management more authority, it has proved impossible to change the peculiar organizational structure in a short time. In such a situation it is difficult to take adequate political decisions and obtain necessary support. Therefore, we are lacking some important factors that affect the success of such an endeavour. Nevertheless, using the positive experience from the development of the student records information system and the contemporary information technology infrastructure, some substantial improvements can be achieved in the three information systems analysed.

From the technical point of view we recommend gradually replacing the present PC-based systems by a modern client-server architecture, and to start the development of the unified software that will use a common database for all member institutions. The necessary infrastructure was established last year by building an optical network which connects all member institutions. On the other hand, the University Computing Center has at its disposal the required development tools and hardware equipment (viz. Oracle 7, Alpha workstations).

This goal can be achieved most easily in the personnel information system. Compared to the student records and finance information system, the personnel information system is less complex and therefore easier to implement. Additionally, at present only a few member institutions use computer applications for personnel records. Based on experience from the development of the student records information system, we suppose that it would not be difficult to establish a group of 5 to 8 member institutions that would act as the initiators of a common project with the aim of:

- developing unified software that would later be adopted by other institutions, and
- establishing a unified database of all university staff that will also later be used by applications from the new student records and finance information systems.

The re-engineering of the present student records information system can also be done without major problems, since all member institutions (except one) already use the same software and the same database schema. Special attention will have to be devoted to the connection with the system for the centralized processing of enrolment applications (Bajec, Krisper & Rupnik [9]), which is unified for all Slovenian universities and independent colleges.

The main problem seems to be the finance information system not only because of the great diversity of applications at different institutions, but also because of the vaguely defined relationships and responsibilities between the university management and individual institutions. It seems that the individual institutions see these applications as vital to their autonomy, and they are suspicious of all change. Nevertheless, the situation can improve by counselling individual institutions on which software to buy, and by purchasing software for several institutions together. In this way, substantial savings can be obtained through negotiations with suppliers and quantity discounts, the number of different suppliers will decrease (only the best will remain), and the member institutions will gradually start to use mutually compatible applications. All these factors will facilitate the introduction of an integrated information system in the future.

5. Conclusions

An analysis of the present situation in the following areas was given: the finance information system, the personnel information system, and the student records system. While all member institutions are using the same software for their student records system, a variety of different, mutually incompatible applications from different sources is used in the areas of finance and personnel administration.

However, using positive experience from the development of the student records information system, some substantial improvements can be achieved in the three information systems analysed. Given that only a few member institutions use computer applications for personnel records, it seems that reintegration can be most easily achieved in the area of the personnel information system. The reintegration of the student records information system is also feasible, since the main effort in building the unified database and unified software was already done during the development of the present system. The most difficult problem is the finance information system: in this area we propose the gradual replacement of existing applications with standard packages from carefully selected suppliers.

International collaboration within EUNIS (European University Information Systems Organization) and the utilization of the experience of universities with similar problems (e.g. Comenius University from Bratislava, the Czech University of Agriculture, Prague) may also contribute to the success of reintegration.

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Faculty of Computer and Information Science,
University of Ljubljana,
Trzaska 25, SI-1000 Ljubljana, Slovenia,
E-mail: viljan.mahnic(at)fri.uni-lj.si

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Center - A distributed computing center of the future?

[1,2] Ludek Matyska, [2]Eva Hladká

Introduction

The role of computer centers at universities had undergone a very dramatic reshaping in the past decade. It is no more a single ``computer aware'' center of the university, it is becoming much more a coordinating place, responsible for a kind of computer related infrastructure. However, new roles are also emerging, and in this paper we discuss a potential which may be gained by merging services of individual computer centers together.

The extremely fast proliferation of personal computers lead to a belief that computers are becoming a tool not too different from other ordinary tools used in our everyday life. The information society of tomorrow began to look like a kind of paradise where everybody uses his or her computer to connect to sources of information, to ease any work to be done. The computer centers started to become an obsolete notion and many universities considered to reduce or even to close them. In the Central and Eastern Europe of the nineties, the situation was even more dramatic due to the very fast changes there.

But, as with any other complex and sophisticated tool, it is not ease to use it without a lot of training and experience. Situation started to change with the emerging of local area networks and their interconnection with the Internet. While at the beginning it was easy to join few computers into a LAN, the interconnection of LANs called for new expertise and, as such, for some kind of centralized control over its deployment. What is more important, new services were looked for and the vital role of computer centers reemerged.

Contemporary Role of Computer Centers

As contemporary computer centers are no more the sole owners of computing related technology at the universities, they have to focus their attention to services which are most efficiently done from a center. While individual users have usually their own personal computers on their desks-- computers whose raw computing power and memory and disk capacity is larger than that of large computers of the past-- these computers must be somehow connected to the network. The infrastructure building and maintenance is thus one of the indispensable new roles.

Another important role is related to reliability and robustness. While individual users can backup their data, just a tiny fraction is actually used to do it on a regular basis. It is much more easier, convenient and cheaper to provide such a service from some central place. It is also much more reliable, as there are usually more than just one device allocated (or allocatable) for this task. Another point is the disk capacity. A failure of individual disk in a personal computer usually means that the computer will be out of service for some noticeable time. On the other hand, computer centers usually build their (large) disk capacities using some kinds of RAID's, where a single disk failure may not be even noticeable by the end users. In general, all the services provided by computer centers are (or may be) backed up in some way, and the redundancy needed is substantially cheaply achieved at this level.

Last but not least, there come the information services used and/or provided by the university. The university management is becoming more distributed, with the responsibility for decision delegated to lower parts of the managerial hierarchy. However, the responsibility for data correctness calls for some centralized supervisors. The information technology allows, when properly used, to take the best from both worlds-- the data are kept centrally, at the computer center, while the access is provided in a distributed way. Similar situation also holds for information provided by the university (e.g., through the web). While the information may be collected, and even prepared, i.e., edited, formatted and the like, in a distributed fashion over many parts of the university, it may then be stored in an individual server, managed by the computer center.

As we have seen, there are still at least three roles where the computer centers have their irreplaceable responsibilities:

1. The infrastructure.
2. The reliability.
3. Information services.

Computer centers are not, however, independent entities in the networked world of today. The increased mobility of researchers and students, coupled with the increased number of people using services of more than just one particular computer center, needs to be supported by a kind of convergence of individual computing centers. It may not be surprising that it is again the ``power'' users, i.e., users of high performance computers, looking always for ways how to increase the computing power they have at their disposal, who are the first one to ask for similar (if not identical) computing environments. However, these users will be very fast followed by others, and it is vital for the computer centers to be well prepared before the main wave will hit them.

The Center

The META Center 3-year project was launched in the last year as a part of the TEN-34 CZ activities of the Czech Republic. Its main goal is to connect the largest computing centers of the Czech universities, namely the West Bohemia University in Pilzen, Czech Technical University and Charles University in Prague, and Technical University and Masaryk University in Brno into one virtual computing center. The primary target of this pilot project, lead by the Masaryk University and supervised by the first author of this article, is a group of academic users of high performance computers at the respective sites, but it is in no way limited to them. The primary goal is to create a large virtual computer with a uniform user interface. This virtual computer is spanning a large geographical area (the distance between Pilzen and Brno is more than 250km). The interface is understood in the broadest sense, i.e., encompassing all the provided services. The META Center is also built as an open center, where more computers may be connected in and where new partners may also become involved. This push a very strong limits on what may be done and how.

A truly heterogeneous virtual computer is built, whose nodes are computers of individual centers. There are three POWER Challenges from SGI, large AlphaServer from Digital and a 19 processor IBM SP2 to be connected in one whole. From the user's point of view the result of the project will be seen as just one large META Computer. Users will be allowed to log to any node while having immediate access to all the META Center resources. This means that user of some program (service) may not be even aware (or take care of) which particular node runs her program, more or less in the same way as users of parallel computer don't care which particular node they are using.

Administration

As may perhaps be predicted, the political and administrative problems are the harder ones. We already identified some places where common agreement is necessary:

- The account creation. In order to have a truly transparent access to the whole META Computer, it is necessary to have account on all its individual nodes. Individual centers have to coordinate their rules for account application with the final goal of trusting each other is such a way that granted application at any particular node will be valid for the whole META Computer.
- The security measures must be unified (at least to some extent), because the security level of the whole META Computer is simply the security level of its weakest part. All centers must adopt similar policies on what is allowed in this area.
- Unification of application program installation and user interface. Individual computing centers differ substantially in their ways of application program installation and especially in ways how these programs are made available to end users; this difference must be removed and all the programs must be accsible in a unified way.
- The interfaces to utility programs must be unified as well. A common interface to queuing system is essential in the area of high performance computing, but this also applies to mailing program interface, to the on-line helps provided and to many similar utilities.

Technical side

The whole META Center project is not possible without a reliable and high performance network between its individual nodes. The sites are currently connected to the TEN-34 CZ backbone, an ATM academic network running at 34Mbps. All the involved computers have direct access to this ATM backbone which means that a virtual channels may be created among them. Both IP over ATM and LAN Emulation mode of the underlying ATM network will be used to create a kind of dedicated routes through which the META Computer nodes communicate. An ATM metropolitan area network running at 155Mbps is currently available at Prague and at Brno, opening thus a possibility to connect a subset of nodes at higher speed than allowed by the backbone alone.

A distributed file system is provided on top of the network connection. After considering all possibilities, the AFS distributed file system from Transarc [2] was chosen as a primary filesystem of the META Center. The main reasons were:

- AFS truly supports the heterogeneous environment as it is available on most important platforms and operating systems, including Linux and Windows NT.
- AFS is a state of the art distributed system, already in use at many sites around the world.
- AFS allows a high data migration freedom, as only the address of volume location server must be known to all clients. Chunks of data (the volumes) may be freely moved to different servers without any need to reconfigure the clients accessing them.
- AFS has a local cache filesystem, increasing thus access speed and decreasing the network load.
- AFS is far more secure than NFS, it also allows to keep higher control over accessibility of individual files than ordinary UNIX file access mechanism.

An AFS multilicense covering all universities involved in the project was purchased. Each university (computer center) established its own AFS cell. There are, however, some peculiarities and problems connected with the use of AFS, which have consequences to the META Center implementation.

- AFS builds its own filesystem structure on top of native filesystem. Usually AFS lacks the support for the newest native filesystems available (e.g., there is not yet support for the XFS filesystem from Silicon Graphics, which means that there is no support for 64bit filesystems). Moreover, the another layer slows down the read/write operations (we found that AFS has as low as just 25% of the performance of the native filesystem, if client and file server are the same machine). The local cache can compensate this slowdown only for the read operations.
- AFS is not fully available for Linux outside USA. While it is possible to access the Linux binaries, the source code is not available even for those having source code license. As a result, the Linux binaries are usually outdated and they don't fit always well with the newest AFS patches or with the newest Linux operating system versions (i.e. they are not compatible with the Linux operating system version necessary to use the ATM cards). As for the NetBSD, even the binaries are not available outside the USA.

Overall, we found AFS to be a valuable tool for the read only filesystems (parts of the operating systems and the application software) but of just a limited use for read/write filesystems (like the user directories). AFS is definitely not a choice when a high local I/O throughput is required (e.g. ab-initio calculations). The AFS is therefore used in META Center to store the read only directories with application programs and shared parts of user home directories. Users have an option to either have all their home directories stored in the AFS or to have (small) local filesystems at each node and use AFS as a shared data repository. AFS is also complemented by the use of the local native filesystems which are made available through (a limited) use of NFS.

The use of AFS naturally lead to the adoption of Kerberos for the user authentication [3]. We are currently using Kerberos 4 implementation (from KTH, Sweden)-- the Kerberos 5 is again available in USA only. To allow for an easy and smooth path for future expansion, each computing center is running its own Kerberos realm and we use the interrealm authentication to move the tickets around. We had to modify a lot of standard programs (like login, telnet, telnetd, ...) to make the interrealm crossing as smooth as possible and especially to eliminate any need for users to know precisely where the realm borders lie. While quite successful, we discovered that Kerberos 4 interaction with the AFS own authentication mechanism is not ideal and that sometimes users have to reissue their passwords to have access to all their resources.

Load Sharing Facility (LSF [1]) from Platform Computing, Inc. was chosen as a job queuing and load balancing tool for the whole META Center. A LoadLeveler is used on IBM SP2 and a gateway is to be developed to connect both these systems. Again, each computing center runs its own LSF cluster with an intercluster communication established to allow for a proper load balancing between individual computing nodes.

The use of AFS and Kerberos lead to a problem whose best solution we are still searching: how to ensure that proper authority will be given to user's jobs when they finally left the job queue and/or when they are running for a very long time (days or even weeks).

The same set of application programs is not available at each node of the META Center. The transparent access allows to use them without knowing where they are may actually run. The queuing system is aware of the location of all major programs and reroutes individual request to nodes where they may be (best) served. There is, however, no such support for interactive programs.

Conclusion

While the META Center project is just in its first phase (the project started on September 1996), we already identified several major advantages of the META Center over the individual centers:

1. It simplifies the access to centralized services of different nodes. It also allows to share ``personalized'' environments between sites, including access to personal files.
2. It increases the utilization of individual computers and software licenses available-- it is no more necessary to buy everything to every site.
3. It provides much higher reliability at much lower cost-- users at individual university may continue to work even in case of ``their'' node failure.

The META Computer, which is scheduled to be put into full experimental operation at the end of 1997, will be used both as a large distributed computer and as a testbed for the unified user interface of computer centers of major Czech universities.

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About this document ...

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[1]Faculty of Informatics,

[2]Institute of Computer Science
Masaryk University, Botanická 68a, 602 00 Brno, Czech Republic
E-mail: ludek(at)ics.muni.cz, eva(at)fi.muni.cz

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Information Strategy - a tool for institutional change.

[1]Andrew Rothery, [2]Ann Hughes

Introduction

This paper will outline the national development of Information Strategies in the UK and the approach taken at Worcester. In addition, we will consider claims made in respect of Information Strategies and comment on the effect of Information Strategy development on the role of IT/Computing Services in Higher Education (HE) institutions.

Information Systems and Information Technology Strategies have traditionally been the responsibility of IT/Computing Services but the Guidelines for Developing and Information Strategy, published by the Joint Information Systems Committee (JISC) of the HE Funding Councils in the UK, pointed out the shortcomings of such strategies:

- “they tend to be technology driven” - an implication that expenditure can be wasted on irrelevant technical innovations
- “they tend to focus on the narrow fields of management related information rather than the academic information which provides the foundations for teaching and research”
- “they have a tendency to seek ways of using technology to improve current processes” - with an implication that this avoids the question of re-assessing the processes themselves

Information Strategies are intended to avoid these faults, and two claims are particularly significant in this respect:

1. An Information Strategy is a set of institution-wide attitudes and a process rather than a documentbrp> 2.Strategy should not be “technology led” but led by information users' needs. Information Strategy will dictate the IT Strategy, not the other way around.

In addition there is an expectation that the process of developing an Information Strategy may be a tool for institutional change at a level outside the traditional scope of an IT/Computing Service.

There is a widely held view that some IT uses have been developed `for IT's sake'. There is a tension here regarding the role of IT/Computing Services - to serve or to lead the way? The notion of an Information Strategy suggests that IT should serve - but we will return to this point.

The JISC Guidelines

In 1994 the JISC established the Information Strategy Steering Group to investigate the potential for developing Information Strategies within HE. Coopers & Lybrand was commissioned to undertake the research and produce a report. A questionnaire was circulated to all UK HE institutions and a number were visited for more detailed discussions.

This resulted in a genuine interest in the use of Information Strategies as a possible means of ensuring value for money from technology, exploiting technological advances, coping with increased numbers of students and reduced funds, and attempting to bring about a change in attitudes, especially towards the ownership and accessibility of information within the institution. The eventual outcome was the publishing of the Guidelines for Developing an Information Strategy in December 1995 (http://www.niss.ac.uk/education/jisc/pub/infstrat).

The JISC Guidelines are very clear that the type of Information Strategy that they are attempting to produce is not just a document, nor is it concerned only with computing or libraries. They define an Information Strategy as “a set of attitudes” and the Guidelines are therefore a guide to a process intended to achieve (or at least partially achieve) those attitudes. An Information Strategy Document is therefore not the most important output of the Information Strategy; that should be the changes in working practices throughout the institution.

BECOME A MEMBER
- Join Eunis
- Application form for institutions/organizations
- Application form for Corporate membership
- Application form for personal members
- Member's data change

RESOURCES
- Distribution lists
- Publications
- Newsletters
- Information Network
- Archives

ORGANIZATION
- Statutes
- Board of Directors
- Executive Secretary
- Past Presidents
- Members

EVENTS
- EUNIS Congresses
- Rectors' Conferences
- Elite Award
- Jens Dørup Award

ACTIVITIES
- Task Forces
- Groningen Declaration
- International Exchange Programme
- Partnership
- Best Practices

Search...

REGISTERED ACCESS FOR EUNIS MEMBERS' REPRESENTATIVE

User Name
Password
Remember Me

Forgot your password?
Forgot your username?
Create an account

The Guidelines break the process up into six stages which will now be described briefly.

Set Up

This stage is designed to ensure top level commitment to an Information Strategy, to identify its scope and who is responsible for its development. It includes identifying previous related information and other strategies, resources for undertaking the work and informing colleagues of the process.

Setting the Context

The objective of this stage is to establish the context in which the Information Strategy would need to operate. This involves identifying the priorities, intentions, approaches to teaching, learning and research; and also the challenges facing the institution and its development plans. This stage also includes identifying a route for the Strategy to gain formal approval within the institution.

Defining Information Needs

This stage involves defining information groups within the scope of the Information Strategy, the development of standards for those groups, and an infrastructure to deliver them. Gaps and problems with any of the groups are identified and projects designed to resolve them.

Defining Roles and Responsibilities

In order for the Strategy to be on-going, it is necessary for people to be identified with active roles and responsibilities for its various aspects. There may be some overlap with those who developed the Strategy initially. The Guidelines identify the following main roles:

Information Strategy Committee

Information (Strategy) Manager

Information Custodians

Information Users

Information Services

Implementation

An important part of the process is to develop an understanding of the need for, and the essence of, an Information Strategy; and much of this should have been achieved during the process of development. However further work will be required to ensure that everyone within the institution is involved, to keep all colleagues up-dated as to progress (and changes) and to encourage those resistant to the ideas promulgated.

In addition, projects to resolve issues will have been identified and whilst these may not all be implemented at this stage, they will require planning for future implementation.

Monitoring and Review

This is essential to check the effectiveness of the Strategy, to assess the changing context and amend the Strategy when necessary. The Guidelines suggest that this should be built into the normal operating cycle of the institution.

Pilot Sites

The Guidelines were generally well received and in January 1996, volunteer `pilot sites' were sought. Out of 26 applications, six were chosen:

Bath College of Higher Education

The Queen's University of Belfast

The University of Glamorgan

The University of Glasgow

The University of Hull

The University of North London

Three main criteria were taken into account in their selection; they should:

reflect the diversity of HE,

represent all four funding councils,

demonstrate their commitment and enthusiasm to the project.

The pilot sites are expected to be open about their experiences in regard to the development of their Information Strategies. A JISC Conference was held in January 1997 at which each pilot site was represented and presentations given on various aspects of the development of the Information Strategy. Workshops on specific aspects of the development process have also involved pilot sites, as have conferences organised by other bodies. At the same time, other HE institutions started their own Information Strategy developments.

Progress of the Pilot Sites

The work of the pilot sites has been co-ordinated by a JISC-funded post. The Co-ordinator was appointed in July 1996 and included in her role was liaison between the pilot sites to encourage best practice and to assist sites where possible. Workshops have been held to enable the pilot sites to get together to discuss their projects and a mailbase list was also established to encourage discussion between them.

The pilot sites commenced work on their Information Strategies in June 1996 and by the end of July 1997 should all have produced draft strategy documents. In general the `Set Up' and `Setting the Context' stages were completed by September 1996. By far the greatest part of the project has been devoted to `Defining Information Needs', with most of the pilot sites taking around seven months to complete this stage. This involved workshops with staff to identify and prioritise information needs and to specify projects to satisfy those needs. Their strategy documents will include plans to implement those projects in the coming year.

Information Strategy at Worcester

Worcester College of Higher Education (WCHE) is a university sector institution with about 4,500 students. It awards a wide range of undergraduate and postgraduate degrees.

WCHE decided to develop its Information Strategy shortly after publication of the JISC Guidelines in parallel with the JISC pilot sites and decided to follow the JISC Guidelines in general terms.

However, in June 1996, at the `Set up' stage, WCHE set up a single development group rather than the two-tier approach, a Steering Group and a Working Group, suggested by JISC. Evidence from Worcester and the JISC pilot sites suggests that this is quite adequate for the smaller institution with a relatively compact and centralised organisation.

The membership of the WCHE development group was as follows:

Vice Principal (Chair)

Library and Information Services Manager

Director of IT

Deputy Registrar

Learning and Teaching Co-ordinator

Head of Science

Head of Academic Services of an associated College

Overall information policy statement

JISC Guidelines do not explicitly recommend drafting a policy statement, keeping strictly within the spirit that an Information Strategy is not a document. However, pilot sites and WCHE have found it useful at the `Setting the context' stage to draft an `information policy' or `guidelines on the management of information'; or a vision of how information should be handled. For instance, the WCHE development group set out eight short statements which were called `information objectives' and these form a succinct statement on information policy.

Information analysis

The `Defining Information Needs' stage is the major part of the development process and should involve a wide range of staff within the institution. The Guidelines outline two possible methodologies: functional analysis and life-cycle analysis. In practice most of the pilot sites have used a variation of functional analysis; although one pilot site undertook a student life-cycle analysis which is likely to result in quite a radical change in the way student information services within the institution are organised.

The Worcester development group carried out its information analysis with an initial approach based around a `functional analysis' of the College split into eleven `information groups':

1. Institutional strategy/ 2. Quality - 3. Taught 4. Research activity information
5. Learning and teaching resources - academic knowledge as contained in teaching materials, books, software, web, and information on how they are organised or located
6. Student details
7. Staff details
8. Services
9. Financial information
10. Physical assets - buildings, equipment
11. Marketing information

The scope extends beyond traditional management information, particularly Groups 3 and 5, which include curriculum and knowledge information.

Following the methodology suggested by JISC, each group was further analysed in terms of information items. For each item, the source of the information, its `custodian' and its users were identified. An initial evaluation of the quality of the management of the information was also made.

These initial analyses proved useful in finding some immediate recommendations for action and improvement. However, at WCHE it was apparent that the development group alone could not complete the initial analyses. Experience confirmed that really, the best way to carry out an information analysis in any depth would be to create a separate working group for each information group, with representatives from those who look after the information and those who use it. At Worcester it was agreed that a programme of workshops should be organised to take place during a second phase over the next two years. This will also have the effect of encouraging dissemination of the Strategy process more widely. There is clearly a question of resources - the organisation, co-ordination and putting into effect of such a programme requires considerable staff time.

The large scale of such an approach is very daunting and most institutions start by focusing on priority areas, with the intention of moving on to other areas at a later stage.

Lifecycle and process analysis

The WCHE development group found that systematic analysis by information group was not on its own the most productive way of identifying ways in which information management and communication could be improved. It carried out some pilot analyses of alternative approaches. JISC refers to `lifecycle analysis' but Worcester and the pilot sites distinguished between two slightly different types of analysis: one is the analysis of a very specific activity (`process analysis'); the second is the analysis of a `lifecycle', which in effect is a sequence of processes seen from a particular perspective.

The WCHE group investigated the lifecycle experience of a student registering at the College, some processes involved in doing research, and the process of writing an essay. Other examples would include the process of preparing a course, the lifecycle of recruiting staff, the academic planning lifecycle. Again, at Worcester, carrying out such analyses in full was included in the workshop programme for Phase II.

An advantage of this approach is that lifecycles and processes focus on the specific needs of an individual's or department's work or experience, so issues of quality of communication and access soon become apparent.

Clearly a disadvantage is that there are thousands of different processes and so it is not possible to systematically work through them all. However, a small selection of lifecycles or processes are enough to cover most information types and can be chosen to highlight a particular priority issue.

Attitudes rather than documents?

Our experience confirmed that creating an Information Strategy is clearly a process rather than a document - and one which could well become a permanent feature of quality assurance within institutions.

Documents are not absent however! An Information Strategy produces a whole box of documents. There is the overall policy document and there are documents and reports arising from information analyses. Recommendations for action emerge constantly as the process develops, and these have to be documented, as do action plans for putting improvements in place. Information Strategy documentation is a stream.

It is apparent that the Information Strategy can certainly transform the way information is handled and communicated - and since information includes academic information this has an immediate impact on learning, teaching and research as well as administration. A good claim for Information Strategy is that it can transform the way people communicate and work within the institution.

The role of IT/Computing Services

Finally what about the role of the Director of IT or other staff in the IT/Computing Service? Certainly they do not have a leading role. With a Chair at a senior level, broad representations on development groups and wide representation at workshops, there is a community wide approach.

Nevertheless, we found at Worcester and at pilot sites that most (but not all) recommendations had an IT requirement. Therefore IT Services will be involved substantially with the implementation of recommendations. Indeed, because of the focus on user and community needs, the developments which emerge will automatically come with a much stronger institutional commitment than if proposed by IT staff alone, and this is clearly helpful to IT/Computing Service departments.

In view of this, the IT/Computing Service must play a part in the Information Strategy process at Steering Group level and within workshops.

Furthermore, there is a role in creating vision. Just as progress cannot be made by merely applying new technology to existing practices, it cannot be made by applying existing technology to new practices. In order to escape the limitations of the current paradigm, there has to be an element of vision in both practices and technology. Though not exclusively so, it is IT professionals who are familiar with what might be possible and who might be researching into new possibilities. This resolves the "who leads" issue mentioned earlier. Technology should not dictate what people should do, but it should provide a vision to help in moving forward. So here is another role for the IT/Computing Service.

In conclusion, the role of the IT/Computing Service, though not central to the Information Strategy process is certainly essential. Indeed its role in implementing IT developments will be enhanced if its work carries the strong institutional commitment which emerges from the Information Strategy process.

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[1]Director of IT,
Worcester College of Higher Education,
Henwick Grove, Worcester, WR2 6AJ, UK
E-mail: a.rothery(at)worc.ac.uk

[2]JISC Information Strategies Co-ordinator
, C35 Cherry Tree Buildings,
Nottingham University, Nottingham, NG7 2RD, UK
E-mail: m.a.hughes(at)nottingham.ac.uk

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Role of the computer center in migration to Information Society- A case study at Lajos Kossuth University of Debrecen

Zoltán Gál, Ida Rápolti, Katalin Rutkovszky, György Terdik

1. Introduction

Almost all citizens have been touched by the information society, which is affecting various fields such as employment, education and professional training, family life, ways of life and costumer's habits, culture and leisure, health and politics, hence nearly all fields of our daily lives.

The formation of the information society is a spontaneous process which is controlled basically by demand and market mechanism. It requires money, time and effort, and there are returns only after the users have exploited the advantages of the new system.

In the educational process the memorising of knowledge is of decreasing importance, and methods of seeking information are gaining ground. Students may search for data and programs from electronic databases. Instead of passive learning, active learning comes to the fore. With the development of multimedia, instructional tools readable from CD-ROM are appearing in addition to the school textbooks. Audio-visual learning is diminishing the amount of learning by reading. Virtual, interactive visual aids are becoming available.

New forms of teaching mean that learning is being customised to the individual. Students may not always be required to be present in the classroom. Subject-matter for any given topic may be sought when required and learning takes place at the student's own pace. During the learning process students need not follow a single linear logic, they are free to proceed in the order determined by their own curiosity. These methods effectively promote the development of creativity in contrast to passive receptive learning.

The form of education does not remain traditional. In addition to and after primary-, secondary-, and further education, on-going learning takes place depending on individual demands. As a result of the possibilities provided by the computerised world networks, scientific research - firstly in the natural and technological sciences, but also in the philosophical sciences - is becoming more and more a matter of interactive team work, it accelerates and increasingly becomes independent of the spatial conditions: the local personnel; laboratory, observatory, and computing facilities; and libraries and archives. E-mail has already become the scientists' most important means of communication: actual international meetings being arranged here or there generally mean only the starting- and ending points of ongoing series of electronic conferences taking place on the network.

The medium of disclosure of the results of scientific research - in other words scientific publication - is increasingly the network. From theoretical physics to classical studies, the number of scientific journals existing only in electronic form is growing in the most diverse disciplines, while texts, data, illustrations, and so on intended for preliminary scientific information can be stored in the pre-publication phase on the local network of any given institution so that anybody may access them through the global networks.

2. City, University and CIC

Debrecen with 260.000 inhabitants is the second largest city in our country. It is economical, intellectual and artistic center of Eastern Hungary. The cultural and scientific life of Debrecen is dominated by the institutions of higher education.

The **Lajos Kossuth University of Debrecen** has Faculty of Arts, Faculty of Sciences and College of Technology. The Faculty of Economical Sciences and Faculty of Low has been established recently. The number of students is about 9000. The number of teachers, researchers and administrative and technical staff is roughly 1700.

In 1991 the University took steps towards establishing a new level of cooperation between the Institutions of Higher Education of city (University Medical School of Debrecen, Agricultural University of Debrecen, Lajos Kossuth University of Debrecen, Debrecen University of Reformed Theology) and one research institute (Institute of Nuclear Research). The Association of the above institutions is **Universitas** leading to the re-establishment of University of Debrecen by the European model in the future.

The **Center for Informatics and Computing** (CIC) has been founded 30 years ago. That time we worked on Polish made computers, ODRA 1013, ODRA 1204. The next stations in our history were in 1974 when we got the Russian made R30 and in 1984 when an East-German made R55-M computer was set up. Since the foundation we have got important role in both research work of our university departments and in education. We have built up good connections with other universities and institutes of the region. Having worked on several research projects our staff gained remarkable experience in teaching and developing applications.

The formal University Church is shared by the Computing Center and some parts of the University Library.

At the beginning of 90 years the architectural development (new computers, network, software) caused structural and role changes in our center.

We are running the following servers:

- SUN SparcCenter 2000 (2 processors, 256 MB RAM, 20 GB HDD)
- VAX 6000/510 (128 MB RAM, 12 GB HDD)
- MicroVAX 3500 (16 MB RAM, 1 G HDD)
- 2 MicroVAX II (16 MB RAM, 400 MB HDD)
- DECSystem 5000/133 (32 MB RAM, 1.7 GB HDD)
- KLTESRV Novell server (40 MB RAM, 2 GB HDD)
- AlphaServer 1000 (256 MB RAM, 12 GB HDD)

In according with functions and services we have four sections in the center:

- Network Management (6 persons)
- Operating Systems (5 persons)
- Operational Section (9 persons)
- Software Development (6 persons)

3. Network infrastructure of UDNET and KLTENET

The Universitas built his own local area network in 1993. The goal was to make connection among institute's LANs with high speed MAN technology named UDNET. This project was managed by Lajos Kossuth University's Center for Informatics and Computing (CIC). It was necessary to make development criteria and strategies for the whole city network for few years. In the plan we estimated the number of nodes to be connected to the LANs, the capacity and bandwidth utilization of each node, the application programs for users, the necessary network resources for good response times, potentially high bandwidth consumer connections. The planned network had to be expandable in topology and in data transfer speed also. In that time multimedia applications were new promising applications and this fact was reasonable to take in consideration in the network planning phase.

One of the main question was introduction of a single network protocol or utilization of more than one protocols. Network manageability was a strict development condition. For getting information about the network behavior was necessary to decide about how complex need to be the management system of the UDNET. Network reliability and security were other important network development criteria.

3.1. Physical level links

The topography of the network was defined by the relative placing of the buildings. Outside, among the buildings we utilize eight fibers optical cables, inside of buildings six fibers type cables are placed. The interior links at each institute use multimode fibers. Because of higher distances the MAN's links are monomode optical cables with 20 fibers. The topology of the Lajos Kossuth University's network (KLTENET) is star/tree like the other institute's LANs. The root of the KLTENET is placed in the CIC. The length of the optical cable inside of buildings is 400 meters, the optical cable length among buildings at KLTE is more than 2500 meters. Among buildings an optical medium makes 10Base-F connections. The remaining fibers are for future developments. On the end of active fibers are modular expandable and SNMP manageable backbone devices.

The OSI 1 and OSI 2 level devices are Cabletron, CISCO and Proteon repeaters, hubs, bridges and switches. First segments were 10Base2 Ethernet segments but in last time we build only structured cabling conform CAT5 standard. In the big buildings are placed more than one backbone devices utilizing FOIRL backbone connections. The 10Base2 segment constructions and homologation are in the CIC's sphere of action. In case of eventual segment fault the CIC effectuate the necessary fault isolation with cable tester instrument and repairs the physical connection.

All users on MAN makes access to the Internet services by a leased line between Debrecen and Budapest. This leased line is a part of the Hungarian national academic research IP based backbone network (HBONE). In 1993 the bandwidth was 9.6 kbps which was increased in 1995 and 1996 to 64 kbps and 512 kbps respectively. This connection has a 9.6 kbps X.25 backup link to Budapest. Both lines are connected to the second AGS+/4 router in the CIC.

3.2. Backbone devices

At the KLTENET in each building a router interface is connected to the switch or bridge device. The routers are CISCO products and are AGS+/4, 4500 and 4700 types. The bridges are exclusively Cabletron MMAC8s modular devices with EMME, CXRMIM, FOMIM modules which makes logical connections among different collision domains. In the CIC and other places where the bandwidth utilization is highest there are CISCO 3100 10Base-T/100Base-T switches for traffic isolation and security. The servers in the CIC are connected to different router interfaces from the segments with desktop nodes. Because of password security the system administrators have their nodes connected to the same segment with the server they supervise. The root of the KLTENET is the AGS+/4 router with twelve AUI and one FDDI interfaces. The topology of KLTENET is represented in fig.1.

3.3. Network protocols

On the KLTENET can be distinguished four categories of nodes: Personal Computers, Novell Netware fileservers, VAX/VMS servers and UNIX servers. This categories determine the routed protocols: IPX, DECnet, IP. The IPX packets are encapsulated in Ethernet II type frames. In some situations there are Netware servers with two DNI cards which separates one segment size intranets from the rest of the network. At the beginning were used very frequently nongraphic type e-mail clients based on DECnet, but in the latest time the DECnet protocol transports the smallest amount of information on our network. In 1993 we used store-and-forward NJE (Network Job Entry) protocol over DECnet for EARN/BITNET connection. After EARN has been wound up we stopped to route DECnet protocol to Budapest.

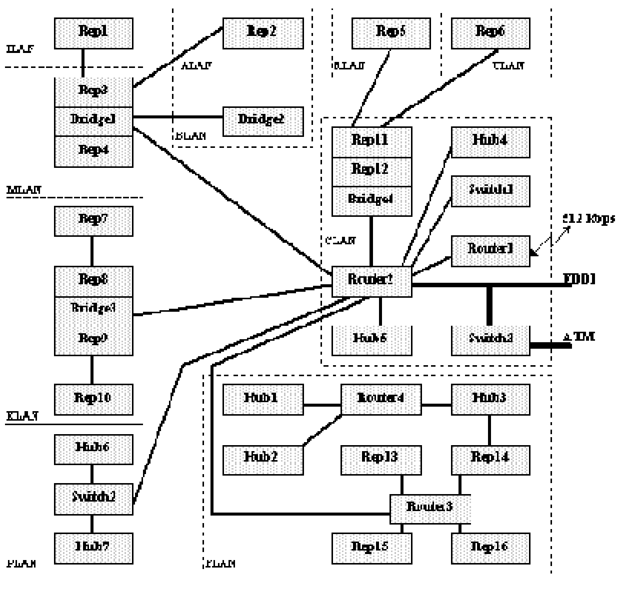

Fig. 1. *Topology of KLTENET (May 1997)*

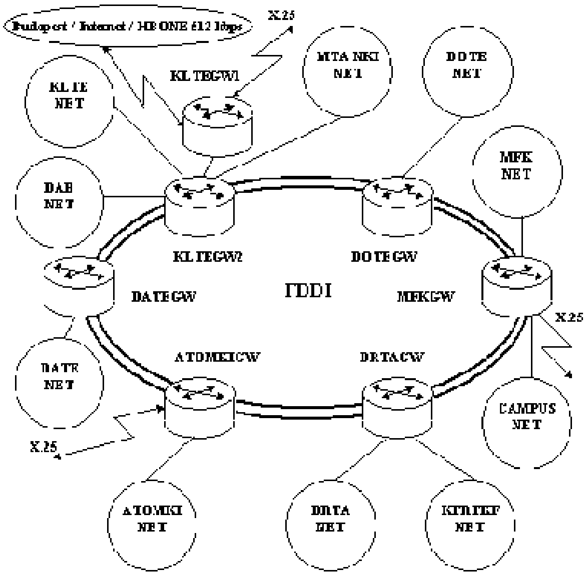

Fig. 2. *Topology of UDNET (August 1996)*

On the KLTENET the most intensive used protocol is IP. Majority of applications runs over IP network protocol. Because all routers on FDDI ring and inside of institute's networks are CISCO products it is possible to use EIGRP (Enhanced Interior Gateway Routing Protocol) as routing protocol. UDNET has single connection to the Internet by a leased line at CIC, so we have no registered autonomous system. UDNET uses 50 C class IP networks from which 18 C class IP networks runs in KLTENET. We use static routing to the Budapest and our IP networks are included in AS1955. The topology of UDNET until August 1996 is shown in fig. 2.

3.4. Network management

The backbone device management of KLTENET is based on SNMP, RMON and DLM (Distributed Local Management) services. The used management software: Remote LANVIEW and SPECTRUM made by Cabletron. The Remote LANVIEW manages Cabletron hubs, repeaters and bridges. The SPECTRUM v4.0 is used for managing all CISCO and Proteon switches and routers. Both parts of the software, SpectroSERVER and SpectroGRAPH runs on the same SUN SS10 (144 MB RAM, 3 GB HDD) hardware platform.

For each node connected to the KLTENET we maintain important information like physical address, IP address, Internet name, etc. This information are stored at the registration in one database with own graphic client interface developed in Delphi. The number of registered Internet nodes on KLTENET is more than 1100. The growth of IP nodes is in correlation with the European exponential tendency. The domain name server at CIC provide secondary DNS service to all other domains in UDNET.

3.5. B-ISDN extension of UDNET

In the last year other new institutes were necessary to be connected to the optical backbone of the UDNET. There were some places where the number of fibers was not enough for making separate voice and data connections among institutes. The bandwidth of FDDI in some situations produced bottleneck, why the Fast Ethernet technology was not also satisfactory for new connections. The phone networks of each institutes are enough up-to-date to satisfy user demands but the direct interconnection among PBXs was not realized until last year. It was an objective claim to utilize the remaining ``black'' fibers for making a private PBX network among academic institutes in Debrecen. The first extension step with ATM technology of UDNET was finished in September 1996. The broadband integrated network of the UDNET is represented on fig. 3.

Two Newbridge Mainstreet 36150 ATM switches are connected with ATM STM1 interfaces. The ATM switches have identical modules: ATM/STM1, FDDI, E1. On the STM1 link there are three PVC (Permanent Virtual Circuits) defined: one PVC for FDDI data connection and two PVCs for two E1 voice connections. The ATM devices realize remote FDDI bridging between the two switch FDDI interfaces. In this way need no ATM LAN emulation. The FDDI frame - ATM cell adaptation is provided conform ATM AAL5 prescription. For the two FDDI rings the ATM is total transparent. The voice channels provide constant bit rate links with AAL1 for PBXes. Because of long distance between Campus PBX and MFK switch it was necessary to use two E1 optical modems with

CCITT G.803 interfaces. The second FDDI ring use single attached station (SAS) connections. The logical links of the FDDI ring and the PBX network are shown in fig. 4 and fig. 5. Both ATM switches and the PVCs are managed with Mainstreet 46020 management software.

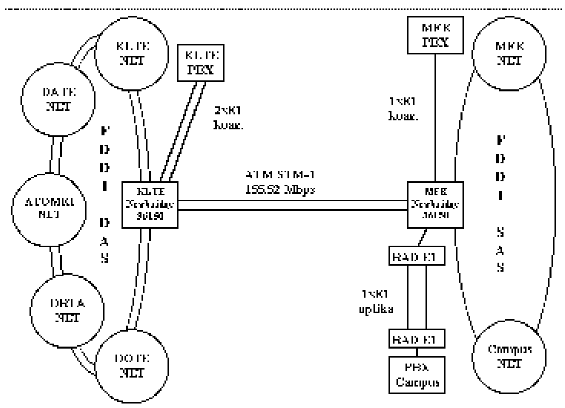

Fig. 3. The B-ISDN extension of UDNET (May 1997)

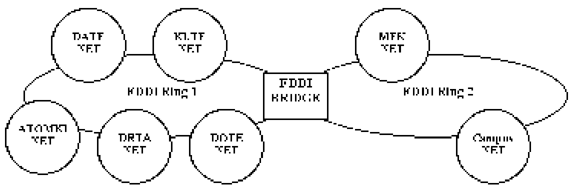

Fig. 4. Topology of UDNET- data (May 1997)

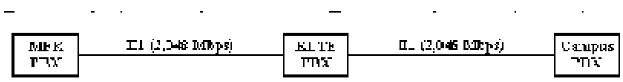

Fig. 5. Topology of UDNET - voice (May 1997)

4. Basic services provided by CIC

4.1. Management of Servers

Two commonly used servers are available in CIC for members of the Universitas. One of them is a SUN SparcCenter 2000 (named: DRAGON). This is the biggest computer in East-Hungary, with more than 2500 registered users.

There are translators for Pascal, SPARCworks C++, SPARCworks FORTRAN, gnu c, c++, java. The SPSS for statistical calculation and ORACLE for database management are also available on this server both for teaching and research purposes.

Our Internet services on this server:

- **E-mail**

There are several clients installed: mail, mailx, elm, pine.

- **FTP,** anonymous FTP server, ftpmail ftp://dragon.klte.hu

We mirror the next often used software: Utilities for Windows NT, OS/2 Utilities, Utilities for Windows 3.1, Utilities for Windows95, Antivirus programs, Utilities for MS-DOS, Oracle related files.

- **News**
- **Gopher**gopher://gopher.klte.hu
- **WWW**http://www.cic.klte.hu

In our web pages we provide information about the CIC, the available services, documentation which are necessary to use the network. We collected useful links of searching engines. There are some pages such as quest-book, advertisements connected to ORACLE database management system.

Students may create and place their own home-pages on the web. Several departments describe their own educational and research work with creating own home-page.

At the University Library, which is the second National Library in Hungary, the Voyager integrated library system is running. The OPAC records are accessible both on local and remote networks via WWW and telnet, so the system offers services to the whole academic community and to Internet users (http://www.lib.klte.hu).

The other main server, the VAX 6000/510 (named: **TIGRIS**) is used as the biggest mailserver in the Universitas, so every student and teacher can get a mailing account. We have more than 4500 registered users. As the CIC is the Regional Center of DEC Campus program we provide support of software buying and installing, license-administration and consulting for institutes of higher education in East-Hungary.

There are translators for PASCAL, FORTRAN, ADA, C, C++. For database management we use ORACLE7, and the 4GL application development tools.

4.2. Database management

The CIC focuses the activity on database systems as well. Such as database systems have become an essential part of a computer science education including aspects of database design, database languages and database system implementation. We use for it ORACLE, UNIFACE, GUPTA systems and tools of ORACLE CASE.

As the part of the unified Administrative Management System of the University a Novell based solution is applied for administrative mails. At the departments we have installed Pegasus Mail clients and created useful distribution lists. We provide support for users continuously.

We developed a Lotus-Notes based application for registry of the official mails of University Rector's Office.

We have a terminal room with 30 PC's connected to the Internet and several terminals of the servers. Students of the Universitas are working on these computers using the Internet services, practice different program languages and commands of operational systems. They write and print their documents. The room is open from 7 am to 21 PM on workdays.

4.3. Teaching activities

Courses for graduate and postgraduate students:

- Database management systems: SQL, ORACLE, UNIFACE, GUPTA
- Design of database systems: ORACLE CASE
- Operating systems: VMS, UNIX
- Practices in programming languages: Pascal, C, C++
- Hardware, network

Courses for University staff:

- MS-DOS, Windows, Word, Excel
- Use of Pegasus Mail
- Basic elements of VMS and UNIX
- How to use the network (KLTENET, Internet)
- How to write HTML documents

5. Conclusion

In the last years of this decade the nature and quality of tasks was changed radically. The role of our computer center is increasing continuously in the higher education in the city as we presented above. In order to make the information systems widely used by every member of information society in the future, there should be more focus at University Computer Center.

6. References:

1) Carl Malamud, ``Stacks: Interoperability in Today's Computer Networks'', Prentice-Hall, Inc

Center for Informatics and Computing
Lajos Kossuth University of Debrecen,
4010 Debrecen, Hungary
E-mail: Zgal(at)tigris.klte.hu, Rida(at)tigris.klte.hu, Kata(at)tigris.klte.hu, Terdik(at)cic.klte.hu

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Developing an Information System at the Engineering Faculty of Porto University

Lìgia M. Ribeiro, Gabriel David, Ana Azevedo and J. C. Marques dos Santos

1 Institutional Environment

1.1 Background

Descending from the Polytechnic Academy created in 1837, FEUP is nowadays a prestigious public institution concerning the national teaching and research of Engineering. When the University of Porto was created, in 22th March 1911, the Science Faculty substituted the Polytechnic Academy. An engineering course was offered within the curricula. Later, in 1915, this course became autonomous giving birth to the Technical Faculty. The present name of Faculdade de Engenharia was adopted in 1926.

The University of Porto is, at present, the largest university of Portugal, with approximately 22,000 students, 1,800 teaching staff (760 with a PhD) and 1,000 administrative, technical and auxiliary staff. FEUP is itself the biggest Faculty of the University of Porto, with near 5,000 students and 400 teaching staff, 240 with a PhD. FEUP possesses scientific, educational, administrative and financial autonomy and presents a departmental structure, composed of six areas, and several central services to support its activities. This organisation is depicted on Figure 1.

Presently FEUP offers eight undergraduate courses, 15 MSc and 8 scientific areas for PhD degrees.

Besides teaching, the Faculty carries on research activities and renders services through 9 research centres and 12 interface institutes. These R&D infrastructures account for many national and international projects being simultaneously an excellent back-up for MSc and PhD work (near 400 and 300 respectively, at present). These organs have important connections to industries, particularly in the northern Portugal, optimising the scientific, technical, human and material potential of the Faculty towards the development of applied (and also fundamental) research.

1.2 Communication Facilities and Library Information Resources

The Engineering Faculty local area network, FEUPnet, is an Ethernet IEEE 802.3 network installed in the campus by the Computer Centre (CICA), in December 1989. The backbone consists of coaxial segments in the several FEUP buildings and fibre optic cables that interconnect these buildings in a star topology. An appropriate switch/router provides for each building a bandwidth of 10 Mb/sec. The number of nodes connected to the FEUPnet has blown up since the early nineties. At present there are near 1300 nodes within the twelve class C networks that make up the FEUPnet. These nodes comprise a central cluster with seven UNIX servers, plus several departmental NT and UNIX servers, computer labs with NT workstations and X-terminals, personal microcomputers, terminal servers, printers and CD-ROM towers, widely spread within the different buildings.

Everyone at FEUP can share network resources and gain full access to the Internet. A 1.44 Mb/sec channel connects the local FEUPnet to the national communication network, RCCN. This channel is currently being upgraded to 4 Mb/sec to guarantee a 1.5 Mb/s bandwidth to the 234 middle and secondary schools that are going to be connected to FEUP in the near future. This project, on the behalf of the Portuguese Science and Technology Ministry, aims to offer, during this year, Internet connectivity to the middle and secondary schools, bringing them to the era of global networking and virtual collaborative communities.

Besides being accessible through the Internet, users may access the FEUPnet using traditional analogue telephone lines and ISDN. Near 400 of FEUP students use these facilities to do remote work and access the information resources available, namely those offered by the Library. Although the Library focus is on the internal resources more or less fifty thousand books, eight hundred periodical titles, CD-ROMs, videocassettes, iconography material, maps, etc. the registration of external, and mainly electronic resources, is also being done.

Both the Computer Centre and the Library are strongly engaged with the development of the information system of the faculty. The Computer Centre has the responsibility of the SiFEUP project and houses its core team, which congregates the following competencies: information manager, system manager, database administrator, Web programmer, database programmer, designer and data entry operator.

2 SiFEUP: Strategic and Implementation Plans

In the past, a multiplicity of autonomous and disconnected subsystems has been developed within our institution. These subsystems include, among others, applications to control human resources, student records, accounting, R&D projects and publications. These subsystems present important voids preventing the existence of a coherent environment and the automation of a significant number of functions.

The initiative of creating an information system to enable faster access and dissemination of scholar, scientific, technical and other info-resources, stimulating a stronger collaboration among members of the academic community within FEUP and other higher education institutions, as well as with industries, was taken by the faculty direction board in 1996. Its strong commitment with the project was essential to make it possible. In effect, the different departments and R&D units within FEUP have large freedom in managing their resources and a high level influence is necessary to push towards the development of an integrated campus wide information system.

To accomplish this task, the direction board formed a working team whose main motivation was to find a balance between the development of an articulated system, moving towards full integration, and the incentives to the information providers within FEUP to creatively produce and disseminate info-resources.

The starting point has been the elaboration of a document with a survey of the status of the information system in FEUP and its intended evolution. The model of information space considered has three dimensions: (1) information providers; (2) information resources; and (3) information end-users.

It was decided that only the elements of the academic community, the units of the FEUP organisation structure, the courses, and the outside partners could maintain info-resources of their own in the system. The decision that only officially recognised units within FEUP could be information providers for the SiFEUP was essential to define the overall high-level organisation of the system (see Fig.2).

The information resources (info-resources) accommodate a wide variety of information types and must integrate multiple sources and repositories, namely the Library sources, several network databases, and Internet resources (e.g. Netnews).

The end-users belong mainly to the internal academic community, although users at other R&D institutions and industries, particularly on the north of Portugal, are also important consumers. The general national and international publics are the ultimate end-users of the SiFEUP. Concerning end-users, different levels must be recognised, both internal and externally, to which different permissions of access to the system must be assigned.

Some of the most important objectives of SiFEUP are:

1. To store and recover institutional legal data (e.g. financial and employee data);
2. To increase internal communication effectiveness one-to-many (diffusion), many-to-one (recovery), one-to-one (transfer);
3. To offer to the institutional managers, at different levels, a decision support system;
4. To continually increase educational quality, giving to the students information about the school, course plans, bibliographic and computational resources, research and social activities, and support services;
5. To create on-line educational materials, namely to gain recognition as a centre of excellence on new learning techniques and to promote open access to education and provision for distant learning;
6. To support R&D activities, in particular to help resource discovery and diffusion of research results;
7. To provide the needed information about the current FEUP activities to the educational and industrial partners, as well as to the general public, establishing an Internet presence in accordance with the institutional mission.

Once the objectives identified, other aspects were accounted for in the system development, including:

1. The system is quite large, the information is dynamic and presents different validation periods;
2. The system growth is expected to be fast;

3. The info-structure accommodates a wide variety of information types, like text, tables, graphics, images, audio and video data;
4. Besides Portuguese, the info-resources must also be available in English;
5. The system must be flexible and modular. New components must be easily incorporated, such as new types of info-resources, new information providers, or new facilities needed by the end-users;
6. The diversity of information providers is large, implying a disciplined intervention;
7. Sensible information, like student marks and financial data, must be secure.

To organise the information space understandably the system must prevail the end-user. This means that the framework facilities and functions should be brought into the system by the specific needs of the end-users, that should not be forced to understand the full organisation of the space. Besides, the system should be integrated into the user's computing environment to make simple the integration of data from the end-users applications.

The Web technology, mainly because of its simplicity, availability and versatility, was chosen to join up the different components of the SiFEUP. The Web is the ultimate interactive end-user interface with the information system.

The Web, however, is oriented towards informal browsing in related documents. It's not an efficient mean to discover resources of interest. Without this ability end-users perceive only a limited fraction of the full potential for sharing resources and do collaborative work. Database systems have already successfully addressed this problem and the SiFEUP make use of their potential.

The information system coherence has thus two modes: the consolidation of the structured data by a relational database and the information access by Web browsers.

The information system involves an important part of unstructured data, organised within a framework supported by a central working team. Within this framework, FEUP information providers build their own info-resources and facilities without bureaucratic constraints, according to their preferences and specific goals.

For instance, the basic information relative to the FEUP departments is structured data easily searchable using pre-defined criteria. The database itself contains the URL of the HTML pages designed and maintained by each department own team.

In order to ensure maximum security concerning sensitive data, like student marks and financial data, separate databases are maintained on servers in isolated networks. Periodic downloads of them are done to the SiFEUP.

3. Current Status and Evaluation

The project started with the elaboration of a comprehensive report establishing the logical subsystems and the general architecture. This document is not too detailed, so that space enough is left for further specification. It works as a framework where the permanent requests, coming from very different sectors, are put in context, helping to establish priorities in the corresponding answers.

The following example illustrates the importance of this plan. The Psychologist, in charge of the Student Support Office, wanted to build an application to support a kind of informal Employment Agency for last year students. The problem was to organise and communicate employer requests and student offers, taking into account competencies and preferences. Normally a standalone program would be built and placed it in a desktop computer of the requesting service. The interested people would then fill another form, repeating lots of data already given at several other desks in the Faculty.

An effort was done to integrate this new facility in the SiFEUP. As a topic called Former Students was former included, it was realised that the Employment Agency could have permanently updated information on identification and academic performance, not only of the students contacting the project desk but also of all the students in the school. The goals of the application were amplified to include the follow-up of the professional career of the former students in order to evaluate the actual impact of our courses in the community and to stimulate a sustained contact with them, which could be complemented by permanent education programs.

The application is now working, as part of the SiFEUP, benefiting from the common database and, at the same time, adding value to it by enabling future correlation's and studies.

Although only a relatively small number of the planned components are already available, some improvement is thus noticeable.

The main current problems are:

1. The lack of technical staff. This delays the release of new components. In fact, most of the development effort comes from students working as temporary collaborators or within curricular projects;
2. The need to increase co-operation between the FEUP units. The policy of assigning the responsibility of keeping the data updated to the corresponding unit requires a co-operation that is not always easy to obtain. As happens with every organisational change, there are habits to modify and different models and perspectives about the institution to acquire.

The measure of the adequacy of the SiFEUP becomes fully significant only in the framework of an evaluation of the performance of the Faculty itself. This global evaluation is still beginning. Meanwhile, as the development of the SiFEUP is done in-house by a team who knows how it works, a first degree of correction is guaranteed. Several meetings with the directors of departments, services and courses have been promoted. There is an e-mail address where people send comments, suggestions and requests. A guest book page in the system where everybody can leave a public message is also available. From these feedback's, adjustments are done in the system in order to extract the information in the way and at the time it is more useful to its consumers.

4. Conclusions

In this paper we have presented our experience on creating a modular and flexible system to organise, access, communicate and search large amounts of information, related to the Engineering Faculty educational, research and administrative activities.

The motivation behind the project and the approach selected are both described. We show that a dual-based approach, on the Web and database technologies, is adequate to benefit from the capabilities of storing, structuring, and searching large amounts of data, with adequate exploring tools and levels of security, and to access these same data with a simple, versatile and wide used tools.

The experience here summarised may be useful for other sites that wish to create, manage, access and share large amounts of on-line information, in an integrated and extensible fashion.

Faculdade de Engenharia da Universidade do Porto,
Rua dos Bragas, 4099 Porto Codex, Portugal
E-mail: lmr(at)fe.up.pt
URL: http://www.fe.up.pt

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Managing the Crisis in Information Technology Support in US Higher Education

Susan J. Foster

Environmental screening is essential to strategic planning. It is incumbent upon information resource professionals, particularly those in management and leadership positions, to scan their environment regularly. Part of the CAUSE mission--and the deliberations of the Board of Directors--is to aid that process.

It is instructive to look at the environmental factors identified by the Board last year and set out in the November 1996 CAUSE Strategic Plan, and compare them to the factors that were discussed by the Board in March. Less than a year ago there were six:

- information technology organizations in a state of siege;pressures to reflect an increasingly diverse society;
- survival through institutional cooperation;
- extra-institutional pressures for accountability and for access to affordable, quality education;
- burgeoning ethical and legal issues raised by networked information publication and use, as well as the behavior of network users;
- and the effects on and influences on scholarly communication using electronic media.

Another essential ingredient of strategic planning is awareness and acknowledgment of the emotional climate in which we do our scanning. When we looked a year ago, we were overwhelmed by what we saw and what we were experiencing. I am especially struck by the use of words such as "survival" and "siege." It tells us that a year ago, and perhaps for longer, many of us felt besieged: threatened, defensive, possibly even frozen in place, only just coping, not very hopeful, out of control. As a result, our view was profession centric.

Newly Identified Environmental Factors

This year, in March, the CAUSE Board looked again and this time identified four factors:

(1) It is higher education that is under pressure for accountability, affordability, access, diversity, productivity, service (especially to K-12 educational reform), and seeking shared solutions. These are not the sole province of information resources management. We have allies, both within our institutions and among them, who are also searching for partners with whom to share the load and the solutions.

(2) We recognize that our traditional technology support infrastructure is no longer adequate nor scaleable to meet expectations for change. Scalability requires partnering, inclusiveness, malleability of boundaries.

(3) The barriers to making full use of information resources have shifted. Technology is no longer the limiting factor. Now, more often than not, institutional culture and practice are the inhibitors or catalysts for change.

(4) The last factor is the cycle of infusion and diffusion of information resources that, at the national level, has led associations whose focus has been on discrete constituencies to discover their common agendas and seek greater coherence. On our campuses, various constituencies are discovering issues related to information, with varying levels of understanding of their complexity and common elements.

Clearly our outlook has changed. A year ago we saw ourselves potentially at the mercy of our environment. Now we know that not only can we be actors upon it, but we are an integral part of the whole from which strength and progress can emerge.

There is no one path forward. Institutions will find or adopt those ways that use their strengths and valued attributes. Collaboration will provide for those needs that only scale can achieve.

We are on the threshold of unprecedented diversity in institutions and educational models for which information technologies are a diverse and strategic resource.

Vice President for Information Technologies,
University of Delaware, USA
Current Chair of the CAUSE Board of Directors
E-mail: sfoster@UDel.Edu

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Annual EUNIS Report on University Information Systems in Europe

Peter Mederly

1. Introduction

At EUNIS'96 Conference in Manchester we made an attempt to characterize the state of university information systems in Central and Eastern Europe. Because there were no statistics available in this area, we made a questionnaire containing questions asking for basic information about the state of computing equipment for education, research and management as well as about the state of information system. We sent this questionnaire to deans of 40 faculties of science, mathematics&physics, and electrical engineering of 40 universities in 14 countries of Central and Eastern Europe. We received answers from 15 faculties of 15 universities in 7 countries. We processed the answers and presented them in Manchester. The complete results can be found in [1].

After the presentation we were asked to try to extend this overview by adding data from more universities. To accomplish this, we chose again the form of inquiry. This time we did not limit ourselves to universities in Central and Eastern Europe but we sent the questionnaires to some Western European universities too. We used three channels: the listserver EUNIS, the list of academic officials that took part at the annual conference of deans of science in Paris in 1996, and we turned also to contact persons at Central European universities taking part in the world-wide ACM International Collegiate Programming Contest. The reason why we took just these channels was simple: we wanted to address people that we had already some contacts with before and in this way to increase the probability that we would get the questionnaires back.

Using experiences from the previous inquiry, to make answering of the questionnaire easier we left out some questions more demanding for collecting of data (e.g. questions about number of computers and operating systems used for education and research as well as the questions about technicalities of the network infrastructure). In spite of their importance, we did not included, similarly as before, the sensitive questions about financial issues and we also promised that we would not present the names of single universities in connection with the presented data. On the other hand, this time we left the liberty to answer for the whole university or for a single faculty (last time we concentrated on faculties).

So the questionnaire was a subset of the questionnaire used in the inquiry for Manchester conference. Our main goal now was to concentrate on applications used in the university information systems.

The questionnaires were sent by e-mail and we got back 18 ones from 11 countries. 17 questionnaires contained data at the university level and 1 contained data at the faculty level. 8 of these questionnaires came from 5 Western European countries and the remaining 10 came from 6 countries of Central and Eastern Europe. We did not send again the questionnaires to the universities we successfully addressed with questionnaires for Manchester because we considered the time interval 6 months as being not so essential from the point of view followed in this contribution (except Slovak universities where we completed data from faculty to university level).

After summarizing answers to both inquiries and after omitting some very poorly filled up questionnaires we can state that we have data from 29 universities in 15 countries. The majority of data about information system concerns the university level (24), the rest concerns the faculty level (5).

2. Results of the Inquiry

We will now successively present an overview of the collected results with some comments. According to what we have promised in the inquiry, we will not present the names of single universities.

The questionnaire contained 3 parts:

1. Basic information about the university.
2. A short characterization of the university network.
3. Basic information about the applications used within the information system of the university.

In the first part we asked about the name of the university, number of its students, the name of the organization unit(s) responsible at the university for academic and/or administrative computing services, and the number of full-time staff positions in this organization unit(s).

In the second part we were interested in the accessibility of the university network (options: A - the university network is accessible (installed) in almost each room, B - the network does not cover the whole university but almost each organizational unit has at least one computer connected to the network, C - the network does not exist), the number of computers connected to the university network, and whether there is an Internet connection at the university.

The main results of the first two parts of the questionnaire are summarized in Table 1. Individual columns of the table contain: a symbolic name of the university (we have promised not to disclose the full names), country, number of students. In the fourth column, there is the number of full-time positions in the organization unit(s) responsible at the university for academic and/or administrative computing services. If the university declared just one such unit, one number is presented. If it declared separate units for academic computing and administrative computing, two numbers marked by (Ac/Ad) are presented. In two cases universities declared just the unit for administrative computing - in these cases the number of positions of these units is followed by an (Ad) remark. The fifth column contains the characterization of the university computer network in terms of above options. The number of computers connected to the network is in the last column. If a position in the table is blank, it means we have not got corresponding data. The data marked with * concerns faculty level.

All universities that responded to the questionnaire have Internet access.

Some remarks about the data presented in Table 1:

- Universities of different size - from 2 500 to 60 000 students - took part in the inquiry.
- Each university has a central unit(s) taking care about academic and/or administrative computing services. But the numbers of full-time positions in these units are considerably different. Also the organization differs. 6 universities (21%) have separate units for academic and for administrative computing. The rest has at university level one computing center for both types of services with number of positions ranging from 3 to 100. This fact alone may considerably influence the situation in the use of information technologies at the universities.

Table 1
Basic information about universities and their networks

University	*Country*	*Number of students*	*Number of positions in CS unit(s)*	*Network accessibility*	*Number of computers*
U1	Austria	23 000	56/10 (Ac/Ad)		2 500
U2	Finland	6 000	15/7 (Ac/Ad)		2 500
U3	France	60 000	40		10 000
U4	GB	12 700	75		3 900
U5	GB	17 000	12 (Ad)		
U6	GB	18 000	20 (Ad)		
U7	Ireland	11 000	53		2 500
U8	Ireland	8 500	25		1 350
U9	Czech	6 000			1 500
U10	Czech	15 000	45/5 (Ac/Ad)		2 000
U11	Croatia	50 000; 1 000 *	60	A *	70 *
U12	Estonia	8 100	25		1 000
U13	Hungary	6 000; 2 500 *	30	A *	220 *
U14	Lithuania	10 000	125/13 (Ac/Ad)		500
U15	Lithuania	10 000	100		300
U16	Lithuania	4 500			200
U17	Poland	45 000	79		
U18	Poland	20 000;1 300 *	5 *	A *	480 *
U19	Slovakia	8 300	68		1 000
U20	Slovakia	20 000	20		2 000
U21	Slovakia	5 500	11		200
U22	Slovakia	2 500	18		170
U23	Slovakia	3 500	26		600
U24	Slovakia	11 500	43		750
U25	Slovakia	4 000	11		500
U26	Slovakia	15 000	63		2 500
U27	Slovenia	14 000	17		2 000
U28	Slovenia	2 450 *	3 *	A *	700 *
U29	Slovenia	30 000; 700 *	3 *	A *	120 *

** data concerns faculty level*

- At 21 universities (72%), the university network is accessible in almost each room. At the remaining 8 universities (28%) the network does not cover the whole university but almost each organizational unit has at least one computer connected to the network.
- The biggest university network has 10 000 computers connected, the smallest has 170. The rough ratio number of students / number of computers in university network varies from 2,4 to 33.

The third part of the questionnaire dealt with university information systems. With regard to EUNIS mission, we can consider this part the most important.

The first question of this part was whether the university has centrally maintained WWW system. All but one responses were YES.

Further we listed most common applications usually used at universities. The applications were divided into several areas:

- Financial and personal information: Accounting, Operative financial records (orders, invoices ...), Equipment records (inventory), Personal records, Salaries.
- Student information: Personal records of students, Admission process, Study records, Dormitories, Financial aid, Schedules.
- Library: On-line catalogue, Acquisition, Catalogue, Loan services.
- Science, research and international relations: Publications, Research projects, Visits abroad, Foreign guests.

There was also place for presentation of other applications used at the university. For each application we asked for the following information:

- Operation environment: hardware and operating system.
- Network operating system if the application runs in network environment.
- The source of application. Options: I - developed in-house, S - bought as a standard application, D - developed by an external partner, O - other.
- Implementation environment.

We were aware that the structure of applications at different universities need not be exactly as presented in the questionnaire but we expected that people would look at the list more from the functional point of view. It turned out that in general this assumption was satisfied.

An overview of responses to this part of the questionnaire is in Table 2. The first three columns of the table contain the name of the area, the name of the application, and the total number of applications that appeared in the questionnaires. Next five columns contain data about operating systems used for the application. The headers of columns are self-explaining, O stands for "other". Next two columns say how many implementations of the application are running is network environment (N) and how many as standalone (S/A). Unfortunately, incompleteness of the answers has not enabled us to make a more detailed classification of the network operating systems used. Columns headed I, S, D, O (which stand for single options described above) contain figures about the source of the application. The last section of the table is devoted to implementation environment. Individual column headers have the meaning as follows: DBF - implemented in Clipper, FoxPro, or DBase. Or - implemented in Oracle. 3GL - implemented in a 3GL language such as COBOL, C, FORTRAN, Pascal. IIP - implemented in Informix, Ingres or Progress. Off - implemented in MS Office. O - implemented in other environments. U - implementation environment unreported.

Table 2
Overview of information about applications

Area	*Application*	*# of*	*Operation environment*					*Network*		*Source*				*Implementation environment*						
		Appl.	*DOS*	*UNIX*	*VMS*	*Win*	*O*	*N*	*S/A*	*I*	*S*	*D*	*O*	*DBF*	*Or*	*3GL*	*IIP*	*Off*	*O*	*U*
Financial	*Accounting*	29	16	5	4	3	1	20	9	10	13	5	1	14	4	5	2	1	1	2
and	*Operative Financial Records*	24	14	4	2	3	1	16	8	12	6	5	1	14	2	3	2	2	0	1
Personal	*Inventory*	22	15	4	2	1	0	11	11	14	4	4	0	15	3	2	1	1	0	0
Information	*Personal Records*	27	17	4	5	1	0	21	6	14	8	5	0	14	5	2	2	0	3	1
	Salaries	27	16	4	3	1	3	21	6	9	10	7	1	15	4	2	3	0	1	2
	Total for the area	***129***	***78***	***21***	***16***	***9***	***5***	***89***	***40***	***59***	***41***	***26***	***3***	***72***	***18***	***14***	***10***	***4***	***5***	***6***
Student	*Personal Records of Students*	28	14	8	3	2	1	22	6	22	1	5	0	15	6	2	2	0	2	1
Information	*Admission Process*	24	14	5	2	2	1	19	5	21	0	3	0	16	4	1	1	0	2	0
	Study Records	22	11	6	1	3	1	18	4	19	0	3	0	12	5	1	1	1	2	0
	Dormitories	15	8	3	3	1	0	11	4	12	1	2	0	7	4	1	1	1	1	0
	Financial Aid	13	8	2	1	1	1	8	5	10	1	2	0	9	2	0	0	0	1	1
	Schedules	16	11	1	2	2	0	5	11	13	2	1	0	8	2	4	0	0	0	2
	Total for the area	***118***	***66***	***25***	***12***	***11***	***4***	***83***	***35***	***97***	***5***	***16***	***0***	***67***	***23***	***9***	***5***	***2***	***8***	***4***

Table 2 (cont'd)
Overview of information about applications

Area	*Application*	*# of*	*Operation environment*					*Network*		*Source*				*Implementation environment*						
		Appl.	*DOS*	*UNIX*	*VMS*	*Win*	*O*	*N*	*S/A*	*I*	*S*	*D*	*O*	*DBF*	*Or*	*3GL*	*IIP*	*Off*	*O*	*U*
Library	*On-line Catalogue*	20	1	9	4	1	5	20	0	4	8	5	3	0	1	2	2	0	8	7
Information	*Acquisition*	16	4	7	2	1	2	15	1	5	6	3	2	3	0	0	2	0	5	6
	Catalogue	25	6	10	3	1	5	23	2	8	9	5	3	3	1	1	3	0	10	7

	Loan Services	16	2	8	3	1	2	16	0	2	8	4	2	2	0	1	2	0	6	5
	Total for the area	***77***	***13***	***34***	***12***	***4***	***14***	***74***	***3***	***19***	***31***	***17***	***10***	***8***	***2***	***4***	***9***	***0***	***29***	***25***
Science, Research, International Relations	*Publications*	13	6	4	3	0	0	10	3	8	3	2	0	4	2	1	0	0	4	2
	Research Projects	8	4	2	2	0	0	5	3	5	0	3	0	4	2	1	0	0	0	1
	Visits Abroad	7	6	1	0	0	0	3	4	6	0	1	0	5	1	1	0	0	0	0
	Foreign Guests	4	3	1	0	0	0	2	2	3	0	1	0	3	1	0	0	0	0	0
	Total for the area	***32***	***19***	***8***	***5***	***0***	***0***	***20***	***12***	***22***	***3***	***7***	***0***	***16***	***6***	***3***	***0***	***0***	***4***	***3***
	Total for all applications	***356***	***176***	***88***	***45***	***24***	***23***	***266***	***90***	***197***	***80***	***66***	***13***	***163***	***49***	***30***	***24***	***6***	***46***	***38***

Some remarks on the data in Table 2

- We have got information about 356 implementations of applications in total. If we look at the data collected in the individual areas we can see that the most numerous are applications in the financial and personal area (124) and in the student information area (118). The smallest number of applications is in the area of science, research, and international relations (32). As for libraries, 77 application were presented but it turned out again that library systems form relatively independent part of university information systems. It is clear that almost all universities have some software for libraries but in several questionnaires people presented no information about library software and even if they presented, they were not able to provide complete information.
- Let's concentrate now on the most important areas, i.e. financial and personal information area and student information area. As for operation environment, network, and implementation environment, there are no considerable differences between them. In operation environment we can still see the clearly leading position of MS-DOS (61% and 57%, respectively) followed by UNIX (16% and 21%) and OpenVMS (12% and 10%). Windows systems (7% and 9%) are still relatively behind. Concerning network vs. standalone environment, about 3/4 of implementations are networked (terminal-host implementations we also considered as networked). As for implementation environment, the most frequent implementation tools are Clipper, FoxPro, and still also some DBase (55% and 57%), second place is for Oracle (14% and 19%), then there are 3GL (mainly COBOL) applications (11% and 8%). Other well-known database systems Informix, Ingres and Progress have together the next place (8% and 4%). After other (4% and 7%) and unknown (5% and 3%) implementation environment at the very end there is MS-Office (3% and 2%).
- The equilibrium between the two areas is broken when we compare where the universities got their application from. While for financial and personal information area the figures are the following: developed in-house 46%, purchased as standard products 32%, and developed for the university by external company 20%, for student information as much as 82% of implementations have been developed in-house. 14% come from external companies and just 4% have been purchased as standard applications. The visualization of these facts is in Fig. 1 - 4.
- It would be interesting to compare the situation between western and eastern universities. Unfortunately we have just 8 western universities participating in the inquiry so we cannot make deeper conclusions. Nevertheless, if we take the data from these universities and compare them with the data from eastern universities we can see some clear differences. At western universities, there is:

  - much less applications in DOS environment,
  - much less standalone applications,
  - much more applications in Oracle and in COBOL,
  - relatively less in-house developed applications and more applications bought as standard products,

  comparing with eastern universities.

In the third part of the questionnaire we also asked which applications do share common data and whether the sharing is on-line or off-line. Next question was about the methodology used for in-house application development and the last question was: what is the expected development in the area of university information system at the university in the next three years. Options: A - IS will be maintained mostly at the current level with inevitable changes of existing applications, B - IS will be enhanced by adding further applications. Existing applications will be maintained and inevitable changes of them will be made, C - A development of a new IS will be started.

Fig.1 - Operating environment

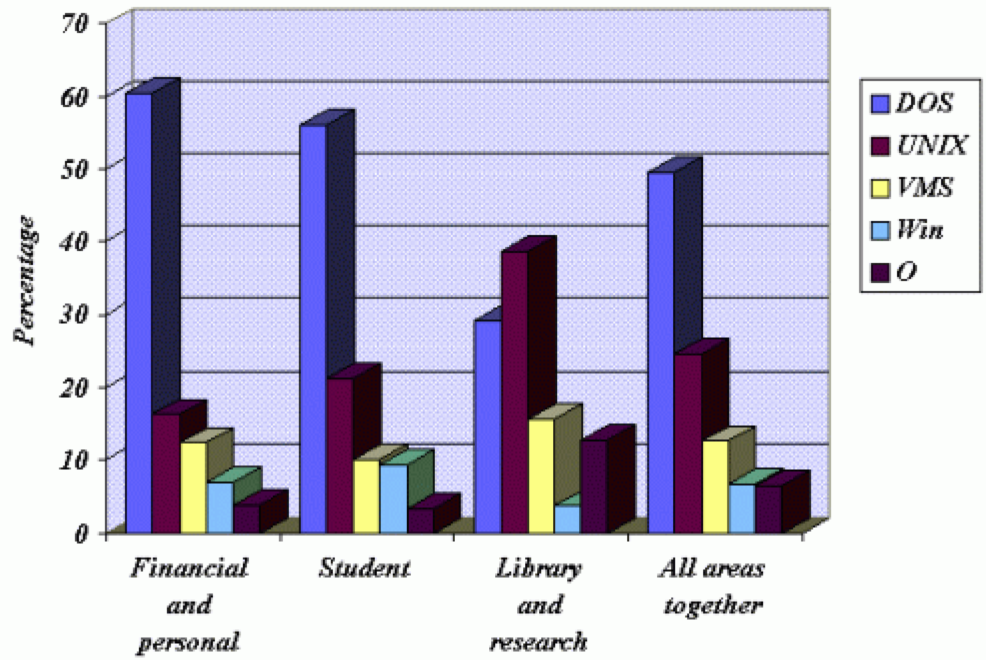
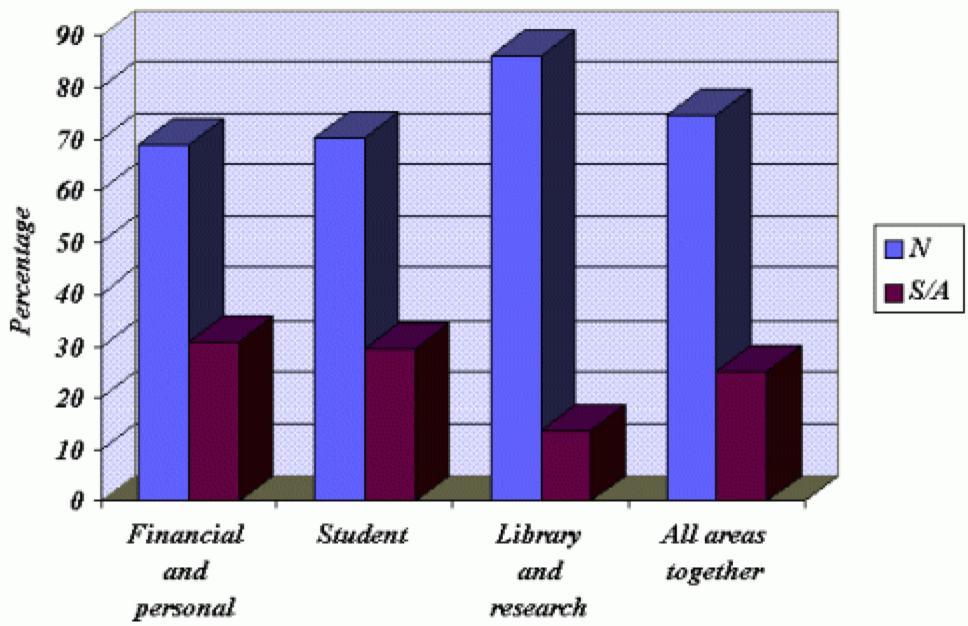
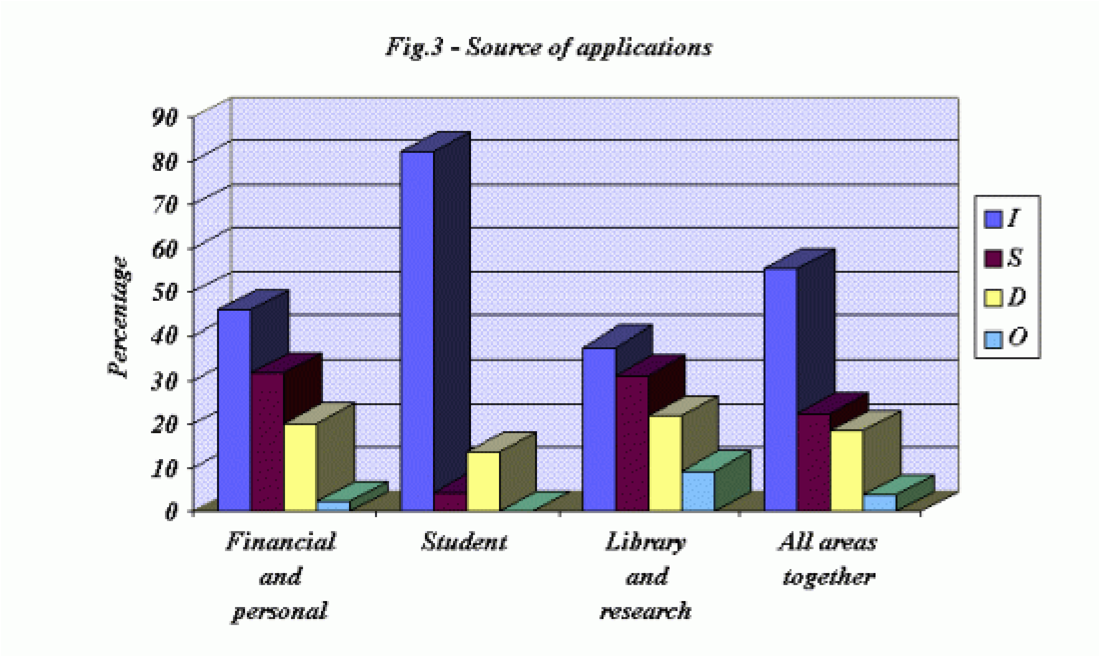
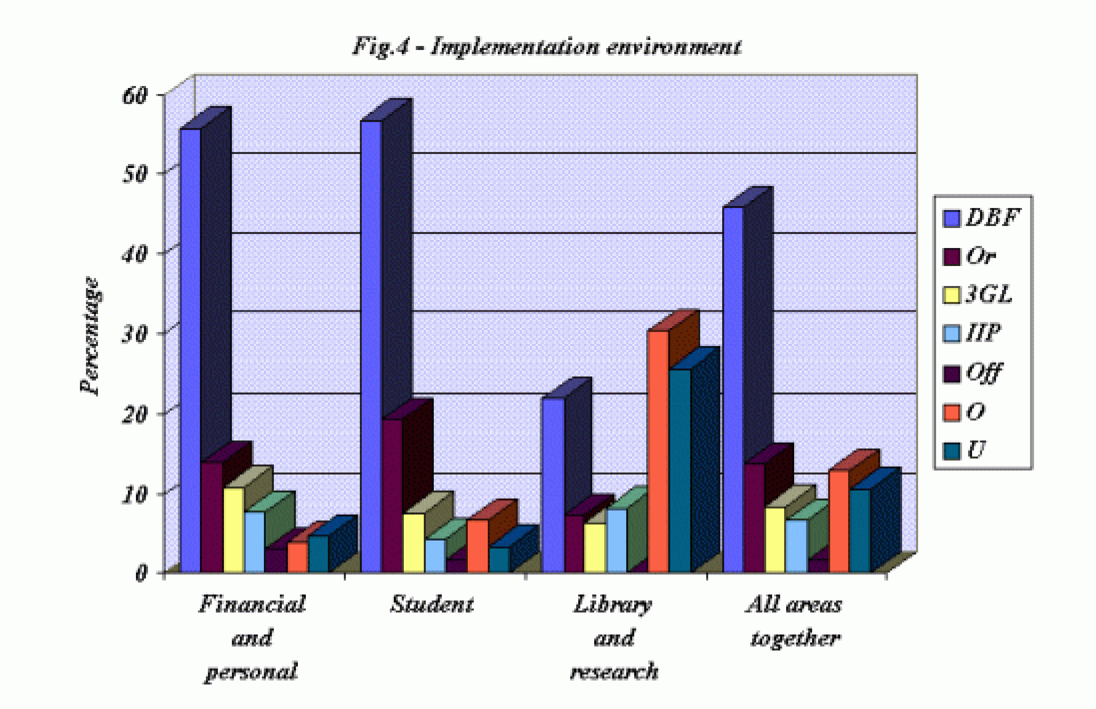


Fig. 2 - Network environment







The results of this part of the inquiry could be summarized as follows:

- The question about the sharing of data was formulated rather freely. From the answers we can estimatethat at 8 universities (28%) the data among applications are shared to large extent, at 10 universities (34%) we can speak about some sharing of data (typically within individual areas of applications), at 4 universities (14%) there is no sharing of data and the remaining 7 universities (24%) did not answer the question.
- Although all but two universities (94%) developed at least one of their applications in-house, only 7 universities (24%) declared the use of a development methodology. 4 of these 7 universities are western ones.
- As for the expected development of the university information system within the next three years, 17 universities (59%) suppose that the development of the new IS will be started (option C), 11 universities (38%) expect that their current IS will just be enhanced by adding further applications (option B), and just 1 university is satisfied with its information system and expects that its IS will be maintained mostly at the current level with inevitable changes of existing applications (option A). At western universities, option B prevails over C (5 and 3), at eastern universities option B has much smaller frequency than C (6 and 14).

3. Closing remarks

In the end of this contribution we want to accent our awareness of the fact that the inquiry we have obtained data from cannot be considered large and representative enough, and therefore we cannot make very deep and indisputable conclusions from it. Nevertheless, it has confirmed some facts and problems known to people working in university information systems area, the facts and problems that led to the establishment of national and international organizations for co-operation among universities in this area. If we had to say more concretely what could be a real contribution of this inquiry, we would formulate it perhaps like this:

1. The inquiry has brought the first, although incomplete, picture of the state of university information systems around Eastern and partly Western Europe (at least in EUNIS environment).
2. The inquiry has shown that many universities want to start the development of new information system for themselves in near future.
3. At the same time it turned out that in spite of the fact that many applications are developed in-house, this development is done without any standard or nonstandard methodology.
4. The inquiry has also shown that it has already appeared examples of good integrated university information systems.
5. Two rounds of the inquiry brought first experiences with such kind of activities. It would be worth to think over whether EUNIS should not make such an inquiry, properly modified, a regular part of its activity. This activity could lead to a permanent database of information about university information systems in Europe.

4. References

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Comenius University,
Bratislava, Slovakia
E-mail: mederly(at)fmph.uniba.sk

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The Future Compatible Campus: Global Education in the 21st Century

Diana Oblinger

The year 2000 is less than 1,000 days away. How will we create the future compatible campus when the 21st century is almost upon us? Change seems to be occurring at an ever increasing rate.

Many of the reasons for this rapid pace of change relate to information technology. The volume of new information is increasing at such a rapid pace that the class of 2000 will be exposed to more new data in a year than their grandparents encountered in a lifetime. The evidence of the information explosion is all around us.

- Ten thousand scientific articles are published every day (Forman, 1995).
- Ninety percent of all scientists who have ever lived are alive today (Prusak, unpublished).
- Beginning in 1907, the Chemical Abstracts Society took 31 years to accumulate its first million abstracts; the next million took 18 years, and the most recent took 1.75. More articles have been published on chemistry in the last two years than all of recorded history before 1900. (Noam, 1995)
- As of May 1996, there were more than 33 million articles and web pages. It would take over five years to read just the new listings added each month (Van Alstyne, 1996). Even so, only 1% of the world's recorded knowledge is available on the Internet.
- Predictions are that by the year 2020, knowledge will double every 73 days.

One of the defining trends of the future will be the rate of change. In fact, for the first time in the history of higher education, the ability to manage change is becoming a competitive differentiator.

"Many feel that traditional self-contained, time-delimited "degree" programs may have increasingly limited use in a world where information and skills become quickly obsolete. Education has already become a lifetime process and with the advent of a "virtual" university comes the possibility of providing the learning people need, when they need it, wherever they happen to be.

"We must move beyond the idea that any particular model of education is sacrosanct and concentrate on the content and results of that education. Success as a "lifetime" university will mean the creation of a much more flexible and adaptive education. `Just-in-time' courses will need to respond to the diverse and shifting needs of emerging careers, developing social problems, and opening areas of knowledge. Some classes may need to be available in modules so that students can choose the parts they need to know." (Duderstadt, 1996).

There are other indicators of the rate of change. Microprocessor performance has been increasing at a relatively constant rate, doubling approximately every 18 months. This trend is expected to continue. Its impact, however, is a perceived time compression which will cause changes in business, education, entertainment and daily life.

A steady rate of growth (2x per period of time, as in 2, 4, 8, 16, 32....) will yield progressively larger increments of growth as the rate continues. The result is that it takes less time to cover the same increment of technological improvement as time goes on. This is perceived as less time; it stresses our established models.

The result is that we sense a breathless pace of change. The impact is felt on organizations, as well. Asset volatility is high. Neither organizations or individuals can purchase the "right" machine. As soon as it is bought, it is out of date. No one can keep up with the current version of the software. Organizations are spending enormous energy, time and money churning hardware and software in an attempt to stay current. In spite of large investments, institutions find themselves with two or three levels of technology that are now obsolete, but which they cannot afford to discard.

Add to this scenario the fact that these changes are dwarfed by what we believe will happen in network bandwidth. Expect changes on the order of 800 to 1,000 times in bandwidth (Tuller, 1997). To put this into perspective, it is possible to transmit close to 1.2 GB (gigabits) of information over a network with current capabilities. This is roughly equivalent to 85 books or 39,000 pages of text per second. Such transmission speeds also support scientific visualization. Compare this to the capabilities available in 1989 when transmission speeds enabled a mere two pages per second to be sent across a network (Hulser, 1997).

SCENARIOS

Most of us predict the future based on the past. Instead, let's begin our glimpse of the future with scenarios of what is really represents the present and what will be the probable future.

Age 15. The term papers in this course are web-based. The students have grown up thinking and composing in hypertext. "Technology" is as natural to them as a household appliance. A student has an aunt who lives in Ireland. She just began a job processing insurance forms for a US company. The firm moved its operation from America to Ireland to take advantage of the high literacy rate and competitive wages.

Age 16. A student is preparing for college entry. He/she uses CollegeNet to browse information on colleges of interest and receives periodic "counseling" updates such as reminders to begin preparing for college entrance exams and to develop a savings plan for college. These same students routinely correspond with pen pals from around the world. Getting connected and staying connected is taken for granted. This is the first generation for which the world is their "neighborhood."

Age 17. Students participate in Project FeederWatch on the World Wide Web. Not only are they able to research questions using the online database, but they contribute to a research which spans North America. The project from Cornell University's Laboratory of Ornithology is founded on the concept that scientific literacy can be improved by involving the public and school children in scientific research. A student later learns that a Korean firm has bought out his father's company. Mergers and acquisitions are changing the face of business.

Age 18. Students are taking a college course--at a distance--to get an early start on college credits. One 12th grader has a pen pal in India. Her father is working on a global software project--the project moves across three continents (where each one is a work shift) every 24 hours.

Freshman year. A college freshman uses information technology for a history course, utilizing historic archives that are in digital format on the Internet. At the same time that the student hears FDR's radio broadcast declaring war on Japan, he/she is able to read along from his notes. Access to the original material is more motivating and memorable than just reading from a textbook.

Sophomore year. A sophomore is studying music appreciation. However, instead of all the content being provided by the professor, students learn the fundamentals then are provided with a music analysis tool. Their assignment is to select a piece of music, analyze it and present it to the class. The students must teach each other.

Junior year. A junior is working on a team, selecting problems in a kinematics class. Applying principles from engineering and physics, the team collects data, analyzes the problem and reports the results on the web. The students find it motivating to be able to select their own problems and for their work to be shared with others.

Senior year. A senior is solving a microbiology problem. There has been an outbreak of food poisoning. The assignment is to identify the pathogen, find its origin and recommend corrective action. Lab tests are performed and analyses are made. Feedback is instantaneous. Information from multiple courses must be integrated.

Adult learner. An adult is studying for a new career in auto mechanics. Prior learning is assessed using a pre-test. Content for the course is delivered using video, text and audio in an integrated environment where tools such as a glossary are easily accessed. The learner is able to study on a flexible schedule.

There is an increasing body of evidence that technology, when well utilized, will lead to improved student achievement. More important than improving current educational practices, technology provides an opportunity to achieve results that have not previously been possible; to find entirely new approaches to teaching and learning; to reach students who have been immune to current strategies; to teach new, higher order skills; and to reinvent education (Verville, 1997).

THE LEARNING ENVIRONMENT

Whether describing the present or the future, information technology will play a role. One of the great values of technology is that it expands our options. Hundreds of years ago, the lecture was designed as a surrogate to direct access to scholarly information. When books were a rare commodity, the closest students were able to come to authentic information was the lecture. Today our options range from original archives to digital books to three-dimensional representations which move about the world at the speed of light. If you ask the question, "Why do we teach the way we do?" the answer is often that we didn't know there were other options. This no longer needs to be true. With what we know about cognition, technology and communication, we now have the richest collection of educational options available in centuries.

It is not just the medium that is changing. We are in the process of shifting what it means to be literate from the memory base of knowledge acquisition to knowing how to find and use channels of information. Knowing how to learn is more important than the facts accumulated (Adams, Carlson and Hamm, 1990).

The brief scenarios on the previous pages provide a glimpse of education as we approach the 21st century. The learning environment of the future will continue to incorporate information technology (IT). The functional characteristics of IT, coupled with a better understanding of cognition, will lead to the development of learning environments that are authentic, interactive, equitable, sensory, modular, global and network-based.

- Authentic: Information technology allows us to bring students as close to the real experience as possible. Students can travel back in time to FDR's "Day in Infamy" speech. They can experience the pain and struggle of Dax Cowart. This access to authentic information--the original source material of scholars--brings students closer to the level of scholarship that faculty experience. It is through working with authentic material, coupled with learning the "way of thinking" of a particular scholarly community, that students enhance their learning.
- Interactive: Passivity has given way to interactivity. It is well recognized that the greater the interaction--student-to-student, student-to-professor or student-to-information--the greater the learning. The value of technology to education is partially encapsulated in the phrase "getting connected." "Connections are not just to information, but to other students, instructors and experts. Networks offer learners and teachers access to new ideas, perspectives, cultures and information--enriching locally available resources" (Harasim et al, 1995).

Students can easily interact with their fellow classmates, regardless of the fact that they may be spread across the country or the world. Although the face-to-face method may be the most efficient form of communication, such meetings do not occur very often (or at all when classmates span the globe). Said another way, the communication bandwidth peaks during face-to-face sessions and falls to zero in between traditional class sessions. Networked communications allows students to communicate 24 hours a day, seven days a week (i.e., asynchronously). The result is that, averaged over several hours, the effective bandwidth for asynchronous communication can be much higher than face-to face communication (Mayadas, 1997).

Another element that is different for students in on-line classes is the opportunity to learn from each other--to see the work of others and to compare their ideas with those of their classmates. Students learn not only from their own work, but they can learn from everyone else. By its very nature, this kind of on-line environment encourages collaboration and group interaction (Kearlsey et al, 1995).

- Equitable. Delivery of education through a collaborative, computer-mediated environment alters the relationship of the instructor, the students, and the course content. The many-to-many, asynchronous nature of the medium "democratizes" access and encourages student input (Harasim, 1991). In fact, studies are showing that students feel they have more access to the professor than they did in traditional, lecture courses as well as more interaction with other students.
- Sensory: Digitization has allowed us to effectively create a common, worldwide "language" with which to communicate. Virtually everything can be translated into a common currency of bits and bytes. The significance of digitized information is that the conversion of text, graphics, images and video into bits provides information with a digital passport to travel across global networks. Powerful new communications technologies are giving networks the bandwidth needed to handle rich but space-consuming content like video, MRI scans or great works of art. Networks are developing the speed to support interaction, enabling two-way communication and collaboration. Together, digital content and high-speed networks allow us to create "microworlds" that create sensory experiences that are much most motivating and memorable than text alone.
- Modular: It will become increasingly common for institutions to share courses, modules and curricula. The expectation that every faculty member create his or her own unique course will be replaced by a model of mass customization. Courses will be built of modules that can be "snapped" together to create unique combinations, individualizing and personalizing instruction. Few faculty will develop their own digital course materials from scratch; most will use component material directly or tailor it. This will facilitate more rapid response to the needs of learners whether the goal is completing a standard degree program or acquiring a skill related to a specific job or career.
- Global: Knowledge knows no boundaries. Education without a cultural frame of reference limits its value. The ability to use language ,interact and work productively with people from other cultures are skills that will be embedded in courses. Global systems are represented in the 21st century curriculum. These systems affect the quality of life as exchange rates raise and lower the price of goods and as pollution and public health problems trascend national boundaries (ACE, 1995).
- Network-based: The network--the global information infrastructure--allows learners to access resources anywhere at any time. Both students and instructors can share ideas, concerns and solutions with peers--no matter where they are--as easily as if they were in the next room. It also allows for nearly instantaneous updating of information. Because knowledge is distributed, communities of learners come together and disperse based on needs and interests, not solely on geography.

Technology is helping higher education execute the social obligation with which it is invested. Education is seen as the key to social and economic progress. Network technology is allowing us to establish education as the centerpiece of community and global networks. This extension of the benefits of education to the community-- to women, minorities, the elderly as well as underprivileged children-- will enable us to facilitate the development of learning communities that transcend the traditional boundaries of education.

In the 21st century university, our options will be expanded. Communication, computing and networking technologies extend the reach and range of traditional residential colleges and universities, enabling students to synthesize on-campus with on-line experiences. Some learners seek a mixture of face-to-face experiences and network-based education. For example, the on-campus student who wishes a more individualized, self-paced, self-directed learning experience can achieve that desire through technology. With a goal of reducing the time to degree, students may choose to complete courses in residence while simultaneously fulfilling other graduation requirements on-line. The network expands options for interaction among faculty and students. External experts are more easily accessed; opportunities for faculty to individualize and personalize contact with students is increased (Oblinger, 1997).

We see an immense opportunity to establish forms of electronic-based collaboration--from the student level to the institutional level--that can bring about major improvements in both access and learning, while meeting the legitimate public and institutional concerns about cost and quality. This is not to suggest that technology-based learning should replace traditional pedagogy; this is not an either/or proposition. Computer-assisted, self-directed, electronically-mediated learning will work for some institutions but not for others, for students in some fields, but not for all students in all fields (Mingle, 1995). As institutions move toward the creation of their campus of the future and a learning continuum that spans birth to death, it will be important to understand the nuances of where networked learning is the most appropriate alternative or supplement to traditional residential education, and how it can best be implemented.

TRENDS TO WATCH

Although no one can accurately predict the future, identifying the trends to watch is critical as we anticipate the form and function of our future institutions. We believe the defining trends of the 21st century will be:

- Technology
- Globalization
- Complexity
- Demographics
-

Linkage between education and economics

Technology

To put information technology into perspective, consider a few facts.

- In 1995, Americans spent more on PCs than on televisions
- If you drive a Ford Taurus (or a Mondeo) today, it has more computing power than the first lunar landing module
- In 1985, the most expensive car in the US was the Cadillac. It cost $17,000, got 12 miles to the gallon and weighed over one ton. If the auto industry operated on the same technology trajectory as the computer industry, today's Cadillac would cost $12,63, get 5,900 miles per gallon, weight 14 pounds and be 3 feet long.

Our purpose is not to belabor the technology itself. Of more importance are the changes that it stimulates. In fact, our view is that information technology is a transformation agent that will change every institution, every business and every individual in profound ways. We are moving rapidly towards global connectivity which is changing access to content, services and communication. The likely consequences include:

- Everyone will become a technology user because costs will be low enough and compatibility will be high. New software will allow the broader population of users to easily deal with ever more complex systems.
- Inter-enterprise integration will become pervasive. We already see this in the form of electronic links among suppliers, distributors, students and faculty.
- We will process and transport bits, instead of things and people; information will displace the physical. Working this way will be faster and less costly, as well as less harmful to the environment.

As a tool, technology enables the transmission of information. However, the critical process is people interacting with other people. Technology enables us to develop a much more participatory and collaborative society. The societal implications of participation and collaboration could be immensely powerful. Drawing on research in collaborative learning, we know that there are significant, positive cognitive and non-cognitive effects of collaboration.

Information technology also places pressure on the "middleman." Computer networks offer the possibility of learners accessing services and information directly rather than through an intermediary. We have seen service delivery change in business (e.g., automatic teller machines) as a result of this "middleman" phenomenon. One of the challenges to higher education will be to identify those "transactions" where humans are "in the middle," redesigning them so that they add value.

When confronted by skeptics who question whether technology will have an impact on higher education, the response is that it already has. Information technology has opened new, fundamentally different options for higher education, both in how to run "the business" of higher education as well as in teaching and learning. History demonstrates that fundamental technological change ultimately begets significant structural change, regardless of whether the affected participants choose to join or resist the movement. The changes that universities have weathered over the centuries did not upend their basic technology. Information technology does (Massy, 1997).

Globalization

In the global marketplace, companies, industries, products, technologies and even jobs no longer depend upon the strengths and weaknesses of any one nation's economy or industrial base. Jobs lost at home reappear abroad. Goods and services flow freely across borders and among trading blocks. Graduates must compete with their peers from overseas (ACE, 1995).

Global competition is one of the most significant forces of change in the last five years for business. This is the environment in which graduates will work. It is tempting to assume that much of this global pressure stems from "sweat shops" or exploitative labor practices. However, global competition no longer means a low wage unskilled labor pool. Increasingly, competition is coming from a high quality, highly productive work force.

The strategy of many countries is to skip over being an industrial power and move directly to being a powerbroker in the information age. It is a savvy approach. For those with massive populations, their raw power is in people. If they are educated, have a strong work ethic and are motivated to become middle class consumers, they will become fierce competitors with the US and Western Europe. "Industrialized" nations cannot afford to stand still.

Globalization is not just about competition, it is also about interdependence. As an example of international interdependence, consider the nations involved in manufacturing and selling my Honda Civic. The engine was assembled in Japan with some US parts. That engine was likely shipped on a Liberian-flagged freighter with a Greek crew, manufactured in Ohio, distributed by a trucking firm and sold to me in North Carolina. Where once we were in competition, we are now bound by mutual dependence.

Globalization represents a structural change. When a structural change occurs, things never go back to the way they were. We will never be able to recreate the time when the US or the UK was the dominant economic and cultural force. Globalization is inexorable. It will not be reversed; it cannot be legislated away. One of our educational challenges is to integrate globalization into the curriculum in a meaningful way so that we can capitalize, rather than be constrained, by globalization.

Complexity

Everything appears to be getting more complex. More technology is used in the workplace. More technology is involved in home products. More technology is used in education. By the year 2000, 95% of the US workforce will use some type of information technology in their jobs. In addition, almost all workers are asked to make decisions and solve problems. With this increasing level of complexity it is not surprising that 75% of our workforce needs retraining just to keep up.

In the workplace, the people with whom we interact are more diverse in terms of culture, gender, ethnicity and age, making interpersonal communication more complicated. As layers of middle management are removed for the sake of efficiency, different tasks are being required of workers. All these add to the complexity of work.

The more complex a process or an event, the less likely it is that a single individual knows enough to master it. Complexity also compounds the likelihood that something will "go wrong" and specialized knowledge will be required to correct it. In both of these cases, the knowledge needed will most likely be found through others. As the nature of work itself changes, there is much greater emphasis on workplace knowledge--the knowledge that is embedded within the routines, processes, and norms of the organization. To be efficient, organizations must gain access to this non-articulated knowledge that resides within groups of professionals. (Prusak, 1997).

Demographics

When we begin thinking in global terms, it does not take long to realize that most of the world's population is elsewhere. Many of us grew up with the assumption that the US or the UK "dominated" the world. The truth is that we no longer dominate; we are one among many. Not only do 95% of the world's consumers reside someplace other than the United States, but economic growth is more rapid outside the US than it is here. As other countries experience economic growth, they behave similar to us. The availability of more disposable income makes them better consumers. It increases the size of the middle class.

Another dominant demographic trend in our countries is aging. The "graying" of our population is likely to produce a variety of changes in society at large and in higher education, as well. This aging labor force will require new investments by the public and private sectors in education and training in order to facilitate American economic growth and productivity. For example, as older adults work longer and postpone retirement, many seek continuing education in order to stay abreast of new technologies and developments with professional disciplines. For those who do retire, many pursue learning for enrichment and enjoyment.

At the other end of the age continuum, consider "Generation Y," those children who will reach their teen years as the next century begins. They will be the first generation to take the Internet for granted. Generation Y's orientation in space and time will be different from its predecessors. Some are growing up with online pen pals on other continents. Far more than today, their world will be global, connected and around-the-clock. Their neighborhoods will not be the street where they live, but the people with whom they interact, electronically (Graham, 1997).

Generation Y will never know a world without computers. Global conversations over the Internet will bring distant cultures close. What's more, they won't even realize how remarkable that is. This generation views computers as basic equipment, like pencil and paper, not something to be feared. Technologically, this generation is going to make the Generation Xers look like fuddy - duddies (Beck, 1997).

Link between education and economics

Throughout the world, a highly educated population is seen as the key to economic growth and a stable society. Higher education's importance will continue to grow as the world's economic strength is increasingly based on an information age model. Economic prosperity is linked to an educated workforce which can compete in a global economy where information technology sets the pace of change. All things being equal, countries with higher levels of education and training will be the least affected by employment dislocation and other problems associated with global competitiveness.

It is no wonder that the demand for education has never been greater. For a large proportion of its clientele, education is an investment--a down payment--on a career, social status or more immediately, a job. Most students take the degrees they do to get the jobs they want, knowing or hoping that these jobs will repay the investment (Brown and Duguid, 1996). In 1992, a worker with a bachelor's degree earned 1.74 times as much as a worker with a high school diploma (Bureau of the Census, 1994).

No surprisingly, the single most important factor in determining level of income is level of education (CFAE, 1997). This poses a troublesome future in the US. I assume it is similar in the UK. If current trends are extrapolated for 20 years, by 2015, male workers with a high school education will have lost 38% of what comparable male workers earned in 1976. And those without a high school diploma will have lost 52% in real earnings over the same period. Only college graduates will be able to hold their own out to 2015. This economic polarization is even more alarming when linked to demographic statistics; African Americans and Hispanics have lower college-going rates than other ethnic groups.

It is in the interest of all to promote higher levels of education and training for those who are rapidly losing earning power in society. Low levels of education are powerful predictors of welfare dependency, unemployment and incarceration, all of which are very costly. Moreover, by 2015 the numbers of workers for every retiree on Social Security will be one-fifth what it was 50 years ago. This means a shrinking proportion of American workers will not only have to maintain US economic competitiveness in the global marketplace, but will also have to support the economic base of the rest of the nation at the same time (CFAE, 1997). Will the trends be noticeably different in the UK or Western Europe?

Figures involving education, income and social services help illustrate the importance of education. In Indiana, the break-even point for state services is $38,000. The average Indiana worker who earns less than $38,000 per year uses more services than he or she pays for through taxes. Someone who earns more than $38,000 contributes to the general tax revenue. The average high school graduate in Indiana earns $34,000 and the average college graduate earns $55,000 per year. Thus, the average college graduate is likely to be a net contributor to the public welfare; someone without a college degree is apt to be a net user of services. It is to the benefit of the state to increase the proportion of the population obtaining college degrees (Brand, 1997).

Education has broad economic returns that go beyond the individual. For example, for every dollar Illinois invests in undergraduates at the University of Illinois, returned to the state are $4.31 in taxes over time (Anonymous, 1996). Colleges and universities stimulate economic growth through the creation of new jobs, as well. A study found that the 4,000 companies founded by the Massachusetts Institute of Technology (MIT) graduates or faculty as of 1994 employed 1.1 million people and generated $232 billion in world sales. In the US, MIT-related companies employed 733,000 people or one out of every 170 jobs in the country (Kindleberger, 1997).

Perhaps because of all of the positive effects of higher education, the demand is great. Unfortunately, population growth is outpacing the world's capacity to give people access to universities. A sizable new university would now be needed every week merely to sustain current participation rates in higher education. A crisis of access lies ahead (Daniel, 1996). Half of the world's population is now under 20--three-quarters in countries like South Africa and Palestine. Our traditional concept of the campus university will deny higher education to all these young people. Without vigorous action, many of them will grow up to be unemployed, unconnected, and unstable. In a global world, that is a global problem. We require mass training and employability and mass education to inspire the human spirit (Daniel, 1997).

ORIGINS OF THE FUTURE COMPATIBLE CAMPUS

With the demand for higher education worldwide expected to exceed 100 million by the year 2007, education is a growth industry. Large opportunities often attract many rivals. The most aggressive competition facing traditional institutions today is not from within higher education but from new providers of post-secondary educational services. Will their more nimble structures and market-oriented cultures allow them to dominate non-traditional, post-secondary education? (Twigg and Oblinger, 1997)

The inertia in our systems of higher education is immense. Many point to an exemplary record and ask why there is any need for change. How does the Future Compatible Campus begin? More often than not, its origins stem from fear--fear of moving ahead or fear of being left behind. Although all institutions are unique, there are some common philosophies that are emerging among campuses which are "future compatible."

FUTURE COMPATIBLE PHILOSOPHIES

Learning-centered

Future compatible campuses are consumer oriented--they put the learner at the center of their philosophy of service. These institutions are concerned with ensuring value for the learner, not just the organization. Access to information is more open. Centers of competency are created, where generalists are often empowered to help students without long waiting lines or shuffling students from office to office.

Historically, undergraduate education has operated on the premise that the student spends four years living on a campus, insulated from home, work, and the social environments outside the campus. Consequently, it is a campus-centric system that is both place-constrained (the campus or the classroom) and time-constrained (delivered according to an academic calendar and a specific course schedule that is controlled by the provider). The campus-centric model assumes that students will choose from a campus-established set of courses and curricula. Control over the content is in the hands of the provider--the faculty or the institution. Administrative functions such as admissions, financial aid and registration are designed for the convenience of the institution, with minimal regard for the needs of the consumer.

The combination of new communications technologies, changing student demographics, the rising costs of a residential experience, and the need for continuing education throughout a lifetime is eroding this centuries-old system. The modus operandi of the campus should be changing. Relationships among learners, instructors, and information resources are shifting, as well. The rapid proliferation of information and communications technologies is making it possible for the control of delivery to move out of the hands of traditional providers--higher education institutions and faculty --and into the hands of consumers.

One indication of the rising power of learners is the trend for students to learn independent of time and place. The assumption that higher education takes place in the classroom or on the campus is being shifted to the workplace, the home, the library, or even the network. Communications technologies enable a shift toward asynchronous (at different times) rather than synchronous (at the same time) learning experiences, which makes learning available seven days a week, 24-hours a day. Increasingly learners use networks to interact with their peers, their instructors, external experts, as well as information resources; they do it when it is convenient, not just during scheduled class times.

The change from a campus-centric to a learner-centric learning model is accelerating. By expanding the number of potential providers--for content, courses and curricula--learner choice is expanded. The days of a campus-centric model are fading (Twigg and Oblinger, 1997).

This is not to imply that students are without responsibility. In a learner-centered environment, students will be accountable--for updating their mailing address or seeking out external experts for course projects. Institutions can make the processes simpler, but will not assume the in loco parentis burden. Learning is hard work. Although information technology can make learning more motivating, engaging and enjoyable, it will always require exertion. The new learning environments and skills that will be required of students are likely to require additional effort. For all involved, becoming learner-centered will require some adjustment.

Learning organizations

Future compatible campuses believe in the value of on-going learning for everyone. Training is provided for faculty, staff and students. This training focuses heavily on problem solving and sharing. The view is that the collective wisdom of the organization is greater than that of any single individual. Only by sharing does everyone benefit.

To create a sophisticated and continually improving workforce, we need to create and nurture learning organizations. "How institutions of higher education engage their workforces in learning activities is one of our sadder ironies. Colleges and universities are, of course, learning organizations by definition. If we are to develop sophisticated problem solvers in our organizations, we will need to increase our commitments to the formal training agenda. In addition, we will need to discover, uncover, empower and replicate that complex informal system of successful mentorships, peer networks, informal collaborations and grapevines that exist already in the organization" (Ernst et al., 1996).

Becoming a learning organization mirrors the individual's commitment to learning. For singular workers, brains, know-how, broad skills and the willingness to learn throughout life have become the essential tools for building a career (ACE, 1997). Job skills are more important than a job, alone. In the university of the 21st century, employees will recognize that their job and security depends more on their own competence and work skills than on the hierarchy. Assessing skills, finding good teachers and making time for self-improvement will become part of the university culture. The goal will be to ensure that employees have skills that are valuable and transferable--from one department to another or from one institution to another.

Redefine learning

Future compatible campuses have redefined learning. All too often, the operative definition of learning is teaching. The emerging philosophy recognizes that learning is not always dependent on teaching. It also stresses that learning is a social process and interactivity is closely linked to learning achieved.

Access to information technology can enhance learning in several ways. When compared to traditional classes, student satisfaction with online courses is higher; GPA and other measures of student achievement are the same of better; a higher level of critical thinking and problem solving is reported; and there is often more discussion among students and instructors in a course. Instructors are able to track the progress of their students in a detailed way and have a better understanding of what students are/are not learning. Computer networking provides a more authentic learning environment in the sense that students can easily communicate with other educational professionals outside of the class if they desire (Kearsley et al., 1995).

Concomitant with an emphasis on learning vs. teaching is the focus on learning productivity vs. teaching load. Learning productivity (Johnstone, 1992) describes a concept that will allow higher education to attain significant and sustainable productivity increases through greater attention to the learner. "Learning productivity relates the input of faculty and staff not to enrollment or to courses taught or to credit or classroom hours assigned, but to learning, i.e., to the demonstrated mastery of a defined body of knowledge or skills."

One way to make learning more productive is for students to master a body of knowledge in less time. Learning that takes less time can cut the traditional costs carried by the institution, but also the opportunity costs (lost earnings) of the student. Another way to make learning more productive is to make it possible for students to get the courses when they need them (Johnstone, 1992). The way we will achieve sustainable productivity gains in higher education is by facilitating more learning from students, not just increasing the workloads for faculty. If we are serious about learning, the learner should be our focus.

There are many ways in which information technology might be used to leverage learning if the bars of convention were dropped. Massy (1997) illustrates some important benefits from reengineering such as relaxing traditional constraints on the economics of the educational process. For example, faculty labor is applied at the times and in the circumstances needed rather than in fixed quanta defined inflexibly as courses per semester. Technology substitutes for some of what has traditionally been viewed as faculty work, but faculty labor is redeployed to tasks that professors can do best. Support staff and graduate student time may be used to a greater extent than in some kinds of institutions currently, but it is concentrated in areas where faculty do not have a comparative advantage--not in places, like small group discussion sections, where a professor's wisdom can confer important benefits.

Another critical component in redefining learning is to think in terms of learner needs rather than teaching franchises. Currently, most teaching, course credits and degrees are bundled together seamlessly in accredited institutions, with credentialed faculty, controlled by various combinations of accrediting associations and government agencies. A learning franchise, on the other hand, provides access to powerful learning systems, information and knowledge bases, scholarly exchange networks with customizable learning modules and systems open to anyone who needs them and can compensate the provider. Measurement and certification are important for many but not all learners. Students can pay for as little or as much mentoring as they choose (HEIRA, 1996).

Reinterpret administration

Future compatible campuses have redefined administration. New definitions eliminate unnecessary work, dismantle unproductive policies and reengineer policies to achieve efficiencies and make a more learner-centered environment.

Organizations evolve not just because they change but because we change our point of view in looking at the work of an organization. When this occurs, we need to redefine the work. In the future, work will be directed mainly by cross-functional and self-governing teams. The effectiveness of such teams will depend on their members' access to one another, to cross-functional information, and occasionally, to elements of the campus leadership. Such work practices will demand enhanced integration of data across functional systems, robust networking and technical interfaces that lower the cultural barriers between diverse work cultures (Ernst et al., 1996). Administration will be redefined.

Consider organization charts as an example. Although they are useful guides, they are outmoded. Institutions do not manage through structures anymore, they manage through processes. The emergent organizational paradigms succeed by empowering people and horizontal processes in ways that are supplemental to--or independent of--the "formal" vertical organization.

To enable organizational transformation, we need to shift our attention away from the organization chart and towards the creation of an information-rich infrastructure. We will need to (1) eliminate the technical, cultural, hierarchical, and procedural boundaries that divide or isolate intelligent and motivated people; (2) create a policy environment that stimulates and rewards collaboration; (3) promote easy access to the kinds of information people need for making sound decisions; and (4) specify, measure and reward the achievement of defined and customer-centric objectives (Ernst et al., 1996).

Leverage partnerships

Future compatible campuses realize that new kinds of strategic alliances will be required to remain viable. Outmoded notions (e.g., philanthropy equals partnership) are disappearing. Business, industry, alumni and parents can make positive contributions to education. However, before they can, partnerships and strategic alliances must be redefined.

There are also many lessons that business and industry have learned that could provide guidance for higher education. Although the enterprises are not alike in terms of governance, structure, etc., all involve people, cultures and change. Business has wrestled with massive changes for the last decade. Many of these changes are beginning in higher education. Why not learn from the experience of others?

With those philosophies, the future compatible campus will be different. It will be:

- Mission-driven, not rule driven
- Results-oriented: outputs and outcomes will matter more than inputs
- Customer-driven rather than driven by the needs of the bureaucracy
- Decentralized: decisions will be made at lower levels in the organization--employees will be empowered
- Competitive: the status quo will no longer be good enough. There will be rewards for those individuals and institutions who are more competitive.

PREREQUISITES TO A FUTURE COMPATIBLE CAMPUS

Although there is no formula to create a future compatible campus, there are some prerequisites that must be addressed. Our institutions have inherited traditions and organizational structures that may limit the future of some. Just as the needs of our society have continued to evolve, so too must our institutions.

Information Technology Infrastructure

Much of the future compatible campus involves empowering individual and institutional learning. The development of new instructional models is facilitated by the availability of a reliable and ubiquitous network infrastructure as well as access to computers, anyplace and any time. The framework of the learning environment is changing; the emerging model places the student at the center with more flexible access to people and information. These distributed learning environments exist among a dispersed student population where the educational experience is based on learner needs and integrates traditional institutional functions (e.g., classroom and library). Students and faculty may enter the learning environment at different times and from different locations.

The IT infrastructure is also important in supporting organizational learning. Information gains value as it moves around the institution and is used by many people in many contexts. This exchange of information is facilitated by networking technologies and groupware. However, the IT infrastructure is more that wires, hubs and routers. In addition to optimizing machine efficiency we must enhance human productivity.

New Learning and Interactivity Models

Higher education, as a growing, multi-billion dollar industry, will attract aggressive competition--both within higher education and external to it. To remain competitive as a 21st century university, institutions will develop more individualized curricula. In part, this will be accomplished by pooling the resources of multiple institutions. The brokering of courses from multiple institutions will allow students to choose from a broader array of courses to create a unique program of study.

Tate (1996) described a future where higher education would evolve toward production, delivery and certification organizations (PDCs). PDCs would operate on a national basis, using the most efficient and effective communications media available. Courses and programs would be designed and produced to commercial standards. These organizations would purchase subject-matter expertise from many sources, depending upon the degree of expertise and the quality of the content. In addition, PDCs would provide competence-based testing and certification services. Students could participate in interactive testing at any time or at a place of their choosing--and pay a fee to receive certification upon successful completion.

Another model focuses on electronic commerce and education brokerages. Proposed by Hamalainen, Whinston and Vishik

(1996), education brokerages would provide product marketing and advertising. They would also process customer applications. Able to match customer needs with existing and prospective courses available from any number of educational suppliers, they could also accommodate requests outside the mainstream by bringing in educators with special expertise or through customized combinations of course elements.

Within courses, cognition, collaboration and communication will modify both what is taught as well as how. Problem solving skills will receive significant emphasis. The focus will be on process more than on memorization. Components of "successful intelligence," (Sternberg, 1996) will be woven into the curriculum: analytical, creative and practical intelligence. Traditionally, only analytical intelligence has been valued on tests and in the classroom. Yet all three are needed. Analytical thinking is required to solve problems and to judge the quality of ideas. Creative intelligence is necessary to formulate good problems and ideas in the first place. Practical intelligence is essential in order to use the ideas and their analysis in an effective way.

Many subjects and skills can be approached through apprentice-like learning. Going beyond the traditional libraries, laboratories and studios, newer technologies can enrich and expand options. Technology can be used to support apprentice-like activities in fields that themselves require the use of technology as a tools, such as statistical research and computer-based music, or the use of the Internet to gather information not available in the local library. Some simulations require computers. Other tools help students gain insight. For example, students can be asked to design a radio antenna. Simulation software displays not only their design but the oridinarily invisible electromagnetic waves the antenna would emit. Students change their design and instantly see resulting changes in the waves. The aim is not to design antennae but to build deeper understanding of electromagnetism (Chickering and Ehrmann, 1996).

New Financial Paradigms

To become a future compatible campus, the existing financial structure of higher education will need to be modified. The funding patterns of higher education are archaic when considering the need to change. Institutions each raise all the money they can, spend all they get, and spend it in ways that relate closely to the way they spent the money the previous year (Ehrmann, 1995).

A second financial problem is due to a funding strategy based on inputs rather than results achieved. "The higher education system as currently financed is not adequately serving the public interest. As long as payments are made to colleges and universities on the basis of intent and not results (for example, graduation rates or the demonstrated competence of graduates), inefficiency is built into the financial structure. As long as the higher education financial structure also includes a faculty reward system that encourages them to pay less attention to public need and more to professional demands, research will continue to be valued over teaching and teaching less over teaching more." (Eaton, 1993).

"One of the absurdities of current funding formulas is that an institution could utterly fail its educational mission and yet its revenue would remain unaffected. Nothing could facilitate a shift to the learning paradigm more swiftly than funding learning and learning-related institutional outcomes rather than hours of instruction." (Barr & Tagg, 1995).

Measurement and Accountability

Measurements help people understand what is happening better. They help people communicate that insight to each other, to legislators, to parents and to students (a form of accountability). Measurements help us gain insight into what really needs to change and how well we are doing (Cortada, 1997). Few institutions will become future compatible by chance. Those with well articulated objectives that are linked to appropriate measures are more likely to excel than those without them.

Over the past decade, demands for accountability have begun forcing institutions to measure their performance and communicate it effectively to stakeholders. Even though many have begun, more needs to be done to measure outcomes and the "value-added" by the educational process. Demands for increased productivity arise from the common perception that faculty do not teach enough, students do not learn the right things, and that administrators are reactive "fire-fighters" instead of effective managers. And, the high fixed costs of doing business (e.g., aging, decaying infrastructures and massive deferred maintenance) give institutions a hefty bill to pay regardless of the number of students they attract and retain (Hafner and Oblinger, 1997).

One of the most effective tools to address measurement and accountability is the balanced scorecard (Kaplan and Norton, 1996) which integrates vision, goals, measures and controls to provide a more holistic view of the institution. Performance indicators take into account the customer perspective (e.g., how students or legislators regard the institution), an internal business process perspective (e.g., cycle time, use of resources), a financial perspective (e.g., revenue, expenditures) and innovation and learning perspective (e.g., asking how well the institution is improving and creating value).

Customer Focus

As a colleague said, we spend too much time looking in the mirror when we should be looking out the window (Father Dietrich Reinhardt, President, St. John's University). In many ways, our institutions are too internally focused. The intended beneficiaries of university work are students and society. The 21st century university will excel because it understands and focuses on its customers.

As "customers" of higher education institutions, students are interested in a smooth, integrated process which will produce the results they need. They hope to go seamlessly from admissions to registration, file their financial aid application and receive their awards, pay their fees, attend classes, receive advising and grades, and graduate, with the least possible disruption to their learning experience. They expect to initiate these tasks themselves via technology from their homes and dorm rooms. Like customers of any successful service delivery operation, they count on the institution to make their interactions with it easy, fast and painless.

To transform an institution, the focus must be on what its customers want and need. Many tasks that employees perform have nothing to do with meeting customer needs; they are done simply to satisfy the internal demands of the organization, hence the world of multiple reviews, four part forms and complex certification stamps and approval signatures. Often things are done simply because they have always been done that way. Guardianship, gatekeeping, controlling and regulating must give way to collaboration and sharing in the future compatible campus.

Students are not the only customers of higher education, of course. Others include business, government, and society. As higher education expands its focus on customers, we anticipate that network-based, university-organized virtual communities will become more prevalent, playing a very positive role in society.

Strategic Alliances

Just as no one person has all the skills needed for their job, no single institution has all the skills it requires. Strategic alliances among higher education institutions and partnerships with business and industry will become increasingly common in the 21st century university.

In some cases, strategic alliances will be created so that key personnel may remain focused on the core competencies of the institution. Although operating a mailroom, the bookstore or a legacy system are part of running the university, none represents the university's core business. Instruction and research are the core businesses. Choosing from a sliding scale, ranging from "insourcing" to "outsourcing," universities will select which activities to "own" and which to contract out to another provider.

A more important step for the 21st century university, however, is the refinement of the notion of partnership. All too often, "partnership" is synonymous with philanthropy. The premise of a partnership suggests that performance can be significantly improved through joint, mutually dependent action. The requirements include risk sharing, the need to view the relationship as a series of exchanges without a definite endpoint, as well as the need to establish a range of mechanisms to monitor and execute the operations of the partnership. Because of the high degree of mutual dependency that evolves, these partnerships become strategic alliances.

As higher education and business become more adept at partnerships and strategic alliances, both parties must develop trust that they share similar goals. Trust and confidence are built up through a working relationship. As trust and confidence are built, mutual dependencies will evolve. This is reinforced by each partner understanding how the other works. Although it takes time to educate each other, the key is sharing knowledge. Of course, effective partners bring distinctive resources to the relationship to build something greater than either could have done alone. Skills are brought by each party. Interdependence may replace autonomy as a characteristic of the 21st century university.

Culture of Change

What we know about cognition, collaboration and communication should allow us to change higher education--to redesign the learning environment. Initiating and sustaining the redesign of education, institution-wide, will require strong executive leadership and a viable process model. The redesign of education entails a fundamental rethinking of instructional strategies. The critical questions to ask are:

Why do we do what we do?

Why do we do it the way we do?

What must we do? (What is critical to our success and our students?)

What should we do? (without regard to what is currently done)

(Hammer and Champy, 1993)

Why do we do what we do? Why do we do it the way we do? Among the answers are because that is how we were taught and because the culture of higher education emphasizes autonomy. The tradition, the existing infrastructure, the lecture-based experience of faculty and the fact that it is more comfortable to preserve the status quo than to change it all contribute to higher education's lecture-based approach to learning. The tough questions are: What must we do? What should we do?

"Resistance to change is a hallmark of higher education. It has been said that changing a college is a lot like moving a cemetery--you don't get a lot of help from the residents. In this case the residents include the education bureaucrats, the faculty, the administrators, the students and the parents--all stakeholders in the status quo." (O'Banion, 1997).

The challenge for higher education will be to create a culture where change is accepted--even welcomed. Seen in a positive light, higher education is entering one of the most challenging and potentially creative periods in its history. Although to change will require enormous acts of potentially career limiting leadership (Rush, 1995), changes will be required if higher education is to thrive in the 21st century. If higher education is not the architect of change, it may be its victim.

Common Sense

There is no single blueprint for creating the future compatible campus. The university of the 21st century will be created with vision, planning, execution and common sense. Our institutions have strengths we would not want to abandon. In addition, we must consider human nature--we are rational as well as emotional beings. Changes in one aspect of the institution can have a "ripple effect" throughout other parts of the institution. Even the finest plans may fail without ample application of common sense.

CONCLUSION

"We are engaged in a battle. The world's universities are in crisis, assailed by challenges of access, cost and flexibility. The traditional classroom of the campus university has had a long run as the preferred means for achieving the ultimate goals of the university. But the classroom model is approaching its "sell-by" date. It is not the means that are important, but the ends to which the university aspires." (Daniel, 1997)

The dilemma is that the future is always becoming the present and the present becomes the past. Our real challenge is to inculcate a culture of change in our institutions. The rate of change in our disciplines, our lives and our society will probably never diminish. Only by making change a part of the academic culture will we be able to continually create our future.

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Diana G. Oblinger, Manager, Academic Programs and Strategy,
Global Education Businesses ,IBM Corporation,
PO Box 12195, 3039 Cornwallis Rd, RTP, NC 27709,
USA

E-mail: doblinger(at)vnet.ibm.com

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Technology Strategies for Higher Education: A Vision for the 21st Century

M. Zastrocky

How does an institution plan for and manage information resources when the world is the classroom and exponential change in technology is a given? Are there solutions and strategies for dealing with the problems facing higher education, and can we work together to redefine relationships and resources necessary to support tomorrow's campus? This presentation will look at problems and issues facing traditional colleges and universities in a global marketplace. Participants will be challenged to push their thinking into the twenty-first century as they explore the systems and resources campuses will need to make the world a classroom.

Gartner Group, USA, E-mail: michael.zastrocky(at)gartner.com

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Multimedia Technologies in Universities

M. Heydthausen, J. Knop, K. Vehlhaber

Introduction

Multimedia as one of the key technologies of the ending century will influence and challenge our universities to a high degree.

New technologies in higher education will change teaching and learning: Computer based training, computer assisted learning and teaching will be no longer slogans but will become common like other techniques as videoconferencing, lecture on demand or self-instructing courseware. But we think that there will be no real revolution in teaching and learning techniques. More likely there will be a (sometimes slowly) evolution, because not only techniques have to change but also teachers and students have to adopt themselves to that changes.

But not only education is challenged by the new techniques. University research and development and even administration will be influenced by multimedia. A broad variety of information that is now traditionally handled will be performed by multimedia information systems.

In this paper we will sketch some multimedia techniques and their application in academic teaching and learning on the one hand and their application on a special example in university medicine on the other hand. We will discuss the possible benefits and will not hide the difficulties that arise in the context of their implementation.

Multimedia in teaching and learning

Besides few critical voices the majority of authors in scientific journals dealing with questions of multimedia in teaching and learning share the opinion that multimedia techniques can be successfully used in university education. The nowadays used terms ,,Computer Aided Teaching (CAT)" and ,,Computer Aided Learning (CAL)" point out that these techniques influence both teachers and learners.

In the following section we will deal with three main questions:

1. What actions must be taken to establish multimedia techniques?
2. How does the technical scenario look like to provide an adequate technical infrastructure for multimedia?
3. What organizational infrastructure can support multimedia in teaching and learning?

The scenario which we have in mind is that of the Duesseldorf University. Thus, the following statements and sections can not be valid for every university in every country. Some might step ahead others may lagging behind.

Actions for establishing multimedia techniques in teaching and learning

Acquisition and evaluation of available CAT- and CAL-programs

There are some sources for relevant products: publishers, research associations, previously made self-developments, public-domain-programs. The commercial conditions are quite different and vary from free of charge to very expensive.

There is also no correlation between price and quality.

However, deciding to use these products depends on the evaluation by the lecturers.

Design and programming of own CAT- and CAL-programs

The design and programming of own CAT- and CAL-programs includes the construction of lecture materials (e.g. projection of multimedia - worked up foils) as well as the construction of individual education- or simulation programs. For the production of CAL-products for video processing should be set up a well equipped multimedia lab. Apart from tools for recording and digitalising pictures and sound there should exist workstations for a digital rework of multimedia material. The equipment of the multimedia lab must include author systems for construction of CAT- or CAL-products.

Distribution of CAT- and CAL-programs

Through license restrictions some commercial available multimedia products could only be distributed by original CD-ROM. Thus, CD-ROM players will be necessary for distributing these products. The technical limitations are obvious. Frequently used products without license restrictions should be made available to users by an appropriate server because of the easier technical handling and higher access-speed. Uncleared is the problem how such products could be used by students at their homes.

Electronic lecture-halls

On the university campus should be set up electronic lecture-halls and electronic seminar-rooms available for multimedia-supported lectures. They offer the following services:

- Online-access to computers for calculations, simulations, graphical representations. The computer monitor can be projected by a beamer to a screen in the lecture-hall.
- Online-access to central servers holding videos, CBT-software, ...
- The lecturer has an interactive white board at his disposal.
- There is a video-conference-system available in order to have live-conversations with external round of talks transmitting it into the lecture-hall.

Video conferences

The technology of the video-conference can be used in university education for the realization of the so-called teleteaching. Several applications are possible.

- Transfer of lectures to another place within the same university.
- Cooperation between universities by transfer of lectures.
- Real-time video conference between two lectures on the same subject in different universities.

Evaluation and integration of new multimedia techniques

Through the dramatic development of multimedia techniques there are always new technologies that could be adopted for teaching and learning in universities. Some current keywords are Computer Supported Cooperative Work (CSCW) or Electronic White board. Further on a digital video-library is a very important service of education in the university. Such a video-library supported by a powerful video server can be used to set up a service called ,,lecture-on-demand".

Technical infrastructure

An adequate technical infrastructure can be developed from the activities pointed out in the previous section.

Most important parts of the technical infrastructure are:

- A high speed network with a big bandwidth.
- Multimedia labs for the design of own CAT- and CAL-products.
- Video servers keeping lectures, parts of it or other video information for supporting university education.
- Electronic lecture-halls.

Organizational infrastructure

In addition to technical infrastructure an organizational infrastructure is needed for efficient support of multimedia techniques. Part of this infrastructure is any university institution dealing with media in a wide sense: library, computing center, media centers (if existent) and every potential user of media.

To keep the organizational structure easy to survey it is planned to have a permanent multimedia working group in Duesseldorf consisting of:

- representatives of the different faculties,
- library,
- computing center and
- administration.

This working group is responsible for:

- progression of the multimedia concept for Duesseldorf university,
- planning, implementation and integration of new multimedia techniques,
- survey of the technical realization,
- coordination of all tasks concerning multimedia aspects in university.

Multimedia in Medicine

Not only aspects of teaching and learning are challenged by new techniques. University research and even administration will be influenced by multimedia. Our next examples for multimedia techniques are taken from medicine. Medicine combines various aspects for multimedia support: research, patient administration and the wide field of hospital information and communication systems.

Health care has lagged for a long time behind other domains supporting work by efficient computerized techniques. One exception are systems for financial transactions in hospitals and for patient admission, as related topics. These were the first systems supporting data processing in hospitals. Information systems for patient-related medical information came up later. Information in these systems is mainly handled in a traditional -non multimedia- manner.

The next section will sketch some aspects of changing traditional patient records to multimedia records and the benefits connected with this change.

Patient records

A patient record for a given patient contains all information concerning anamnesis, findings, treatment, and more of this given patient. It forms the basis for the continuity of the patient`s treatment and influences hereby the quality of health care substantially.

Patient records, however, are often found to be handled on a traditional manner. That means: a lot of paper, more or less exact and readable or complete, possibly referring to further data in X-ray archives, ECG departments, labs, ...

During the last years a lot of efforts have been pushed into computerizing patient records 1). The term EPR (electronic patient record) describes and summarizes these efforts. In Europe a pre standard has been defined by the European Committee for Standardization (CEN).

Patient records in principle are multimedial constructs in an almost natural sense: The information stored in and ordered by an patient record consists of written material, pictures, graphics. The associated information can enclose for example film sequences (heart catheterisation), curve diagrams (ECG, EEG). Voice information is stored rarely in a traditional patient record by lack of an adequate medium. But a lot of information during the patient`s examination is acoustic information. Additionally, an EPR is handled very interactively. With these details an EPR-system is qualified as a multimedia system.

For the user (doctors) of an multimedia EPR-system arise a lot of advantages:

- Reduction of written materials. Representation of information by means of a graphical patient record.
- Direct access even to time dependent media like X-ray films.
- Possibilities to integrate other media like videos or voice information to the patient record.

Visual Information Retrieval

For searching information in an EPR-system the user needs an effective tool. An information retrieval system is expected to help a user specify an expressive query to locate relevant information. The role of the emerging field of visual information retrieval (VIR)2) systems is to go far beyond text-based descriptors to store, and retrieve this ,,imagery-based" information content in visual media.

Visual information

There are two kinds of information associated with a visual object (image or video): information about the object, called its metadata, and secondly information contained within the object, called visual features. Metadata is alphanumeric and generally expressible as a schema of relational or object-oriented database. Visual features are derived through computational processes - typically image processing, computer vision, and computational geometric routines - executed on the visual object.

The simplest visual features that can be computed and retrieved are based on pixel values of raw data, and several early image database systems used pixels as the basis of their data models. A pixel-based model suffers from several drawbacks. One is, that variations in illumination and other imaging conditions affect pixel values drastically, leading to incorrect query results, but significant video segmentation results can be obtained by measuring pixel differences over time.

Most applications for VIR fall between automated pixel-oriented information models and fully human-assisted database schemes. They do not require pixel-level queries; nor are they constrained to only a few object classes. For this middle-of-the-spectrum applications, visual information can be defined in terms of image-processing transformations computed on the visual object. In most of these middle-of-the-spectrum applications even the system's designer needed training to perform effective retrieval. In medical-image databases, fully automatic feature extraction is still a research problem. The general experience is that completely automated image analysis works well only for small, controlled domains and it is very computation intensive.

Moving from images to videos in VIR adds several orders of complexity. Most research and commercial efforts take the following approach: Consider a video clip as a large number of image frames with progressively varying image content. Videos contain three kinds of motion information: one due to movement of the objects within the scene, second due to motion of the camera, and third due to special post-processing effects, like image warping. Ideally, a video information system integrates motion and frame information into a single computational framework, but current research is not there yet.

Summarizing we can say that many aspects of VIR systems are important for the application of multimedia techniques im medicine but they are not yet properly understood. Especially for the retrieval of multimedia databases there are still a lot of research problems.

Assessment of Cost / Benefit Relation

An estimation of a cost/benefit relation for a given technique has two faces: First the specification of costs and secondly an understandable description of what could be the benefits of this specific technique.

The question of the costs for the technical implementation is easy to solve. In contrast to this, the description of benefits is a hard job. What is the benefit of the multimedia support for teaching and learning? What amount (in ECU e.g.) is it worth? Being not able to answer these questions we will choose another way to describe benefit. We will try to answer the following question: what could be the obstacles, what are the difficulties for multimedia techniques to produce benefits?

Costs

The following table gives some details of necessary expenses (in ECU) building up the multimedia infrastructure for Düsseldorf university.

Estimated costs for:	Amount (in ECU):
Investments	
Electronic lecture-hall (per piece)	110.000
Multimedia-lab (per installation)	90.000
Video server	125.000
Future costs for investments (5%, per year)	9.000
Man power (per year)	
Multimedia-lab	100.000
Video server	25.000

This table does not contain costs for network infrastructure which is a condition sine qua non for any multimedia technique and it does not contain costs for further extensions of the underlying network.

These few examples show that the costs are enormous: one electronic lecture-hall is not enough for a large university no more than the installation of one multimedia lab. Thus, the respective costs in the table have to multiplied by an adequate factor. Over the years the costs for investments still stay relatively small. The real financial problem are the costs for the supporting man-power.

Obstacles and difficulties

For efficient support of teaching and learning by multimedia techniques it is important to integrate these techniques as normal tools in preparing and offering lectures and as a normal way to achieve knowledge. A lot of possible obstacles must be overcome:

1. Old habits.
2. Change in self-understandig: the professor is not a teacher but a learning facilitator.
3. Preparing multimedia for teaching requires a lot of time.
4. Support of teachers in preparing multimedia requires a lot of man-power and for that reason a lot of money.
5. ...

Points 3 and 4 are only technical obstacles that could be solved by means of time, man-power and/or money. Real problems are old habits or necessary changes in self-understanding of teaching persons. The ,,real" integration of multimedia techniques means a fundamental change of teaching methods also.

For multimedia support in other areas of interest (like administration or medicine) we have the same technical and financial restrictions like in teaching and learning. Specific for these areas is -as pointed out already in the section about visual information retrieval- the need for further research. Often there is a great uncertainty how multimedia techniques could support a given area of interest.

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Computer Center , Heinrich-Heine-University,
Universitaesstr. 1, D-40225, Düsseldorf, Germany
E-mail: knop(at)uni-duesseldorf.de, heydth(at)uni-duesseldorf.de

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The Web as an Effective Learning Environment for Universities

Jarmo Viteli

The Association of European Universities has published a report (CRE DOC: November 1996) "Restructuring the University: University and the Challenge of New Technologies". The message, as you can see below, of report is clear: The world is not the same tomorrow. Universities have to rethink they aims and objectives. New Technologies is one of the main strategic issue for universities. The time to act is now.

The rapid development of new technologies has implications for the provision of higher education. The new possibilities of Digital Technology like Internet and World Wide Web are already and will be largely applied the traditional markets of universities, that is, regular students. In addition opportunities in Open and Distance Learning (ODL) create new markets, while the principle of lifelong learning extends the age groups to which the university can offer education. Thus, the potential created by new technologies for teaching and learning requires a considerable rethinking of the universities aim and objectives, and a fundamental restructuring of the ways in which it delivers those objectives.

The development of new technologies does not bring with it a miracle solution to the range of problems most universities are now confronting. Multimedia and Networks should not be a diversion for universities from other questions that will determine their future. Technological progress should be exploited by higher education institutions to further their strategic objectives.

This presentation will offer models, examples and research results of how different universities have utilised WWW as an effective learning environment. As we know, today will be history of tomorrow. That is why I will also look ahead to those research projects which are creating tomorrow - like digital paper, agents and immersive environments on the Net - to get a hint of the future.

Senior Research Scientist, Director of Hypermedialaboratory, University of Tampere, Finland

email: jarmo.viteli(at)uta.fi URL: http://www.uta.fi/hyper/

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La situation des Etablissements d'Enseignement Supérieur en matière de technologies de l'information appliquées à l'Enseignement. Une analyse à partir des contrats d'établissements

State of the art for Information technologies in Higher Education in France. An analysis from the State contracts

F. Thibault

- Technologies d 'information

  et enseignement supérieur

  - La situation des établissements français
  - à partir des contrats signés avec l 'Etat

- Les contrats

  - Passés avec les universités à partir de 1989, par tranche et pour une durée de 4 ans
  - objectifs majeurs du ministère :
  - impliquer un nouveau mode de pilotage des établissements
  - modifier les relations entre la « tutelle » et ses « services extérieurs »

- La contractualisation

  - Pensée comme une solution à l 'augmentation du nombre d 'étudiants et à l 'amélioration parallèle de la qualité de l 'enseignement
  - devait donc accélérer la modernisation des établissements et déclencher des innovations

- La contractualisation : une rupture

  - Mettre fin à la politique des guichets
  - Mettre fin au fréquent morcellement des établissements en favorisant, en leur sein, l 'émergence d 'une approche globale par grands secteurs de développement

- Les technologies d 'info. avant la contractualisation

  - A partir des années 80, des guichets particulièrement bien dotés (entre 300 et 400 MF par an)
  - Une succession d 'opérations reposant sur l 'achat d 'équipements (audiovisuel, laboratoires de langues, matériels informatiques)
  - Pas de réelle politique de production de ressources ou de dispositifs, quelques aides ponctuelles.

- Typologie des établissements à partir des contrats 95-97

  - 4 types d 'établissement :
  - les anciens : des actions vivantes dans des composantes sans projet global
  - les débutants : 1 ou 2 actions initiées et un début de réflexion sur le projet global
  - les progressistes : en cours d 'élaboration du projet global
  - l 'avant-garde : projet global en action

- Les indicateurs d 'existence d 'un projet global

  - connaissance de l 'existant
  - portage politique (vice-président, chargé de mission, commission de concertation...)
  - définition de cibles et d 'objectifs intégrés aux objectifs globaux de l 'établissement
  - organisation des infrastructures techniques
  - arbitrages financiers
  - communication autour du projet

- Répartition des établissements

  - « anciens » : 20%
  - « débutants » : 45%
  - « progressistes » : 25%

    - « l 'avant-garde » : 10%
    - La forte proportion, en1996, des anciens et des débutants témoigne de la difficulté à contractualiser. pour les T.I on assiste cependant depuis un an à de réels changements.

- Les différentes demandes honorées dans les contrats
    - Equipements : langues, informatiques, visioconférence, multimédia (40MF, en 95)
    - fonctionnement et mise en oeuvre de dispositifs de formation (EAD, autoformation, centres de ressources en langues..., 35 MF, en 95)

- Les problèmes posés par ces demandes
    - Absence de codes communs et difficulté de rendre lisibles les projets
    - Peu de demandes pour la production de ressources ou de dispositifs
    - Difficulté d 'appréhender les équipements dédiés à la pédagogie (même situation pour la recherche)
    - Pas de demande pour des actions interuniversitaires

- Les stratégies de changement en oeuvre depuis 96
    - Aide au changement : existence de Renater (très importante pour l 'utilisation pédagogique), des CRI, du CSIESR, de GEMME
    - Pour la tutelle : renforcement de l 'accompagnement du projet (à l 'étude indicateurs de suivi), prise en compte de l 'interuniversitaire (contrats et hors contrat pour la production)
    - Dans les établissements : - mise en place d 'une instance forte de coordination en préservant les services existants - création de nouveaux services à partir de l 'éclatement des anciens

- Impacts du changement
    - Mise en oeuvre de la contractualisation, (nouveaux modes de gestion : appels d 'offres internes -prélèvement à la source sur la DGF- parfois décharges de service, heures spécifiques pour les personnels)
    - Dépassement de la procédure avec la nécessité, pour les grands projets nationaux (PCSM, EAD) d 'une aide directe de la tutelle.

- « La cohérence globale doit primer sur la juxtaposition. »

MENESR, Ministery of Education, 1 rue Descartes, 75231 Paris Cedex 05, France
thibault(at)dgrt.mesr.fr

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The Forms of Further Teachers' Education at University of Ostrava in the Czech Republic

Eva Burianova

The development of information technology has begun to influence teaching information technology and general knowledge subjects at primary and secondary schools in the Czech republic since 1990. Schools are equipped with computers, but only few teachers have been able to use the new technology in an active or effective way in teaching so far.

The teachers who finished their studies before 1990 had had no opportunity to work with the computers and information technology during their university education.

There are a lot of various opinions among our teachers saying that computer knowledge is not necessary for teaching and they manage without it. The answer to this attitude is the development of information technology, which enables teachers and students access not only to the new information but also to the co-operation among themselves on various levels.

There are the reasons for which our Department of Computer Science wants to deal with further education of teachers.

It is a very important thing for the teachers, headteachers and headmasters to be acquainted with the possible ways of utilising the computers and information technology. Only then they will be willing to introduce them at schools.

1. The teacher's training centre

We set up The Teacher's Training Centre at University of Ostrava designed for Information technology at primary and secondary schools.

We have these aims :

- information technology will be used in education at the primary and secondary schools,
- schools will use the services of the Internet for the communication between themselves and with our university,
- schools will be communicating with schools in other countries.

There are 69 primary schools in Ostrava. At present some schools are equipped with various types of computers in laboratories but in others there have not been any computer laboratories so far.

Computer facilities at primary schools in Ostrava

Computer type	The number of schools equipped with a laboratory
PC	25
Macintosh	2
Consul	16
None	26
Total	69

2. The education courses for teachers

We have divided our work into several stages in order to reach our aims. In the first stage our department has offered the education courses for teachers teaching the subjects of general education.

We are offering these courses:

- Basic Work with Computer and Operating System
- Education Software
- Word Processing Systems
- Database and its Application
- Using Spreadsheets
- Algorithms and Programming Languages
- Using Internet
- SGP Baltazar - Czech programming language for children

2.1 Basic work with Computer and Operating System

Teachers attending to this course have never worked with computers yet. They start learning how to operate the computers, they get acquainted with MS DOS operation system, system of files and directories, Windows.

2.2 Education Software

This course intents on the Czech education software, which teachers use in mathematics, physics and chemistry. They work with multimedia programs for history, geography, biology and Czech or foreign languages as well.

2.3 Word Processing Systems, Database and its Application, Using Spreadsheets

These courses acquaint teachers with the application software of Czech and foreign firms (Microsoft, Software T602, Lotus) and their using in education.

2.4 Algorithms and Programming Languages

The course is aiming at interesting algorithms for children and Pascal programming language.

2.5 Using Internet

We offer this course, but teachers have no interest in it. Unfortunately, only few schools are connected to Internet now. But Education authorities in Ostrava have opened a project called “The Information System in Ostrava Education“. One of its aims of this project is to connect schools to Internet. Therefore we are expecting a great interest in this course next year.

2.6 SGP Baltazar - Czech programming language for children

Teachers learn “Soukup Graphic Processor (SGP). It is a program for children (4-16 years old) and it is very popular in the Czech Republic.

Interest teachers in offer course

The teachers are interested in the courses very much. 148 teachers participated in 12 courses in Autumn 1996 and Spring 1997.

The number of graduates in the realised courses

```
Basic work with Computer and                        62
Operating System
Education Software                                  14
Word Processing Systems                             25
Database and its Application                        14
Using Spreadsheets                                  10
Algorithms and Programming Languages                12
Using Internet                                       0
SGP Baltazar                                        11
Total                                               148
```

3. Distant education

In the second stage we are going to offer distant education for in-service school teachers. It is expected that schools will be connected to Internet. We are going to prepare study materials and textbooks in electronic forms. We would like to exchange experience with foreign universities as well.

Now our department offers Lifelong Education in Computer Science - Postgraduate study of computer science for in-service teachers :

- the study for three years
- tuition - 84 hours per a semester
- curriculum is the same as in regular study and there are these parts:
- theory of informatics
- information technology and application
- programming and computers
- educational software and didactics
- study finishes with extended diploma

4. Organise a project

In the third stage we are going to organise some project for primary or secondary schools. This project will intent on transporting experience with multimedia, Internet and the Web in teaching between these schools.

At present we are contacting several primary schools in Ostrava's area that would like to participate in “Using Information Technology at Primary and Secondary Schools“ project.

Our help to these schools:

- to work out the presentation of their schools and put it on WWW pages in Web server in our university,
- we will enable the teachers of these schools to have access to the computer laboratory at our faculty in order that they can be acquainted with the latest information technology and work with Internet,
- the preparation of competition called “Utilising Internet at our school“ for primary and secondary pupils and teachers.

We and the teachers together are going to prepare a conference. The teachers will present their work with their pupils and acquaint the participants present at the conference with the utilising information technology at their schools.

Department of Computer Science
University of Ostrava
Bráfova 7
702 00 Ostrava 1
Czech Republic
E-mail: buriano(at)osu.cz

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Architecture Intranet/Internet au service de la gestion de la scolarité

1 Jean-François Eritzpokhoff,

2Peter Wegbrands,

3Jacques Bourel

Une nouvelle génération d'applications client/serveur basées sur l'architecture Intranet/Internet émerge. Ces techniques apportent de nouvelles réponses aux besoins et aux problËmes généralement rencontrés dans la gestion de la scolarité et de la pédagogie.

1. Gestion de la scolarité pour quel public et pour quels besoins ?

La gestion de la scolarité et de la pédagogie est l'une des principales préoccupations des établissements d'enseignement. Elle concerne un large public, depuis les futurs élèves de l'établissement, jusqu'aux responsables des services administratifs. Nous pouvons distinguer cinq groupes d'individus en fonction de leurs activités socioprofessionnelles : les personnes susceptibles de devenir les futurs étudiants de l'établissement, les étudiants qui suivent des enseignements sanctionnés ou non par un diplôme, les enseignants qui dispensent un ou plusieurs enseignements, le personnel administratif qui assure le fonctionnement des services de scolarité et de pédagogie, et les personnes en charge de la direction de l'établissement. Les besoins de chacun de ces groupes sont différents et cette diversité entraîne un élargissement du champ d'activité de la gestion de la scolarité, depuis la gestion administrative des dossiers, en passant par la comptabilité, la pédagogie, l'enseignement, jusqu'à la mise en place d'actions de communication internes et extérieures à l'établissement. Le personnel administratif joue un rôle pivot dans le fonctionnement de la scolarité. Il doit non seulement gérer les dossiers au quotidien, mais diffuser l'information en fonction des demandes. Il est en contact avec l'ensemble des usagers, depuis les futurs étudiants jusqu'aux directeurs de l'établissement. Outre le travail classique de gestion, la scolarité a de plus en plus une fonction de communication et de diffusion de l'information.

Sur ces aspects fonctionnels de la gestion de la scolarité viennent se greffer des contraintes liées à l'organisation structurelle de l'établissement. Plusieurs facteurs peuvent rendre difficile l'intégration d'un logiciel de gestion et doivent être pris en compte : une organisation hétéroclite de la scolarité, l'existence de sites d'enseignements distants et délocalisés, l'insuffisance de personnels techniques qualifiés, un nombre important d'utilisateurs, l'hétérogénéité du matériel informatique en place ou l'existence d'applications locales. Les services informatiques des établissements d'enseignements doivent faire face à une demande des utilisateurs et doivent avec des moyens limités améliorer l'accès à l'information à l'ensemble des acteurs de la scolarité. L'un des objectifs est de rechercher des solutions techniques qui permettent non seulement de limiter les coûts, mais également d'améliorer l'adaptabilité des outils à l'environnement technique et humain.

2. Architecture Intranet/Internet

Conçu à l'origine pour diffuser de l'information, le World Wide Web permet aujourd'hui de concevoir des applications pour interroger et mettre à jour des bases de données. Le concept du Web appliqué à la gestion de base de données créé un nouveau type d'architecture client/serveur qui se situe à la croisée des chemins des solutions gros systèmes (Mainframe) et du client/serveur classique. Les avantages techniques et aussi l'ouverture d'accès à un large public suscitent un engouement de la part des principaux éditeurs de solution logicielle. La mise en oeuvre d'application Intranet/Internet est aujourd'hui possible, même s'il subsiste encore certaines limitations techniques. D'abord ressenti comme une évolution, voir une révolution informatique à la lecture des médias, l'architecture Intranet/Internet trouve peu à peu sa place au sein des systèmes d'information des grandes organisations.

Le succès du Web vient essentiellement de l'introduction du concept de recherche hyper texte et du protocole utilisé. Chaque document Web possède un lien avec un ou plusieurs autres documents. Ce lien permet aux utilisateurs de "naviguer" de document en document et d'effectuer ainsi des recherches plus ou moins complexes. Les documents sont formatés et balisés à l'aide de marques définies dans le protocole "HyperText Markup Language" (HTML). Il permet de définir un format de présentation des pages Web et des liens hyper-textes. Pour lire les documents Web, l'utilisateur utilise un navigateur Internet (Browser). Ce navigateur est un logiciel capable d'interpréter les balises HTML d'un document. Ainsi, le même document Web peut être lu depuis différents navigateurs, indépendamment du système d'exploitation et du processeur du poste de travail utilisé. Cette propriété permet d'envisager la création de documents multi plates-formes pouvant être diffusés à l'ensemble des machines connectées à l'Internet. Les éditeurs de logiciels ont d'ailleurs tendance à considérer le navigateur Internet comme une sur-couche au système d'exploitation dans laquelle s'exécutent des applications. Le navigateur Internet tend ainsi à banaliser le système d'exploitation des stations de travail.

L'évolution du protocole HTML a permis de rendre les documents Web plus interactifs, notamment avec l'adjonction de fonctions multimédias et de la programmation en langage de script (JavaScript, VBScript,...) ou en code semi-interprété (Java, ActiveX). La possibilité de programmer à l'intérieur d'un document Web permet de réaliser des applications indépendantes de la plate-forme cliente. Les programmes Web peuvent être exécutés soit du coté du serveur Web, soit à l'intérieur du navigateur client. Les programmes exécutés côté client sont chargés depuis un serveur Web et sont exécutés à l'intérieur du navigateur. Plus ces programmes sont complexes et plus ils font appel à des caractéristiques du navigateur client. En revanche, les programmes exécutés côté serveur sont totalement indépendants du client, puisque le serveur Web les exécute avant de retourner le résultat sous la forme de code HTML. L'une de leur principale fonction et de servir de passerelle entre le serveur Web et le serveur de base de données. Ils permettent d'interroger des bases de données et de retourner le résultat sous la forme de pages HTML. La charge de travail étant répartie entre le poste client, le serveur de Web et le serveur de base de données, on parle d'architecture client/serveur trois tiers. Ce type d'architecture s'applique aussi bien à des accès publics (Internet) qu'à des accès réservés (Intranet). Dans le cas d'un Intranet, le processus d'authentification est la clé de voûte de la sécurité du système et doit donc être protégé.

L'architecture Intranet/Internet apporte des avantages techniques notamment en terme de déploiements des applications. L'application est installée sur une seule et même machine : le serveur Web. La livraison de nouvelle version de l'application est ainsi grandement simplifiée. Il n'est plus nécessaire, comme c'est le cas dans une architecture client/serveur classique, d'installer l'application et les pilotes (ODBC, SQL*Net,...) sur chacun des postes clients, il suffit seulement d'installer un navigateur Internet sur les postes clients et l'application sur le serveur Web. Certains constructeurs d'ordinateur proposent d'ailleurs des postes de travail allégés (Network Computer) dédiés aux applications Intranet/Internet. Cette facilité de distribution de l'application permet non seulement de faciliter le travail des équipes de développements, mais également de réduire les coûts de gestion de parc informatique. En outre, cette architecture permet de délocaliser et de nomadiser le travail des utilisateurs.

Il existe toutefois des limites techniques inhérentes aux outils Intranet/Internet. Le protocole réseau du Web (Hyper Text Transfert Protocol) n'a pas été conçu pour le mode transactionnel des applications client/serveur. Lorsqu'un utilisateur a émis une requête, il n'a alors plus le moyen de reprendre le contrôle sur sa propre demande. Le serveur n'a pas non plus les moyens de contrôler le déroulement des transactions. Dans un environnement multi utilisateurs, cette lacune peut notamment poser des problèmes pour gérer les verrouillages d'enregistrement (Lock row). Les éditeurs de logiciel de base de données ont pris consciences de la faiblesse du protocole HTTP et proposent déjà des solutions pour gérer des connexions Web persistantes. Les applications Intranet/Internet sont limitées en terme de fonctionnalité. Par exemple, le navigateur Internet permet d'imprimer la page HTML telle qu'elle est affichée à l'écran, mais cette fonction n'est pas toujours suffisante. Il serait souhaitable qu'à terme des balises dédiées au formatage d'impression des documents soient intégrées dans le HTML. Encore récentes, les techniques de développement d'application Intranet/internet doivent être améliorées et être adaptées aux besoins des applications de gestion.

3. Mise en oeuvre d'un Intranet pour la gestion administrative de la scolarité à l'ENSAM

L'Ecole Nationale Supérieure d'Arts et Métiers (ENSAM) a mené une expérience innovante en réalisant une application Intranet pour la gestion administrative de sa scolarité. Développée par une petite équipe d'informaticiens et d'enseignants de l'école, cette application a montré non seulement que l'architecture Intranet permet d'apporter des nouvelles réponses à un certain nombre de contraintes techniques, mais qu'elle est également capable de s'adapter à l'organisation particulière de la scolarité de l'ENSAM.

Le modèle informatique retenu donne aux services de scolarité les moyens de gérer de manière autonome les dossiers administratifs. Les informations sont mises à jour dans une base centrale accessible en mode client/serveur à partir d'une application Intranet. A partir de la base centrale, les services de scolarité peuvent extraire à tout moment une sous base locale contenant les informations sur les dossiers administratifs de leurs élèves. Une deuxième application permet de répondre à des besoins particuliers et locaux tels que des impressions (carte d'étudiant, certificat administratif,...) ou des statistiques. Les données des sous bases peuvent également être utilisées pour alimenter d'autres applications locales antérieures au nouveau modèle. Ainsi, les centres ENSAM peuvent exploiter comme ils l'entendent les données extraites et conservent une autonomie par rapport à la gestion générale de la scolarité de l'école.

Les choix techniques de ce modèle s'appuient sur le système d'exploitation Microsoft Windows NT. L'un des avantages de ce système d'exploitation propriétaire est qu'il apporte une solution pour protéger l'accès à l'application Intranet. Le système d'authentification sécurisé (Challenge/Response) de Windows NT permet en effet d'éviter que le mot de passe des utilisateurs circule en clair sur le réseau public. Toute demande de connexion à une ressource gérée par un service de IIS ouvre une session sur le serveur Windows NT. Le serveur envoie une clé (un chiffre calculé de manière aléatoire) au navigateur client. Ce dernier exécute une fonction de chiffrement basée sur cette clé et sur le mot de passe de l'utilisateur, puis retourne au serveur la valeur ainsi calculée. Le serveur décode cette valeur avec sa propre clé et compare le résultat avec les informations stockées dans sa base utilisateur (SAM). L'authentification NT contrôle non seulement l'identité de l'utilisateur, mais également le domaine NT du compte utilisateur. Ainsi, le mot de passe de l'utilisateur ne circule jamais en clair sur le réseau. Ce système d'authentification spécifique ne fonctionne qu'avec le navigateur Internet de Microsoft (Internet Explorer) et ne peut donc être utilisé que dans le cadre d'une application Intranet. Par ailleurs, ce modèle permet d'utiliser les fonctions de sécurité (réseau et fichier) et les outils d'administration de Windows NT pour administrer et surveiller l'application Intranet.

Aucun utilisateur ne peut accéder directement à la base. Un utilisateur doit d'abord avoir été authentifié par le serveur d'application Intranet, avant de pouvoir ouvrir une session dans la base de données. Le noyau de la base de données vérifie seulement que l'utilisateur a été authentifié au niveau du système d'exploitation du serveur Intranet et qu'il est autorisé à ouvrir une connexion dans la base de données. Un système de gestion de base de données se compose de plusieurs objets dont les principaux sont des Tables, des Vues, des Fonctions et des Procédures stockées. Il contrôle systématiquement l'accès aux objets de la base en fonction des privilèges de chacun des utilisateurs. Si un utilisateur ne possède aucun privilège sur l'objet, alors il ne peut ni "voir" ni "atteindre" cet objet.

Dans la base centrale de la scolarité, un utilisateur n'accède jamais directement aux données de la base. Il doit toujours passer par des objets filtrants. L'utilisateur accède à ces objets filtrants en fonction de ses privilèges. Il ne possède aucun privilège sur les informations brutes contenues dans les Tables de la base. Les objets filtrants sont des Vues, des Procédures ou des

Fonctions stockées dans la base de données. Ils accèdent aux données contenues dans les Tables de la base, en fonction de l'identifiant unique du centre ENSAM de rattachement de l'utilisateur.

4. Conclusion : l'Intranet au service de la scolarité

Conçu à l'origine comme un outil de diffusion de l'information, le Web apporte une nouvelle approche dans la conception des applications informatiques de gestion. Une application basée sur une architecture Intranet/Internet permet d'étendre le champ d'action de la scolarité, notamment en améliorant l'aspect de diffusion de l'information et de gestion des flux des étudiants. Elle contribue à améliorer l'accès aux informations non seulement aux principaux acteurs de la gestion de la scolarité, mais également à un plus large public, depuis les futurs étudiants jusqu'aux enseignants et anciens élèves. Avec le Web, la scolarité prend une dimension nationale et internationale. Les services de scolarité des différents établissements peuvent échanger et partager des informations. Au coeur de l'activité des établissements d'enseignement, la scolarité dispose d'un outil qui lui permette d'anticiper les besoins en cours et à venir.

La force des applications Intranet/Internet réside dans les propriétés du navigateur Internet. Ce navigateur est capable de communiquer avec un serveur Web et de fonctionner sur la majorité des systèmes d'exploitation du marché. Dès les débuts de l'informatique, les informaticiens ont été confrontés aux problèmes d'intéropérabilité de leurs applications. Aujourd'hui, ils disposent d'un outil simple, basé sur le HTML, pour réaliser des applications multi plates-formes. L'architecture client/serveur trois tiers répartit le travail entre le poste client, le serveur d'application et le serveur de base de données. Les principales briques logiques de cette architecture sont ainsi dissociées et indépendantes les unes des autres, qu'il s'agisse de la couche réseau, cliente, ou d'accès à la base de données. Si cette architecture demande un effort d'analyse et d'étude lors de la conception d'une application, elle apporte par la suite un gain en terme de maintenance des applications et une plus grande adaptabilité aux évolutions des outils informatiques.

L'architecture Intranet/Internet apporte des avantages techniques importants, mais il existe aujourd'hui des contraintes dues à la jeunesses des outils. Les informaticiens n'ont pas encore eu le temps d'intégrer ces nouvelles techniques. La conception d'une application Intranet/Internet ressemble davantage à un projet expérimental. Il faut du temps pour apprendre à concevoir de telles applications. D'autre part, il existe encore peu d'outils de développement rapide adaptés aux applications Intranet/Internet tels que ceux que les informaticiens de gestion ont l'habitude d'utiliser. Le Web évolue vite et chaque jour de nouvelles solutions apparaissent aux problèmes d'hier. Les grands éditeurs de logiciels rivalisent entre eux pour détenir le monopole sur les outils de développement Intranet/Internet. Petit à petit, il est nécessaire de programmer différentes versions d'application Intranet/Internet non plus en fonction du type d'ordinateur ou du système d'exploitation client, mais du navigateur Internet utilisé. Si ces applications sont toujours multi plates-formes. L'architecture client/serveur trois tiers répartit le travail entre le poste client, le serveur d'application et le serveur de base de données. Les principales briques logiques de cette architecture sont ainsi dissociées et indépendantes les unes des autres, qu'il s'agisse de la couche réseau, cliente, ou d'accès à la base de données. Si cette architecture demande un effort d'analyse et d'étude lors de la conception d'une application, elle apporte par la suite un gain en terme de maintenance des applications et une plus grande adaptabilité aux évolutions des outils informatiques.

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1Direction Générale de l'Ecole Nationale Supérieure d'Arts et Métiers (ENSAM)
151, Bd de l'Hôpital, 75013 Paris, France
E-mail: jfe@Paris.ensam.fr
2Faculté de Mathématiques et d'Informatique,
Université de Delft, Pays-Bas
3Institut de Chambéry,
Ecole Nationale Supérieure d'Arts et Métiers (ENSAM) E-mail: Jacques.Bourel@Chambery.ensam.fr

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Distance Learning Applications in Banking: The D-LAB Project

1 Anastassios Koutoumanos, 2Nikolaos Papaspyrou, Symeon Retalis, Cleo Sgouropoulou, Ioannis Sgourovassilakis, Emmanuel Skordalakis

1. Introduction

The rapid developments in the European monetary market, emanating mostly from the forthcoming currency coupling of European countries and the intense competition, render the need for vocational training of bank employees essential and urgent. In order to fulfill their duties, bank employees must be up-to-date with recent developments, current laws, practices, etc. Furthermore, the speed and effectiveness with which employees are trained is critical for a bank's activities, for its competence in the market and therefore for its viability. These reasons have urged Greek banks and their managers to change their traditional unfavourable point of view towards training, so that nowadays training is considered a significant part of a bank's strategic plan.

Distance learning, as a training method, seems to have the potential of overcoming constraints in time and place that the traditional face-to-face teacher-centered training method imposes, and thus to contribute in the improvement of the offered training. However, the success of the distance training approach is hindered by a number of factors, such as poor communication between the actors of the training process, troublesome updating of course material, etc. The use of new technologies, supported by the computer networks that banks already have, seems to be in the right direction because it facilitates the frequent updating of the learning material and guarantees homogeneity and a high level of interaction among the participants in the training process [Coll96, Kout96].

A project with the title “D-LAB: Distance Learning Applications in Banking” is underway by a consortium led by the Union of Greek Banks (UGB). The main objective of this project is to design, implement, evaluate and experimentally use a modern distance training system for delivering on-the-job training to bank employees. This system will be based on the new technologies, namely computer networks and networked hypermedia systems, as well as on current pedagogical trends. It is intended to cover the training needs of the Greek banks that participate in the project's consortium and also to demonstrate the technical and economical viability of such an approach. A team from the National Technical University of Athens (NTUA) takes part as a technology expertise provider.

For the development of such a distance training system, the NTUA team has proposed three solutions, based on its experience from participating in two related projects, EONT [URL1] and MECPOL [URL2], within the SOCRATES programme [URL3]. The third solution is particularly interesting from the development point of view and for this reason is more elaborated in the sequel.

The paper is structured as follows. In section 2, a brief account of the current situation and trends in training in Greece, as far as training in the banking sector is concerned. In section 3, a brief description of the D-LAB project is made. In section 4, the three solutions for a distance training system for banks are presented. In section 5 the third solution is described in detail. The paper concludes with some brief remarks in section 6.

2. Current situation and trends in Greece

The current situation of education and training in Greek banks could be undoubtedly described as mediocre. There are no higher education institutes offering courses in banking, whereas only recently a couple of highest education institutes have formed departments offering related courses. The training needs of approximately 54,000 Greek bank employees are currently covered mostly by intra-bank training and some times by training delivered by specialized private companies.

Between 1982 and 1986, administrative Units for Education and Training were created in almost every bank of the public and private sector. These units have planned and organized a lot of intra-bank training seminars, most of which were organized in Athens. In parallel to this activity, since 1985 the UGB has organized a number of inter-bank training seminars in an effort to cover the training needs of banks with little or no training facilities. The methods that have been adopted for training are based on the oral presentation of the material, in form of lectures, and use exercises and written assignments as a supplement.

Distance learning has been used as a training method in other fields with great success. During the last few years, the UGB has organized a number of distance training seminars that were attended by approximately 1,000 bank employees. Although these seminars were delivered with the conventional method of distance training, based on printed training material and the telephone as the only means of communication between the trainees and the trainers, they have had considerable success. This has raised the interest of UGB for experimenting with modern distance training systems.

3. The project D-LAB

The project D-LAB is partially funded by the Greek General Secretariat for Research and Technology, under the research programme . The aim of this programme is the application of technologies and processes that are new to the Greek standards but have been successfully applied abroad. A long-term aim is the creation of an infrastructure for the development and demonstration of innovative products and methodologies of wide economic interest.

D-LAB is a partnership project between several actors of the Greek banking sector and the NTUA, which participates as a technology expertise provider. The project's consortium was formed on the basis of the partners' common interest in experimenting with the distance training method using the new technologies. The project is coordinated by the UGB. The complete list of partners is shown in Table 1.

Table 1. Participants in the project D-LAB.

PARTICIPANTS	ROLE
Union of Greek Banks (UGB)	Coordinator
National Bank of Greece (NBG)	Partner
Agricultural Bank of Greece (ABG)	Partner
Mortgage Bank of Greece (MBG)	Partner
Educational Center of MBG	Partner
INE - OTOE	Partner
National Technical University of Athens (NTUA)	Technology expertise provider

The main objective of the project D-LAB is the development of a modern distance training system for bank employees, based on the new technologies and pedagogical methods. The new technologies that will be used in the implementation of this system are computer networks and hypermedia systems. The project also aims at demonstrating the technical and economical viability of such an approach. The distance training system that will be developed must meet the following requirements:

- It must be equipped with efficient authoring tools to facilitate the development of training material and provide an easy way to manage and regularly update this material.
- It must facilitate the automation of administrative tasks, specify access and update rights for all users and have a friendly user interface.
- It must implement a communication channel, in which all trainees and trainers will participate and discuss electronically matters related to specific courses. The content of these discussions that take place, as well as all questions and answers, must be reusable.
- It must facilitate the users in their attempts to locate and access course related material that is distributed in the Internet.
- The training material must be widely available and accessible at the same time from many different locations. It must also be hierarchically structured and use hypertext links in such a way as to facilitate and guide the users.

4. Proposed solutions

Since the beginning of the project, the most important problem has been to specify the modern distance training system that will be used. The NTUA team has proposed three alternative solutions after investigating related research.

The first solution advocates the selection and adoption of a system similar to the ones used today by banks outside Greece for their training needs. Unfortunately, our experience in this area is very limited and this solution should be realized through investigation of the current situation world-wide. It might lead nowhere if such systems are not available today.

The second solution advocates the adoption of a commercial system for distance education, such as the ones used today in academic institutions world-wide. Web-based distance education systems, for example TopClass [URL4] or WebCT [URL5], are particularly suitable for the needs of this project, since they meet many of the requirements that were stated in the previous section.

The third solution advocates the development of a distance training system specially designed for the needs of banks. This solution will be further elaborated in the rest of the paper, as it is particularly interesting from the development point of view.

5. Implementation approach -- the DDTS solution

According to the third proposed solution, a distributed system structured in three layers as shown in Figure 1 is envisaged for the needs of the project D-LAB. This system will be referred to in the sequel as “Distributed Distance Training System” (DDTS). Each layer will contain a number of nodes which will act as the system's servers. These servers will host the training material and provide other educational or administrative services.

The first layer will consist of a single central node, located at the educational center of the UGB, hosting the training material that is common to all banks. The second layer will consist of several primary nodes, one for each bank participating in the consortium. In each primary node the material of the central node will be mirrored, in order to improve access time and reduce the network load. In addition, primary nodes will host material specific to the needs of the particular bank or supplementary to the common material. The third layer will consist of several secondary nodes for each bank, distributed over the country. These will mirror parts of the training material and provide access to trainers and trainees.

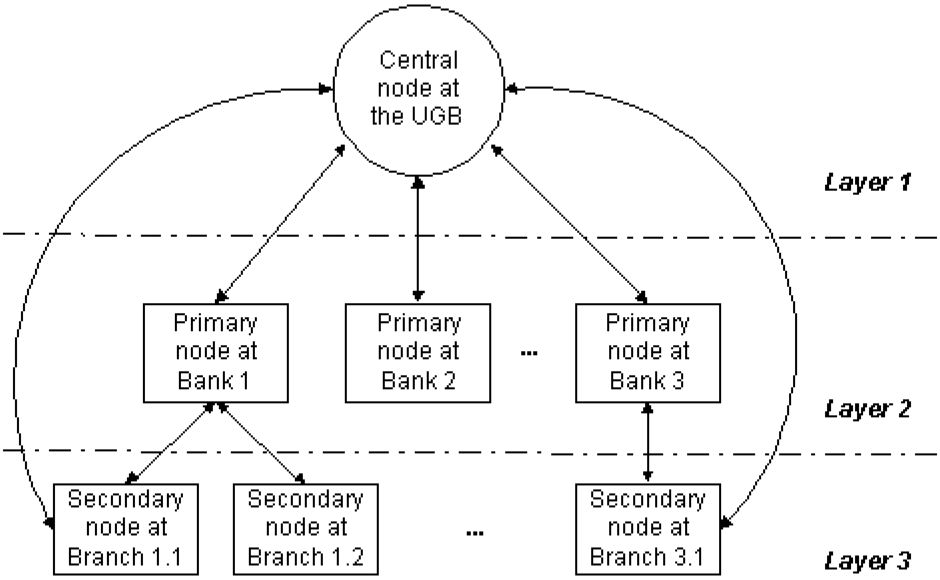

Figure 1 Layered structure of DDTS.

DDTS will be based on the client-server architecture. Each node will contain a powerful server computer, which will host the training material and make it available to the users, who will operate a number of client computers. Such client computers will be connected to DTTS through LANs or modem lines, as shown in Figure 2.

The development of the required training material, its management and updating will be performed only in nodes of the first two layers. Subsequently, updates will be propagated to other nodes through the network. Such an architecture has the advantage of avoiding duplication of effort in preparing, maintaining and managing the training material. Additionally, it makes the access to this material very flexible.

DDTS can be implemented using as infrastructure the Internet and the second-generation networked hypermedia system HyperWave [Maur96, URL6]. Internet offers a large number of services, contains a real treasure of information and is widely used and available today [Hesslop 1994]. HyperWave possesses characteristics that facilitate the development of distance training systems. Specifically:

- It is a scaleable distributed system, in which the stored data can be placed at a variety of sites. There is no need for a central, dedicated server with huge amounts of disk storage.
- It is interoperable with other first generation hypermedia systems, such as WWW and Gopher, and with other popular Internet services, such as Telnet and FTP. Browsing, authoring and administration can be performed using standard HTTP clients or custom application development tools.
- Objects can be added to the system piecemeal as they are constructed. The system is based on an object-oriented database containing documents, links and object information.
- Hyperlinks are stored separately from documents, allowing users to attach links to otherwise read-only documents. In addition, hyperlinks are automatically checked for consistency.
- It is a multi-user system, allowing people with an organization to work together simultaneously and collaboratively. It utilizes access rights for every collection of hyper-documents.
- It supports integrated search engines for full text and object attributes.
- It supports Java and JavaScript, which can be used in order to create applications that extend a server's functionality and improve user-friendliness.
- It is multilingual.

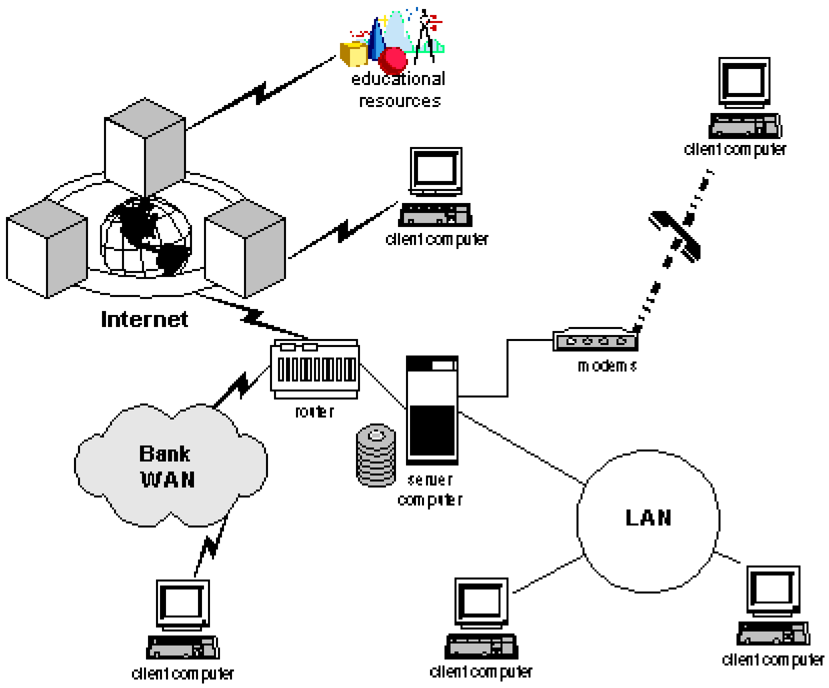

Figure 2 Schematic view of DDTS.

DDTS will support various modern pedagogical methods, such as collaborative, conversational (student-student and student-teacher) and student-centered learning. Apart from hosting and electronically transferring the educational material, the network will also allow the exchange of asynchronous hypermedia messages, as well as synchronous live communication (chatting and teleconference) between trainees and trainers.

6. Discussion

Distance training based on systems utilizing the new technologies of computer networks and networked hypermedia systems will undoubtedly modernize the way in which training is offered in banks today. The problem is how to build systems that will exploit the great potentiality of these technologies in combination with current pedagogical trends.

Of the three proposed solutions towards a modern distance training system for banks within the D-LAB project, the first is by far the easiest. The second solution seems easier than the third, but the adaptation effort that is needed, in order to make it suit the banks' requirements is hard to be estimated without a thorough investigation. The third solution is the hardest but the most promising, given that the proposed system will be specially developed for the banks' needs.

Acknowledgements

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[1] National Technical University of Athens,
Department of Electrical and Computer Engineering,
Division of Computer Science, Software Engineering Laboratory,

Polytechnioupoli, 15780 Zografou, Athens, Greece.
E-mail: tkout(at)softlab.ntua.gr
[2] National Mortgage Bank of Greece, Center for Education,
41-43 Vassileos Georgiou A' Ave., 16675 Glyfada,
Athens, Greece
E-mail: nickie(at)softlab.ntua.gr, retal(at)softlab.ntua.gr, csgouro(at)softlab.ntua.gr, ekkt(at)mail.hol.gr, skordala(at)softlab.ntua.gr

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The Global Alliance for Transnational Education: Transnational Education and the Quality Imperative

Marjorie Peace Lenn

The global marketplace and new technology are contributing to the rapid globalization of higher education. Today's business environment draws its professional work force from all corners of the globe. Human resource development divisions of multinational corporations face the increasing challenge of evaluating courses and degrees from other countries when identifying personnel. Further, higher education is no longer provided solely within national borders. Available through both the higher education and corporate sectors, transnational education can be found in multiple forms, including both electronically and through traditional on-site instruction and training programs. Issues of quality, purpose and responsibility abound in this new borderless educational arena and the time is ripe for a new international alliance of business, higher education and government dedicated to principled advocacy for transnational educational programs. This new alliance is GATE - the Global Alliance for Transnational Education (GATE Brochure, 1996).

It is the purpose of this paper is to provide a brief global context for the new organization and discuss its organization and services as envisioned by its founders.

The Global Context

Institutions globally are seeking new frontiers for growth and recognition. A part of their motivation is spurred by a need for additional resources as developed countries become less capable of subsidizing higher education. But the loftier among motivations lies in the rapid globalization of the marketplace and the needs envisioned by the higher education community to prepare a new generation for this inevitability.

Economic growth is at the heart of this change. For 1992, the United Nations Economic, Scientific and Cultural Organization (UNESCO) estimated the “world market” for international students as slightly in excess of 1.2 million (UNESCO Statistical Yearbook, 1992). However, this world market is measured by the number of students enrolled in educational institutions outside their country of origin as counted by receiving countries. This figure, therefore, does not take into account the unknown but perhaps even larger number of students who are receiving their education in their own country but from international sources. Whereas the United States, France, Germany, the United Kingdom and Canada import the largest number of international students (63 percent in 1990 - UNESCO), the United States, Britain and Australia are touted to be the primary exporters of higher education. The Office of the U.S. Trade Representative reports that since 1992, education has ranked fifth in U.S. cross border sale of services. In 1994, the United States earned about $7 billion (US) for educational services (Ascher, New Trade Agreements: Implications for Education and the Professions, Office of the U.S. Trade Representative, 1996) while Australia earned about $1 billion (US) in the year prior (Department of Employment, Education and Training, Australia, 1993).

These figures not only do not count the number of students who are receiving a “foreign” education in their own countries, they also do not include corporate education. As business globalizes, the multi-nationals are finding it necessary to conduct their own educational programs for their personnel. There are a number of reasons why the corporations feel that this is necessary, such as low quality higher education in certain countries where their enterprises are located, or the lack of educational facilities or expertise in highly technical areas. In some cases, the provision for an educational program is contracted out to higher education institutions in countries other than where the enterprise is located (e.g. the National Technological University, a distance education consortium of U.S. institutions for graduate level degree programs in engineering). But in a growing number of cases, the human resource divisions of corporations are providing their own (e.g. Ericsson Telecom, United Technologies, Motorola and others).

The increasing export market in higher education and new corporate educational programs, accelerated by the new technologies which make distance education a primary medium are but indicative of a larger activity: regional and global economic growth and the subsequent increased academic and professional mobility. Indeed, the multiple accreditation phenomenon already taking place in Europe and North America may barely become normal activity before it is replaced by regional and eventually global accreditation, motivated by the trade agreements. These forms of quality assurance may provide a system of standards and evaluation applied commonly among institutions and their educational programs on a regional or global basis. Although the question, “what is a quality institution of higher education,” is at the heart of regional activity in the developing world, it is the globalization of the professions and the need to provide common professional preparation which is the fastest moving pretense for regional and global standards setting and accreditation.

There are recent global initiatives which also recognize the rapid internationalization of higher education and the need to assess its effectiveness. In the professions, a recent example of international accreditation is the 1989 agreement among the engineering accreditation bodies of Australia, Canada, Ireland, New Zealand, United Kingdom and the United States. Known as the “Washington Accord”, the accrediting bodies agreed to recognize the substantial equivalence or comparability of their respective processes for accrediting engineering programs. The accrediting bodies can make recommendations to licensing authorities in their home countries that engineering programs in the other member countries be treated as equivalent (Ascher, Ibid., 1996). The General Agreement on Trade in Services (GATS) of the World Trade Organization has begun to affect business as usual by encouraging the development of common educational standards, mutual recognition and the liberalization of the processes by which professionals are allowed to practice. Traditional nationalistic modes of quality assurance, including institutional and programmatic, will inevitably work in conjunction and/or give way to global forms of public protection and educational quality, beginning with professional education. Countries which have not established their educational systems based on rigorous standards of literally "world class" quality further risk the replacement of their professional labor force by those who have anticipates global mobility and have fine-tuned their quality assurance systems accordingly.

The Global Alliance for Transnational Education: Formation, Organization and Services

GATE was envisioned by the corporate sector and founded in 1995 by Jones International, Ltd., a multinational telecommunications corporation. Jones has since been joined by a number of multinational corporations including Coca-Cola, Ericsson Telecom and others. The first invitational forum of GATE was held in October, 1995, co-hosted by the Center for Quality Assurance in International Education and Jones International, Ltd. GATE's founding affiliates are individuals drawn from:

National Quality Assurance Bodies: Committee of University Principals, Republic of South Africa; Commission d'evaluation de l'enseignement collegial, Canada; Chilean Accreditation Council; Secretaria de Educacion Publica, Mexico; National Council for Education Awards, Ireland; Academic Degrees Committee of the State Council, People's Republic of China; and the New Zealand Academic Audit Unit.

National Higher Education Associations: Hungarian Rectors' Conference; American Association of Collegiate Registrars and Admissions Officers; The Laurasian Institution (Asia and U.S.); the Australian Education Office; and the American Council on Education.

Institutions with Major Off-Shore Offerings: Open University (United Kingdom) and Monash University (Australia).

International Organizations: The United Nations Educational, Scientific and Cultural Organization; the International Network of Quality Assurance Agencies in Higher Education; and the Organisation for Economic Co-operation and Development.

The founding affiliates identified three primary needs at the heart of establishing a new organization:

I. The need for a reliable and current data base of transnational educational programs globally

A major service of GATE is a global data base. For a list of "accredited" institutions of higher education and their programs, human resource divisions of corporations, qualifications authorities, admissions offices of educational institutions and prospective students (among other users) currently rely on multiple and expensive publications of various national and international bodies which are typically outdated by the time they are printed. These publications further generally list institutions which operate within national borders but do not usually list: a) the transnational educational programs of these institutions in other countries; b) the degree programs produced by the private/corporate sector; or c) the growing number of distance education programs which are "beamed" across borders to foreign national student bodies. The data base, being developed with the assistance of the American Association of Collegiate Registrars and Admissions Officers, will be in accessible printed as well as electronic form.

II. The need to develop cooperatively principles of good practice

Key to GATE's purposes are Principles of Good Practice in the provision of transnational programs. The Principles assist institutions and organizations in the development and evaluation of quality education which crosses national borders. They are adopted by national systems for application to transnational programs provided by their institutions of higher education, and/or they are applied directly by GATE in a centrally administered, international peer review process for quality assurance and improvement, requested on a voluntary basis. The latter use has made it necessary for GATE to develop a system of quality review, including the identification of qualified external reviewers and the establishment of an evaluative process which promotes and maintains educational improvement. At its first conference, participating countries envisioned using GATE as a process of external review for foreign programs wishing to enter their country.

III. The need for an international forum to coordinate quality assurance and other activities related to principled advocacy of transnational programs

GATE's founding affiliates envisioned a global organization of institutions of higher education, national higher education and quality assurance associations, intergovernmental organizations and national ministries of education, and major corporations dedicated to principled advocacy of transnational educational programs. Further, although higher education is key to GATE's purposes, the organization concerns itself with the full range of education including postsecondary, higher and post-graduate and professional continuing education and training. The participants of GATE will come from both industrialized and developing countries.

GATE's inaugural global conference took place in London in September, 1996 at which: the three needs and sets of activities above were endorsed by the participants; an international Board of Directors was appointed; a Secretariat was named, administered by the Center for Quality Assurance in International Education in Washington, D.C. Over time, GATE's operational centers are envisioned to be located throughout the globe. Membership for higher education institutions and organizations and governmental agencies is without charge as the funding resources for GATE is borne by the corporate membership.

GATE is a global organization which operates like many organizations with newsletters, access to data bases, invitations to global forums on specific topics of interest and an annual meeting. GATE's second annual meeting is scheduled for October 8-11, 1997 at the Ritz Carlton Pentagon City in Metropolitan Washington, D.C., USA. This meeting will be co-sponsored by the Programme on Institutional Management in Higher Education and the Centre for Educational Research and Innovation of the Organisation for Economic Co-operation and Development. GATE's time is right and those who have envisioned this new organization look forward to corporate, higher education and governmental communities joining in this much needed and timely partnership.

Executive Director,
The Center for Quality Assurance in International Education and The Global Alliance for Transnational Education (GATE)
Suite 370, Washington, DC 20036 USA
E-mail: millerb_gate(at)aacrao.nche.edu

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The Scandinavian - Russian partnership in networking and distance learning: next steps

Anatoly Lifshits

Introduction

At EUNIS'95 Congress in Dusseldorf the author has stressed the great importance of distance learning and networking for Russian enormous territory. Being the representative of one of educational institutions of Russian North West author has made a call for collaboration to the Scandinavian countries (EUNIS'95 congress, pp 55-71).

This call to collaboration was heard by Finnish colleagues in 1996 and now we have prepared a common Finnish-Swedish-Norway-Russian project in networking and distance learning. The target sectors are business and management for SME's -Small and Middle Enterprises.

The time of organising such common project in 1997-1998 was a good period due to European commission had decided at that time to develop several projects in the field of Cross-Border Co-operation (CBC) and gave special grants for such projects.

The Euro-Arctic Region - the ìNorth-Topî of Europe where are gathered the borders of the northern parts of Norway, Sweden, Finland and Russia is one of the most suitable region for CBC both from the geographical point of view and from the economical one. Therefore there was organised special CBC project called Interreg Project. One of its part is targeted to the development of telecommunications. The paper describes the under-mentioned project concerning to this part of CBC.

Scope

National and regional Chambers of Commerce and Industry (CCI) and surrounding them SME's of the above-mentioned four countries form the common virtual Euro-Arctic Chamber of Commerce. Naturally to serve this Chamber there is necessary to organise the integrated telecommunication network that gives the possibility for their collaborative economical activities. So described project is aimed at organising of such international telecommunication network and to use it in business and trade.

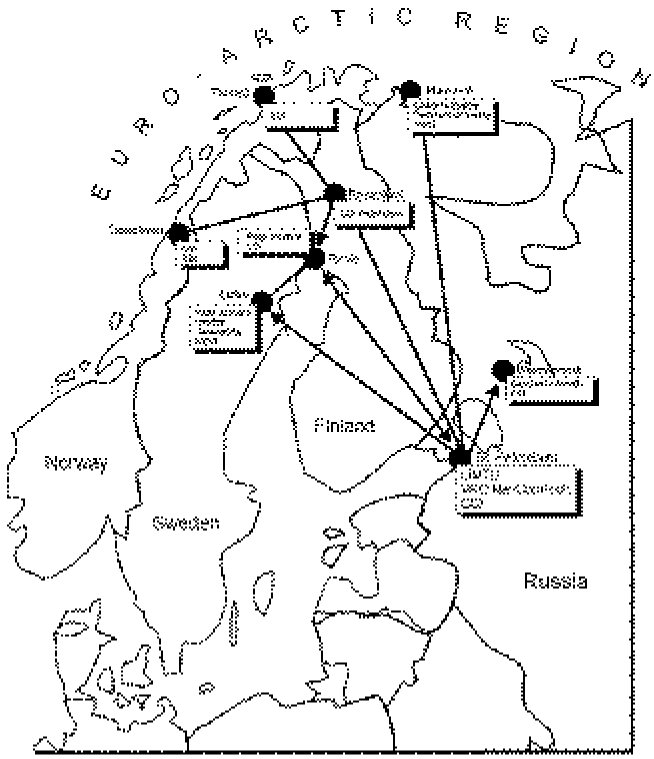
The main participants are: Kemi-Tornio Polytechnic (Finland), Rovaniemi Polytechnic (Finland), Telia Nera and Interbiz (research and project companies in Sweden), Murmansk Technical University (Russia), Murmansk research company in computer science ìComplex Systemsî (Russia), Karelian University (Petrozavodsk, Russia), Vocational Renewal Centre ìManagement and Computer Technologiesî (St.Petersburg, Russia) and Chambers of Commerce and Industry in above-mention sites. This project is financed by CBC (Interreg) program of European Union concerning Euro-Arctic Region. Sweden and Finland financed their parts as the members of European Community, the Russian part is financed by TACIS but from special CBC fond, Norway should pay their part from their own budget.

The ultimate goal of this project is to increase the exchange of information and international marketing of enterprises' activities and business opportunities in the Barents Euro-Arctic region for SME's by telecommunications.

The special goals of this scientific, teaching and business oriented project are:

- to establish telecommunication system (including Internet) in Euro-Artic region;
- to provide the information communications with information transformation of the national commerce and industry databases using Internet and Russian RBC-NET;
- to provide the distance learning courses for managing target groups in above-mentioned countries in Euro-Arctic region.

The main difficulties in research part of this project deal with developing of suitable telecommunication system for information exchange regarding that Russia and EU countries use different standards and formats of databases and information exchange systems. The CCI's and SME's in western countries use Internet wherever the Russian customers mainly had only E-mail in the best case. Big cities as St. Petersburg and Petrozavodsk are the exceptions. These difficulties will be overcome due to establishing special information analytical center in Russian institute ìComplex Systemî in Murmansk. The educational distance learning process for all participated countries will be managed by Vocational Renewal Centre in St. Petersburg through auxiliary groups in Tornio (Finland), Murmansk and Petrozavodsk (Russia). (See fig. 1)



Euro-Arctic Russian-Scandinavian
Distance Learning
NETWORK

Fig. 1

Work packages

The project includes several work-packages. Each work-package has one responsible partner and several active partners involved.

The following work packages are thoroughly prepared now:

- User-need analysis
- Specification
- Developing
- Education
- Verification
- Demonstration
- Exploitation

The brief overview of the main of them is presented.

User-need analysis.

There are two main types of users in this project:

- the end-users from the small and medium enterprises (SME) in each country participated;
- the Chambers of Commerce and Industry (CCI) in the same places.

The CCI's also may be divided into two classes:

- the CCI's, who will be responsible for electronic publications;
- the other CCI's.

User-need analysis was made in several sectors and include the assessment of information, technical (including telecommunications, hard and software) and educational needs. The stress was put on the peculiarities of development of the virtual WWW-site called Euro-Arctic Chamber of Commerce and Industry (EACCI).

Specification. Specification includes three main phases: pilot studies, substance design and solution design.Pilot studies include: present status analysis, objective status analysis and project design.

Substance analysis includes: notion analysis, task flow analysis, inter-actions design, user interface design, form design, access path analysis, data storage analysis, data communications design.

Solution design includes: normalisation, file design, database design, cartage group analysis, design of processing regulations, design of integration of Russian databases to EACCI.

Developing. The main part of this phase of project includes the establishment of the Analytical - Informational Centre in Murmansk and development of computerising technologies for electronic exchange of information in Barents Euro-Arctic region via Internet. The objectives are to design, to develop and to create communications and exchange of documents between the Chambers in EACCI, to create common site for electronic publications, to develop informational data bases for EACCI and to develop infrastructure of EACCI, in order to serve SME's in EACCI.

Education. The educational part of the project was done under leadership of the Vocational Renewal Centre (VRC) ìManagement and Computer Technologiesî from St. Petersburg due to its experience in distance learning.

The educational target groups are:

- personnel of the active CCI in EACCI, who will be responsible for electronic publications and the future system of EACCI;
- personnel of the other CCI in EACCI;
- personnel of other regional SME's;
- technicians and other persons to be involved in project developing (on the consultation level).

The main educational objectives of the project are:

1. To develop the educational methodology and training methods and to prepare the following materials:

- the training programme;
- the course modules for the above-mentioned target groups;
- the training materials;
- the business game;
- the appropriate CD ROM containing the above mentioned courseware and issues.

2. To provide the training of trainers (face to face and telematic workshops, seminars, consultations).

3. To provide the pilot course for the above-mentioned target groups in each participated country.

Before the beginning of the preparing the training materials it was necessary to analyse:

- the peculiarities of how to use telematic services and how to organise both in-country and international business for SME's in Russian part of Arctic region to be covered;
- hardware, software and information solutions to be provided for the East-West communications for SME in EACC project;
- previous similar educational projects;
- the possibilities of using the results of pervious similar educational projects (using INTERNET etc.)

The economical and geographical peculiarities of the project, the composition and disposition of the users' main principal role of telecommunications defines the distance learning as the main learning technology in this project.

Training courseware

The training materials to be done will include work-book for students, the trainer's guide, the business game documentation and the CD ROM.

The work-book should be done in modular form and should include the necessary basic information, learning materials and exercises for the activities in most useful topics for target groups: accessing the market; preparing the product for the electronic market; electronic publication in progress; looking for necessary information in electronic data base; in-country business through electronic communications; international business throughout electronic communications; information retrieval; security; billing etc. In every module the most appropriate telematic application should be chosen and practical exercises should be included.

The business game will be an important part of learning process. It will be prepared in order to give hand-on practice in using of different telematic applications in the CCI's and SME's business. The appropriate modern software and information solutions should be taken into account within different project activities.

All necessary documents are to be prepared: the games project, scenario, time plan, game's programs, participant's guide etc.

The target group in the business game are:

- personnel of CCI's;
- personnel of SME's
- personnel of Murmansk information analytical centre.

The CD ROM has to include all essential information in electronic form to provide training process of upper-minded target groups and also to self-study. The CD ROM will detail the contents, the material and structure, as well as the technical aspects such as the media (text, video, animation, still images etc.), hardware and software platforms to be used.

The CD ROM should contain training support tools during the standard course and also a self-training stand-alone tool for users of upper-mind target groups who either will not attend the EACC courses, or who will repeat the learning material.

The trainer's guide includes the methodology, programme and techniques of training process. It will also include in details the training instructions to all lessons, practical works and business game.

As to language - the course materials and CD ROM will be prepared firstly in English and after verification will be adapted upon the nationals needs and translated by partners into the national languages if necessary.

Distance learning activity

The learning process will be distributed in space and time. The central control class is planned to be organised in VRC in St. Petersburg, where all necessary educational and telematic equipment will be installed.

In each national or regional district there will be established smaller local classes also equipped with all the necessary but not so sophisticated tools. Each SME to be participated in pilot course should be at least equipped with computer, modem, telephone with loudspeaker and fax. Each CCI should have necessary networking and computer equipment.

After preparing the training materials, technical and software telecommunication the educational process envisages the following parts:

- selection pilot trainers national and regional pilot trainers;
- providing the first international face to face workshop to the trainers;
- selection the national and regional training groups;
- preparing the regional classes to the pilot groups;
- delivering the training materials for both trainers and trainees;
- providing the international and regional telematic workshop to the trainers;
- providing the pilot course for the target groups;
- providing the final face to face international, national and regional seminar after pilot course;
- preparing necessary updating in the learning materials;
- preparing the educational training programme for the follow up period after the project will be finished.

Discussion

As numerous research groups around the world are refining the art of creating telematic-based co-operation, and several have proven to be quite effective, there is a growing consensus among researchers and practitioners that more should be done in the form of international collaboration and joint innovative projects. Especially it is important for distance learning.

But there are many difficult problems on this way. Russian specific economical, historical and cultural features and traditions contribute also into the complexity of the research and development scope. Also educational theorists are in need of tools for evaluating new educational strategies and alternative curriculum models. But the successful maintenance and finishing of the described will help to develop coherent educational experience.

Telematic itself has now rather poor methodological level. Current, "information base" models of information access, particularly for the evolving Global Information Network and World Wide Web are limited. To be organised effectively telematic projects must has access to, and facility with, modern specialised systems, software and interfaces. The project will work to take advantage of - and drive - the technological collaboration in the Euro-Arctic region and evolution of the Global networking. We propose the development and dissemination of educational programs that are rich in use of media and easy to use, adopting a more familiar, television -like `look and feel'. Moreover, these programs will teach: they can provide coherent and comprehensive information about new forms and ways of international business, assist the learner in information retrieval and provide a basis for further learning.

Now there is a growing demand for co-operation in life long and open learning. This project is a first step to wider and closer collaboration in this field. We do hope it will help to analyse the problems embedded in such a radical change of the role of telematic and the obstacles for such change.

Acknowledgements

I would like to express my especial gratitude to Dr. E. Pekkarinnen Kemi-Tornio Polytechnic for the inviting in the common EACCI project and support in productive common work. This article was written using the material of common ACCI project and I would like to thank Ms. Sharlotte Eder from NCC, Lulea, Dr. Timo Tolvanen - Studio Willage, Finland; Dr. Perti Lakkala Rovaniemi Polytechnik, Dr. S. Semionov and Dr. N. Kumashowa North CCI, Murmansk, Dr. V. Mishkin. Dr. A. Orlov, Dr. I. Uvarova, JSC ìKomplex Systemî, Murmansk for useful and interesting materials and discussions during preparing the project. I thank Prof. Dr. Tatiana Gavrilova VRC, St. Petersburg for the help in preparing of this article.

Vocational Renewal Centre ìManagement and Computer Technologiesî
Gastello12, St. Petersburg, 196135, Russia
E-mail: alif(at)limtu.spb.su

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INNOVA Project:a Proposal for Fostering Electronic Teaching and Learning Based on the WWW.

Enrique Rubio-Royo, Antonio Ocón-Carreras, Manuel J. Galán Moreno

Towards New Paradigms in Teaching and Research; Academic Computation Challenges

Nowadays, any organisation (specially universities) faces an scenario characterized by the consolidation of a new paradigm (evolution towards Information Society or Economy) which requires a modification both in its structures and behaviors, in as much a new definition regarding its mission and goals, a new strategy of competitiveness based upon technologic innovation and information.

The evolution of Information Technologies and its introduction in the scope of teaching and research, give arise a wide spectrum of new possibilities (most of them not yet explored), which not only promise an improvement in the productivity of learning process, but also a qualitative change in its nature. At the same time, the consideration of knowledge as a fundamental resource in the economy of information, and the substantive changes in society, enterprises, and labor, are fostering an increasing demand of formation and learning to suit the needs of new professional qualifications and its rapid changes, which makes more evident the obsolescence of existing qualifications and formation, and the lack of relationship between the productive system and curricula, and low proficiency of the traditional model of teaching (expensive and slow).

So, at this moment, the environmental conditions are becoming optimal to put on the foundations, with a certain warranty of success, a new model of creation and transference of knowledge. In fact, due an increasing demand of a more productive and cost-adequate formation, best suited to socioeconomic environment; requires a research activity which should not be divorced to lecturing and vice-versa. In this sense, the Information Technologies are providing great expectations in the field of formation regarding two new formative contexts and new forms of interaction.

Besides, those aspects of Information Technologies make possible the elaboration of several proposals that come from Education Theory (Jean Piaget, Seymour Papert, Vygotsky, ...) based on teaching techniques which emphasize in bi-directionality, participation, collaboration and inter-disciplinarity, instead of traditional approach based upon passivity, individuality, uniformness and unidirectionality.

In this context, a new foundation for the creation and diffusion of knowledge is proposed, which should be well suited to the Economy of Information, considering the organization as a shared information network; and as a result of a integration and synthesis of different aspects and several considerations as:

The proposal of a prototype of an architectural model of formation and learning based on a shared network of formation and information, the convergence of Library services and Academic computation, the definition of scholar information services based on the design of the organisational information cartography, and the convergence of the different models of teaching (Ocon, 1.995), as shown in fig. 1.

Under these circumstances; which are going to be the new challenges for academic computation (lecturing and research), in this new times of revolution in scholarship and knowledge concepts?

During the eighties, there was, generally speaking, a massive introduction of distributed computing in higher education environments. During the nineties, after the initial explosion of the eighties, we can say that academic computing is reaching its teenage. Indeed, we are shifting from a fast and chaotic growing to a development of ways that involve an institutional dimension, new paradigms in teaching and research, and new models of information services management.

By this way, academic computing should provide the creative basement of an increasing academic population in a rich information environment (through the use of Internet).

So, one of the most important aspects which modern academic computing is facing right now, deals, more than technology itself, with the need of warrant the access to a living information environment, and from this the needs of developing new media for this goal and, at the same time, reduce the interval of time between the creation and diffusion of knowledge.

Another aspect which should be considered is to provide an adequate management of academic computing, considering the great differences relative to the eighties point of view: from mainframe to desktop computing (due to the increasing power and decreasing price of personal computers and workstations). This trend produced a shift from computation and programming languages, devoted to calculations, to personal productivity tools and applications; from reduced technological environments to a widespread community of users; etc.

In this circumstances, which new technologies and which new learning and reearching applications will be the key for innovation in academic computing?. Which new challenges will they bring to the supporting groups these new applications and technologies?.

We consider that academic computing will be characterized at least by this three new classes of computation:

1. An increasingly rich information environment, which will require the access and processing of great amounts of data.
2. Visualization and post-processing tools (that transform raw data into 3-D presentations and animations), which are able

to show the temporal evolution of a given process.
3. Composition and management of hyper-media and hyper-text documentation (web publishing).

Starting with this considerations, the ULPGC is developing institutionally a Plan for Innovation Technologies whose goals are, fundamentally:

1. The deployment of an infrastructure of global information - ATM Corporate Network - (http://www.ulpgc.es/ulpnet/index.html) which permits an all-with-all connection.
2. The development of an electronic edition and publishing environment, based on WWW techniques, which simplifies and improves electronic teaching and learning - INNOVA Project (http://www.ulpgc.es/cicei/innnova/index.html).

In the following paragraphs, we will describe these two plans in more detail.

The Voice Integrated Network, "ATM" Data of the University of Las Palmas de Gran Canaria (ULPNET)

The first action proposed by the earlier mentioned Plan of Technological Innovation of the ULPGC, was developing its own infrastructure for information (INFOestructura) that would permit a universal access to the resources and services of information.

On the basis of technological homogenicity and unity of the network and after a deep analysis, we though convenient to adopt the ATM technology (Asynchronous Transfer Mode) rather than SDH (Syncronous Digital Hieranchy) for the integration under a single network of the transmision of any type of information (voice, data, video, etc.). The next step forward was negociating the metropolitan infrastructure to allow communication between the different units of our university. In August, 1996, we signed an agreement with the Spanish National Telephone Company for implanting the Corporative Network of the ULPGC. its scheme is shown in figure 1 and its main features are the following:

1. ATM switches are used (initially, 10 FORE units whose models are ASX-1000 and ASX 200), placed along the different departments of the university and connected by means of multimode (in the university grounds) or monomode (in the metropolitan areas) fiberoptics. These switches have a capacity of 155 Mbps, with the capacity of migration to 640 Mbps
2. The data transport is carried out by direct connection between the main servers and the ATM switches (ten of them, initially) and the costumer servers or stations through a total of 45 Ethernet commuters with access to ATM (FORE 3810 equipment, which will be called from now on LanSwitches), providing nearly 2200 ethernet points. In any case, the commuters installed initially represent the trunk (Backbone) of the network, considering the use of of ATM commuters to facilitate direct access to work groups over ATM as long as this technology is more economic and readily accessible.
3. The voice transfer is dealt with the acquisition of IBERCOM switch boards, as well as by substituting MIC circuits (E1 at 2 Mbps, supplied by the Telephone Company) in these switch boards by links of the same speed, supplied by cards addapted to the ATM commuters
4. The video transfer will be carried out, in due course, throug codificator-decodificator equipment (CODECs), connected to the ATM switches.
5. University delegations in the other islands (Tenerife, Fuerteventura and Lanzarote) will have digital switch boards using added RDSI channels, separatinf the data traffic by means of a router.
6. As added values to the network, we contemplate a 128 Kbps connection to IBERNET (the TCP/IP network of the Telephonic Company), with access to the Internet and to InfoVia, as well as the creation of 4 Videoconference rooms in different departments of the university.

Obviously, this network must proggressively substitute in a non traumatic manner previous infrastructures of voice (IBERCOM network, supported by MIC links) and data (FDDI ring at the campus of Tafira, with links to the other buildings).

This network project requires the existence of adequate wiring in all buildings, in such a manner they can be distributed with the 10BaseT Ethernet standard connections to the LanSwitches. Since the location of the buildings is variable we will implement wiring in the 23 buildings that lacked this infrastructure. We expect this to be completed and operative in about 2 years time.

External connections have developed in a similar manner as internal connections, changing in a short period of time from a 9600 bps line (it used to link the ULPGC with the IRIS network, a 2 Mbps line which belongs to the Canarian I+D network (REDIC), connecting the 3 main research and development units of the Canarian Community: the University of La Laguna (ULL), Institute of Astrophysics (IAC) and the ULPGC, with access to this network through both universities, all other units by means of RDSI connections. The backup of the backbone links (the 2 Mbps IAC-ULL and IAC-ULPGC links) is also through RDSI. The IAC maintains the connection between the Canarian Network and the IRIS Network through an ATM link from the GIGACOM service of the Telephonic Company, at a speed of 4 Mbps and backup by primary access of RSDI (at 2 Mbps).

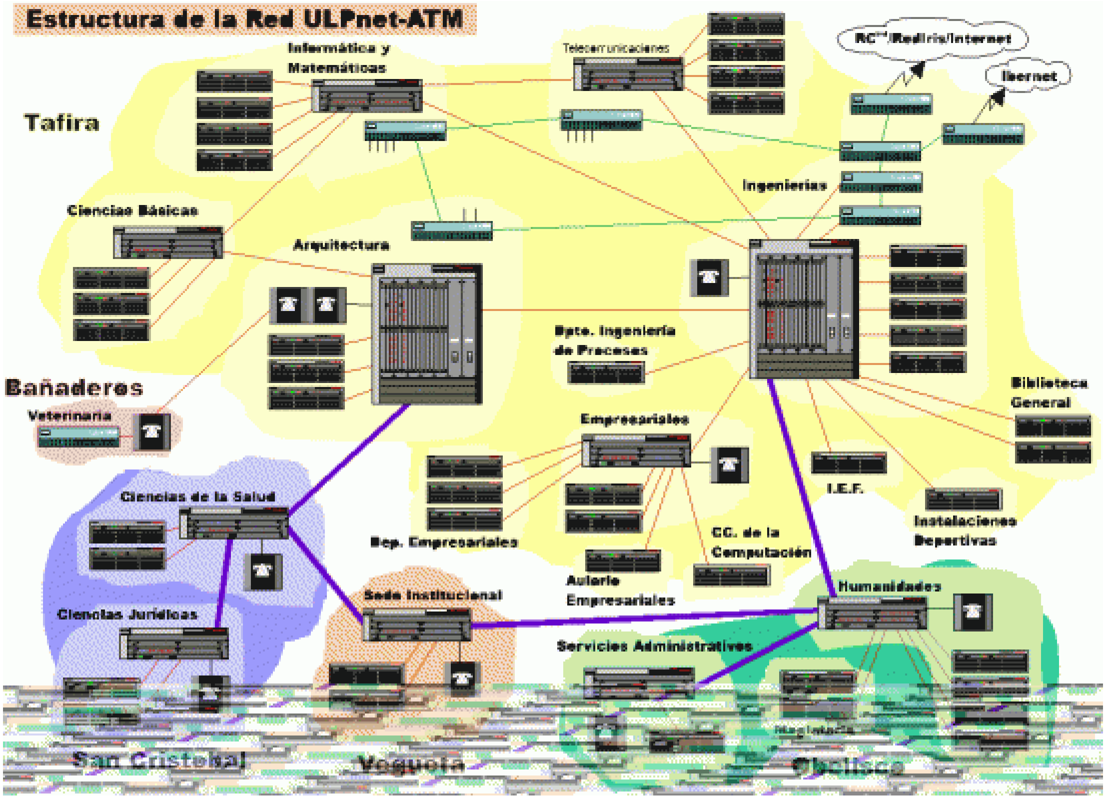

Figure 1

The agreement between the ULPGC and the Telephonic Company introduces a 128 Kbps connection to the IBERNET, with access to the Intenet via InfoVia.

INNOVA Project: Plan for the improvement in the quality of teaching.

As an action inside the Campus Innovation Model, and in the scope of the Plan for the improvement of quality in teaching, a proposal was done in early 1997: the first call for Teaching Innovation Projects of ULPGC. The goal of this call was to stimulate the adaptation to the new paradigms of formation and learning, which implies a new kind of teaching and learning far apart from the traditional models. Inside this Call, the INNOVA Project was presented as a proposal to promote electronic teaching and learning based on WWW technologies, in as much to take advantage of the investments done by the university in the aforementioned Corporate ATM Network (ULPnet).

Before going to a more detailed description of this project, we will try to identify the potential of WWW as an educational tool. Iun this sense, the most important characteristics can be summarized by the following:

- Hypermedia capabilities (Hypertext and Multimedia)
- Information distribution and sharing capabilities, open to Internet
- Free availability of servers, clients (browsers), and auxiliary applications.
- Wide interactive capabilities (forms and cgi-scripts)

Relating to the process of learning, we can see four main actions of web technology:

1. Web as a Tutor: An excellent environment to design hypermedia tutorials and lectures, for local and remote use, in which the student is able to control the speed of learning process
2. Web as publishing supporting tool: Making possible the publication and organization of student on-line multimedia works and projects, with links to many references and network connections, in opposition to the traditional role of the student as "publisher" associated to conventional Information Technologies: books, papers, classroom presentations, etc.
3. Web as a Forum: The web is an exceptional base for debate and virtual exploration and discovery. It should be note that web is the result of the evolution of Internet in a friendlier environment that enables the interactivity with a complex set of Internet protocols: News, distributions lists, online discussions, etc.
4. Web as a Navigator: The capabilities and simplicity of navigation, exploration and search is another differential characteristic of the WWW. Increasingly, there are appearing searching and indexing tools (Altavista, Yahoo, Lycos, ...) which facilitate the organization of resources, giving "online guides" which are fundamental for the design and development of a "cartography of knowledge".

Under this point of view, INNOVA Project tries to foster the online teaching and learning in an information-rich context, with application to:

1. Common shared subjects of the Scientific and technical curricula
2. An specific curricula (Industrial Engineering School)

3. Standard software productivity tools (WWW software, AutoCAD, etc.) with the counsel of differents services and resources of information (Language Laboratory of ULPGC, Computer Laboratory of Sea Sciences School, publishing and Library services of the Engineering Building, CEANI and CICEI).

The main reasons of this proposal were:

- The need to provide a novel learning environment, according to an rich-information atmosphere, in opposition to the traditional approach
- The technological barriers of this new environment are disappearing as Information Technologies evolves and bandwidth increases, which will give rise to a quantum leap in the nature of learning itself.
- The obvious economical advantages of this approach
- The need for the future labor market of new skills for our students, not provided by traditional curricula.
- The cooperative experience in formation and production, and the research about new pedagogical and methodological criteria inside the aforementioned paradigm shift.

The sought objectives and contents are:

- Promote and develop online learning and teaching based on WWW
- Get returns from the investments made in computing and networking facilities in the ULPGC
- Cooperate in the sought cultural drift, towards learning and teaching skills based on Information Technologies, which is necessary for studenty, faculty and staff of our university.
- Establish the principles and tools for a publishing environment based on WWW, with the following points:
- Formation of the participants
- WWW concepts
- HTML Language
- WWW Edition
- Design and development of a generic prototype of interface (institutionally wise), based on WWW, with application to different subjects involved in the project.
- Development of user interfaces, to facilitate the accessibility and use of standard productivity tools, WWW software and AutoCAD
- Develop utilities and tools to facilitate on-line tutorials authoring
- Propose a methodology for learning projects, based on WWW (style guides, rules and stages)
- Enumerate possible technologies related to electronic learning environment
- Integrate the publishing services into the corporate ATM networks
- Start the Scholarship Information Services in the field of Engineering, with the aim of developing the knowledge cartography.

In relation with this proposal, we have taken as starting point, the prototype of instructional interface devised in "Introduction to Computer Sciences" subject:

http://www.ulpgc.es/etsii/departam/inform/inf_bas/si/index.html

with the following aspects: "General Data, concepts and definitions, objectives, evaluation, contents, recommended practices, tests schedule, bibliography, electronic supporting material, collection of exercises, e-mail distribution lists, etc.".

As a possible initial structure for the lessons of the course, the following scheme is proposed:

"Introduction, objectives of the module, index of contents, summary, conceptual map, proposed activities, advanced exercises, self-evaluation tests, solutions to the exercises, glossary with basic concepts, thematic index"

Among the different tools for the course, to be progressively included in the development environment, we could mention:

"Notice board, real time chat, on-line questionnaires, student self-evaluation, e-mail, images archive, page annotation, shared blackboard, student management, student presentation areas; etc".

We should point out that the particular level of development and complexity of the instructional WWW interface for each subject will depend not only on the development of the production environment, but also on the personal and individual commitment with the improvement of teaching quality.

Finally, with this INNOVA Project we have tried to adequate, inside the field of teaching, to a new context characterized by the intensive use of information. Through the use of "VIRTUAL CONGRESSES" we seek to accomplish the same goals in the field of research and knowledge transference. A first experience on this possibility was performed on the "Primer Congreso Virtual Hispano-Americano de Anatomía Patológica" (First Spanish-American Virtual Congress on Pathologic Anatomy), (May-June 1997, http://www.ulpgc.es/conganat).

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Spain
A E-mail: rubio(at)cicei.ulpgc.es

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Hypermedia Technology for Lecture Courses: Selection Strategy, Development and Realization

Vladimir I. Trukhin, Aleksandr N. Sandalov, Natalia A. Sukhareva

Introduction

The structure of university education expects an unity research and education activities both on the part of professorial teaching composition, and with students. One more distinctive part of university style of education is possible to united education and research from the level of waking students selection to university, the level of unceasing professional improvement a professor teaching and research composition. Naturally that all infrastructure elements, ensuring operation of university as a whole and a department in particular are created and developed according to united " selection rules".

Information components, on the technological level - Information Computer Network (ICN) - are actively increasing elements of infrastructure of the department. At a rate of university tasks network facility, on source ideologies present itself distributed system, oriented on experimental and computing procedures, added by the database with information reference and search subsystems. This concept was taken for the base created and developed on the function system structure of information education process support, oriented on the extension of spectrum of research facilities applicable when studying of general and special physics discipline and humanitarian cycles.

1. ICN of Physics Department at MSU

On the modern stage of integration of Physics Department at MSU in the world scientific community, currently unceasing telecommunication system development, as at a rate of the department ICN infrastructure and its access to global Internet ensuring functioning to the work of the professors and researchers with international information and computing resources. Under developing should understand not only equipping Physics Department with computers and software, as well as literate usage, information filling and active use ICN of the department, introducing the modern information technologies to the education and research activity. Thereby, speech goes not on purely technical problems, but on the essential realignment scientifically methodical style of activity professorial teaching and research personnel, on radical change in organizations of cognition process, technologies of acting the scientific studies and educating the students.

High speed performance computer network are in use on Physics Department since 1992 [1,2]. ICN structure is divided into several local groups to internal network, with output on fiber - optics (100 Mbps) and coaxial - cable (10 Mbps) links to external channels. Internal network of the department comprises of at present time near 400 computers in local network on IP and more than 500 computers on UUCP.

According to the program of ICN development, passes a connection on fiber optics links of the three remote building as a part of the department ICN. Each of the remote buildings creates an own local network, falling into united. Now all 32 subdivisions of the Physics Department have a direct access to global Internet. For raising network reliability in the nearest future provided creation an ring network structure with transition on the topology 10baseT, using twist pair as a transport media, with the realization of speed 100 Mbps. Under given topology is ensured high intolerance, broad possibilities of checking and control of the network condition. Constantly developing architecture of network is accompanied operative on modern technologies of ICN with phased rearranging the most busy traffic segments of network.

Integration with global Internet at present time based on two MSU links to the Europe: through the NPI of MSU to Germany (1 Mbps) and to France (256 kbps) and one link to US through the central MSU node with the connection to Moscow Backbone.

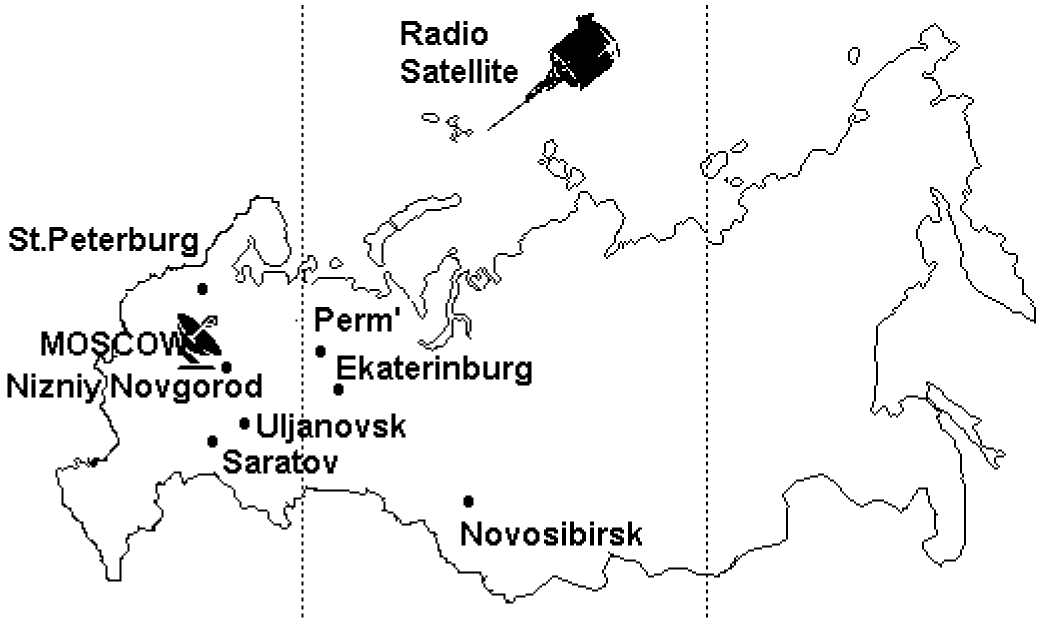

Fig. 1 Universities centers supported by the MSU overland satellite station.

At January 1994 within the framework of the federal program "Universities of Russia" was established the computer network of Russia universities - RUNnet, which primary task is a maintenance of united information space of Universities of Russia and integrate with world science and education community. Federal Moscow region node of RUNnet are located at MSU. Physics Department is an antenna equipment operator of high speed performance (till 2 Mbps) link with such powerful regional education and scientific centers, as Novosibirsk, Ekaterinburg, Nizjni Novgorod, Perm, Ulianovsk and others (Fig. 1) through the overland satellite station, located on the Physics Department building.

On transport characteristics ICN of Physics Department is divided into: local area network, UUCP network and external links. Local network is based on topologies Ethernet 10Base5 with use as a transport media fine coaxial cable and consists of several segments, united through the Central Department Node. Maximum segment length is 200 m under 30 computers in it. For longer segments use repeaters and 4 subnodes with the routers. Exchange protocol is TCP/IP that allows a natural integrate the ICN infrastructure to the global Internet community.

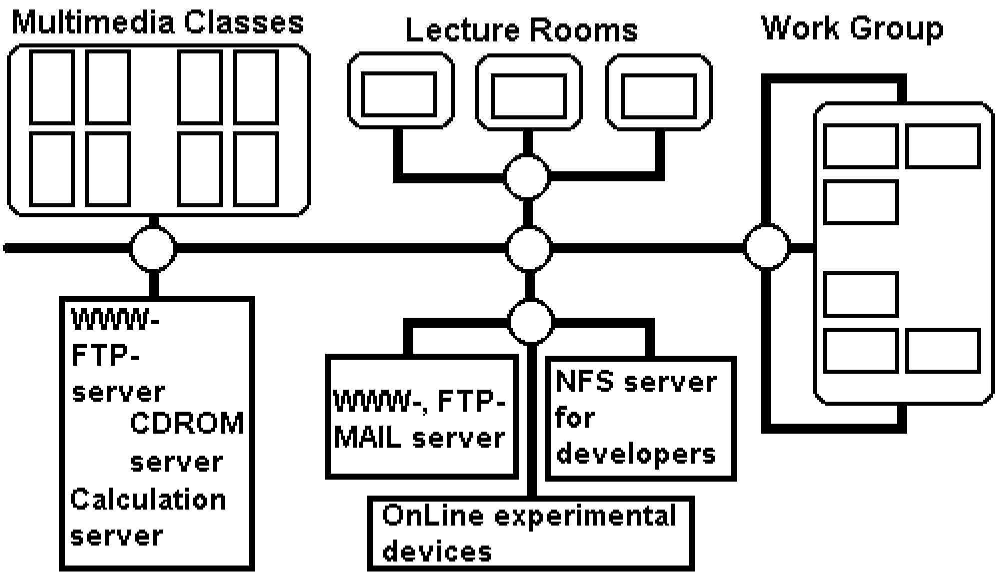

Fig. 2. Block diagram of training support segment of ICN of Physics Department.

Segment, physically realized information training support on logical solution is an independent subnode of ICN, based on three lecture department auditoriums (300 sits each), consist from Server group", Auditorium group", "Working group" and Multimedia computers classes (Fig. 2). In 1996/97 academic years this segment used as transport media the fine coaxial cable and was built on topologies Ethernet 10Base5. How has shown a practice to its usages, forecaster increase of the used information resources and conducted on separate segments of functioning with experimental devices in the on-line mode, transport parameters and level protection inhere are on the upper level of limit. Is it in the nearest future plans is a reconstruction of segment with transition on the single mode fiber optics link together with use in some parts transport media based on twist pair.

Thereby, developed and realized on Physics Department ICN infrastructure allows to realized the whole spectrum of modern information technology for support research and education activities.

2. Information training subsystem: purposes and tasks

According to accepted concepts, ICN is a natural element of scientific activity, seriously changing distribution of the accents in the planning and processing the physics research. Full-fledged entering a information support in the training process can be reached under the simultaneous presentation both forms, and contents of network resources. Here under the form is understood technology of remote access to hardware and software of physics research centers, databases, information search systems. At the selection "contents" of network resources, proposed attention of students, we are intelligently refused from use or development of large number of our own made simulation programs, having shifted accent on adaptation for the concrete training courses research or technologys programs. Such approach allows when functioning on the training material not only to explain strictly essence of fundamental physics phenomenas, as well as preview modern tools of investigations in considered area, ledge-fumes to the culture of data gathering and processing.

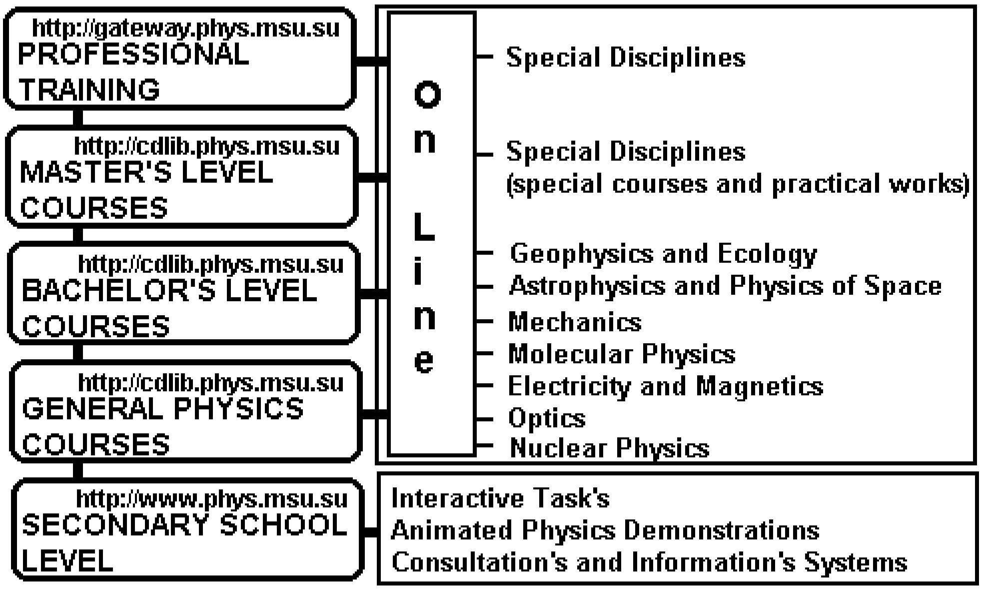

Fig. 3. Courses of physics cycle with introduced by the information support. Physics Department URL servers is shown.

Information providing of education in the auditorium regime processing or under remote access to material now is realized on Physics Department on the whole "educational vertical" - from the system of underuniversity teaching secondary school, students to the system of professional training courses for teaching personnel. On the Fig. 3 is presented realized for 1997/98 academic year "tree" of information support, first of all oriented on the physics courses, technics and technology of modern physics experiment. During 1997/98 academic year on-line mode processing information support consists 32 hours per week for physics profile cycles and 38 hours per week with the account of mathematical and humanitarian cycles.

3. Information lecture cycles support

Introduction of hypermedia support in lecture cycles in the first step of realization the information providing program of education process is connected with the high efficiency of auditorium work, allowing combine a qualify usage hardware part of the information system, ensuring professional explanation of material and broad envelopment of student auditorium (near 200 students).

Hypermedia facilities for lectures we were divided on three classes:

- Interactive;
- Illustrative;
- Informative.

Each of these classes stands out a number of categories.

Interactive class:

- Experiments on remote devices in on-line mode;
- Processing the results of the experiments on remote servers in on-line mode;
- Remote calculations on coordinated algorithms;
- JAVA applications;
- PERL Script interfaces;
- DCR - Shockwave modules.

Illustrative class:

- Slides, prepared with using the sources from common access;
- Connection to systems of global monitoring;
- Video fragments of format QT Movie, MPEG;
-

QT Virtual Reality files;
- VRML - modules;
- GIF - animation.

Informative Class:

- Servers of research centers;
- Servers of companies-producers of experimental equipment;
- Measurements and diagnostic systems;
- Thematic journals;
- Lectures collections;
- Thematic reference database.

Selected to each concrete lecture and systematizing material gathered in separate Web directory with the context page and are afforded in common access.

4. Information support out of classes

Continuing an information support of lecture courses is to show - preparing the material, provided to clients (students, schoolboys, teachers) in out-line mode. At the development of formats of presentation of material was taken into account established at present transport media features, typical configurations of computers and modems, which turned to students account. There are in view of not only university links, but, first of all connection from the homes nodes. Addressing to this service client can, depending on parameters its link, use HTTP -, FTP - protocol, or from the September 1997 - mailing-list.

Below is a list of materials for specified a type of service:

- Hypertext version of original textbooks;
- Programs of courses;
- Lectures texts;
- Seminars programs;
- Typical tasks of seminars;
- Programs of practical works;
- Exams material;
- Program and task of entrance exams.

All facility are submitted in Russian language.

5. Realization of program of interactive distant access

Development of elements of interactive distant access system is conducted with the emphasis of experimental physics studies priority, technology of gathering and processing the experimental data, operating with search systems, shaping the databases. At present time following five distant service elements are developed:

- Interactive measurement complex, working in on-line mode. As an example of working element - precision measurement system, created on the base of 24-bit ADC.
- Interactive systems of processing experimental data on special algorithms, requiring computing resources, exceeding standard PCs possibilities.
- Interactive systems of simulation complex physics processes..
- On line consultations.
- Learning to principles of operating with search-information systems and databases.

Thereby, interactive remote service affords for the students full spectrum of exploratory facilities, to which it can appeal both with educational purposes and conducting strictly scientific studies in the laboratory.

6. Unification of presentation of hypermedia resources

As a rule, lecturers developing and selecting their own hypermedia modules. Variety of tasks of different courses, bridge of operative switching between different applications and exhibits has required an entering the coordinated restrictions on types simultaneously (in session of functioning) downloaded applications. These restrictions are basically imposed device features of technical accompanying facilities (LCD- panels and the workstation). Distinctive structure of workstation hardware must have the next configuration:

- Pentium >133 MHz
- Net Card, exchange rate more than 9600 bps
- Operation memory > 32 Mb
- Hard disk >1Gb

- AudioCard 16 bit
- VideoCard STB Powergraph 64V (1 Mb video memory)
- Integrated amplifier and speaker system.

Functioning the lectures workstations goes under Window's NT or Win95 depending on desires of lecturer. In separate events, define connected by resources, provided transition to X-Windows. Browser - Netscape Navigator or Communicator with the additional programs-helpers.

Base operation system for developers of programs resources and interfaces hardware- programs module is installed by UNIX (Free BSD); for the development the modules of video graphic support is recommended system Windows NT, programs packages for data analysis and graphics results presentation - Mathematica, MathCad, programs packages of graphic processing - Adobe Photoshop, Adobe Premier, Adobe Illustrator. System of digitization of video signal is built on the base of card-converter MiroVideo.

Selected standards allow us to use an extensive bank of the exploratory program module, practically exclude a barrier when turning from educational using software programs to strictly scientific studies. Standards debugging exhibits is provided on stage of their making by using the united facilities with NFS server, containing specially selected and testing programs packages.

Summary

Designed and pass an annual experimental usage system of information support an education cycle. Main attention of at the point development and introducing a system spared for adaptation technics and technologies modern experimental and basic research to scholastic tasks of university course general and special physics disciplines, in the first place needing for the modern interactive information support. During 1996/97 academic year in lecture courses were approved following elements of information supports:

- Undertaking the experimental measurements on removed automatic complexes in on-line mode. Executed functioning on installation on studying the electrooptical characteristics of liquid-Crystal samples (Kent University), polarization microscopy.
- Connection to systems of planetary, overland, satellite and interplanetary monitoring.
- Undertaking a processing the results of the experiment with attraction of resources remote calculations servers on coordinated algorithms. Executed experimental data of ellipsometry measuring, calculated series of Fresnels holograms on MIT servers. All procedures were conducted in the mode direct access from the terminal of workstation, located in lecture auditoriums.
- Adapting the exploratory program complexes to problems of educational courses.
- Adapting the measurements system drivers to tasks scholastic demonstration experiment with the translation its in on-line mode and common access on the standard network protocols.
- Using the whole software programs spectrum of net interactive modeling with various multimedia applications: JAVA, JAVA Script, QuickTime, QuickTime Virtual Reality, VRML, PERL Script, Shockwave Flasch, Shock-wave X-Director, MPEG.
- Hypermedia databases for General Physics course: Mechanics, Molecular Physics, Electromagnetism, Optics and Nuclear Physics was developed.
- Hypermedia databases for courses Geophysics and Ecology, Astrophysics and Physics of Space, includes original facts from national and international research centers, operating in on-line mode with planetary monitoring systems was created.
- Practically realized a project of distance education with lectures demonstrations support.

Generalization of developments for lectures courses is presented in the manner of constantly complemented directories global information resources (hypermedia-directories) and with August 25, 97 will be on the common access. Technical and technological aspects of information providing, established during present elaboration, recommended to introduction for physics and research departments at Universities and secondary Schools of Russia.

URLs of MSU Physics Department WWW- and FTP-servers, affording results of present development to common access:

HTTP-protocol	*FTP-protocol*
www.phys.msu.su	cdlib.phys.msu.su
cdlib.phys.msu.su	gateway.phys.msu.su
gateway.phys.msu.su	

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Physics Department, Moscow State University,
Moscow, Russia
E-mail: dean(at)phys.msu.su, sandalov(at)phys.msu.su, suhareva(at)gateway.phys.msu.su

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Hypermedia Support Practice in General Physics Course

Viktor A. Aleschkevitch, Natalia A. Sukhareva

Introduction.

Information space of Universities of Russia currently has gained a firm regional structure, practically repeating earlier established hierarchy of research and scientifically-methodical schools. As had shown on Russias national and international higher education conferences which were held in 1997 the physics education now based on stereotypes of work on insulated personal computers. The global information networks resources brings a new possibility and technologies to the field of education in physics discipline at the university.

In the presented exploitation through introducing an information providing in the concrete university course, is perfected infrastructure elements of information support in lectures courses, recommended for turning to account at Universities of Russia. Here are not discussed technical and technological aspects of hypermedia providing, but only "initial and border conditions", introduced when making concrete forming general problem of dataware.

Introduction of hypermedia resources in the process of education has put up and required solving four heterogeneous problems:

- selection and development "profound part" of hypermedia supports,
- creating a system of training of developers of hypermedia-systems,
- creating special training program for professorial-teaching personal, using hyrmedia support,
- set up special WWW- and FTP- servers, ensuring systematization information, recommended to introduction in universities and secondary schools of Russia.

Reference positions of hypermedia providing for general physics courses.

Making a base of information resources first of all oriented to the support and development of physics education level, shaping an information working ambiance, generalizing high achievements in the field of methods of scientific research activity.

Basis of university physics education is a general physics course, which interpretative as a course of experimental physics with the detailed presentation of technology and technics of classical and modern physics experiment, methods of modeling of complex physics processes.

Development of experimental physics pass the evolution from the individual labs of alone-investigators, through exploratory groups at universities, national exploratory centers to global international exploratory consortiums. Each stages is characterized with experimental base, determined by the development level of and division of functions when running the concrete measurements. With such standpoints, global network structure of information support presents by itself a regular stage in development of logic in experimental process governing, technologies of data gathering, analysis and generalizing the experimental results.

Priority of experimental operating stages in processing entering information mortgaged in the hypermedia providing base for general physics courses.

Module structure of lecture hypermedia support.

Building lectures hypermedia support on different sections of general physics course passes on standard sequences "steps" for exploratory functioning.

1. Observation of physics phenomena.
2. Choice physics models.
3. Undertaking a qualitative experiment.
4. Processing the results.
5. Computer simulations (modeling).
6. Correction physics models.
7. Undertaking a quantitative experiment and reception of values of physics values.
8. Comparison with analogues from the database.
9. Registration new results in the database.

At present time in the open access submitted varied multimedia elements which allows to realize a flexible information educational material support on positions 2, 4-5-6, 8-9. However, the most important for the general physics courses positions 1, 3 and 7 while insufficiently provided by corresponding information blocks.

In past academic year a work on creation by the module an hypermedia support for lectures in general physics was divided into two directions:

1. selection, analysis and testing of existing information elements;
2. development of new, required for equivalent provision all specified above "steps".

Some examples from thematic systematization of hypermedia resources of opening access for lectures cycles of university general physics courses possible to view on URL http://cdlib.phys.msu.su/GenPhys/HM/

Main types of new information resources under development on Physics Department at MSU is described in two following sections.

Information base "Physics phenomena".

Development of "first step" information support resources for general physics lecturer cycles was conducted within the framework of following requirements:

- unique amongst existing information module,
- development elements must be oriented on greatly broad auditorium and correspond a statement on priority of experiment when studying and teaching a course general physicists,
- inadmissible changing a physics experiment its virtual analogues.

All specified requirements satisfies a network version of demonstration physics experiments catalog, created on analogues passed five-year approbation of videocatalog of Physics Department at MSU. Existing at present catalog generalizes more then 300 years experience of stating a demonstration experiment when teaching physics in the Moscow university and is kept more than 4000 different experiences from the level of school course physics before strictly mini-studies, conducted in academic auditoriums with using the whole spectrum of experimental facilities. Unique demonstration equipment, objects of studying, exploratory style of the demonstrations, unusual experimental deciding putted physics tasks remove catalog material for frames traditional academic-methodical material. VideoVersions of Catalog are used in secondary schools, licees and high schools, many institutes and universities of Russia and abroad.

Development of network variant of videocatalog and granting it in the mode of free access - a first stage of shaping a base of national system resources of remote support of physics teaching. The catalog of animated demonstration experiment is offered clients in two versions, oriented on accompaniment of lectures and functioning.

In "auditorium" version, base separate module is videofile in the format QT Movie with enclosed to it explanatory textual file. The Built-in explaining text expelled in order to avoid language barriers, saved only technological sounds, accompanying undertaking an experiment. Distinctive size one videofile - from 5 Mb before 20 Mb. Expected that lecturer beforehand copies necessary him kit an and carries out some work in out-line mode.

For "out auditorium" functioning is offered version of directory, oriented on functioning in the mode Out-line. Videofile executed in the format animated GIF - a file with the distinctive size in 150 kb. Given built-in textual explanation of observed physics phenomena in Russian language. Text of explanations does not include some analytical transformations and serves only for orientation of lecturer in the searching more detailed information on the observed phenomena. Demonstrations are available at http://cdlib.phys.msu.su/GenPhys/Anidemos/

Experimental remote access systems.

Development and undertaking the experimental measurements in the mode On-line, ensuring "third" and "seventh" steps in hypermedia support - the most labor-consuming information resource element. For this reason on initial stage of the choice of scenarios of interactive experiments, was an accepted decision on maximum unifications of mode of experimental data gathering for as possible broader class quantitative under investigation on lectures of physics processes.

Practically, the whole circle of physics phenomena, considered in the general physics courses, possible divide into four classes:

- Regular nonstationary processes in systems with constant physics parameters.
- Regular stationary processes in systems with changing physics parameters.
- Stochastic stationary processes.
- Stochastic nonstationary processes.

Demonstrative presentation of registering signal for specified four classes of physics processes possible to realize by means of following heels by the program module, passed to a present day an approbation both in the academic demonstration experiment, and in the measurements devices in exploratory laboratories.

- "Time recorder" - regular and stochastic processes;
- "Parametric recorder" - regular and stochastic processes with parametric control;
- "Cyclograph" - Regular processes with cycling changing one of the parameters;
- "Hystograph" - Stochastic and regular processes.

At present hardware and software marketed experiments on the analysis of statistical parameters of physics signals, registrations of temporary rows with remote control of physical system parameters.

Making the educational experimental measurement systems with interactive remote control elements is oriented first of all on the familiarization of students with bases of technology and technicians of modern physics experimental investigations, principles of development of drivers for interfaces of data gathering and parametric control, structure of PERL-scripts, servicing "client-server" dialogue.

A demonstration of interactive experimental system is available at http://calibr.phys.msu.su

Program-minimum for users of hypermedia support system.

Orientation in the flow of exhibits at a rate of the users expects a possession by main notions of network technologies, skills of control in the mode of interactive functioning. The most part of employees, leading teaching the university courses, in the practical person of its professional exploratory activity use only narrow area of existing technologies of network functioning. Below brought program 20-hour, defining minimum of lecturer or assistant of lecturer, preparing to use on lectures of system an hypermedia support:

- Physical and logical principles of information system building. Shaping a datastreams. Addressing the streams. Methods of checking a transmission. Categorization of available information educational resources on the course general physics.
- Protocols of exchange by data. Datastreams based on protocols NFS, FTP, HTTP. Functioning on removed systems on TELNET. Functioning in local networks. Categorization of tasks of information exchange. Practice of information support in universities of the world. Standards of presentation of current educational material. Test tasks. Operative information. Typical structure of information educational server.
- Electronic publications. Operating with news. Electronic conferences. Subscription on electronic journals, mailing lists. Electronic bibliographic bases.
- Organization of global databases of network resources. Principles of working with search systems. Systematization of educational resources in search systems. Typical contextual searching errors. Benchmark analysis of search system efficiency on educational resources. Databases of international physical communities.
- Adjusting the programs-browsers. Use an browsers Netscape Navigator (Mozilla) 3.01, Netscape Communicator, Internet Explorer 3.01, Enhanced Mosaic, functioning with Lynx. Conduct of the direct dialogue by facilities Netscape. Optimization of browser for functioning (working) with multimedia components.
- Multimedia technology in educational network resources. Requirements to hardware ensuring a workstation. Remote education Systems. interactive network courses on the general physicist for different training levels. CD - servers. Development a scenario and creation network CD.
- Modern systems of network multimedia educational exhibit development. VRML Facility. Bases of descriptions and debugged by the program module. JAVA exhibits. Performance Strategy.
- Free, conditionally-free and license software. Order of registration of license agreements on provided to program products. Methods of remote control of spreading software. Evaluation - versions. Beta - versions.
- Preparation information for Web. Elements HTML-3, standards of data presentation, coding molded, graphic information. Adjusting the national fonts. Connection of multimedia elements in Web-a document. interactive documents. Functioning Rules with interactive forms. Protection information, sent on the server.
- Installation personal FTP - server. Rights of users access. Checking an access. Ethics of inviting and warning. The structure of configuration files for FTP - servers, running on the operating system Window's 95, Window's NT. Performance of programs on the server. Protection from unauthorized operations.

The full version program and texts of lectures is available at http://gateway.phys.msu.su/HM/lections97/

Ensuring a development of hypermedia system.

Opened hypermedia system stipulates an unceasing improvement of existing database and new element development. Consequently, second stage, after strictly "start" systems in the usage, it is necessary to consider a training of developers of resources. Under the development of resources in this instance we understand not only programs working the information module, but a development of all functional global information infrastructure (GII) levels coming from tasks of classical university formation.

Training in the considered context has sense additional to main education. For a present day this task dares within the framework of the educational program "High Computer School" at MSU. High Computer School presents an independent subdivision under Department of Computing Mathematics and Cybernetics, in which can enter a student from any department at MSU, passed qualified testing. Academic cycle is consists in two years (four semesters). The special disciplines programs and Out-line lecture courses are available at http://cdlib.phys.msu.su/HCS/Network/

Information project of "General Physics Council Universities of Russia".

General Physics Council (GPC) Universities of Russia unites physics departments from 42 classical universities. Primary task of GPC - a coordination scientifically-methodical investigations and information providing of teaching and learning in general physics discipline. Functioning an GPC is built on the regional principle with the highlighting of leading university in concrete region center. Once per annum pass sessions of GPC, to which are invited heads of general physics divisions of all universities of

Russia, once at two year are organized scientifically-methodical conferences "University general physics course: modern problems".

Practical realization of information exchange gets through WWW server GPC universities of Russia. Below enumerated information blocks of server:

- Regional structure of universities Russia.
- Periodic publishing in the field of physics education.
- Information about conferences on questions of contents of general physics courses.
- The papers of past conference, organized by GPC.
- Information about companies-producers of experimental physics equipment.
- Systems of multimedia support for educational cycles.
- Network minimum-course for users of hypermedia support in lecture courses.
- Information about entrance exams on physics departments at universities.
- Information about Internet-search systems.

When creating a server, was expected that mainstream of requests will accounts for information-organizing material. However, after set up a module "Sites for schoolboys, schoolgirls and students of secondary schools", 80% requests is moved to material concerning to undergraduate level of physics education and using an interactive form of consultations.

Comparatively high activity addressing to the server of schoolboys and students of different universities has provided in a present time to the revising of priorities of sharing the resources with displacing an accent with information-organizing questions to the development of remote educating elements and testing with all approving elements hypermedia - structures. The server addresse is http://gateway.phys.msu.su

Conclusion.

As a result of the annual "exploitation" information support system in general physics lecture courses is perfected all base its infrastructure elements:

- logic of information composition hypermedia modules;
- system of training for users;
- system a training for developers.

Output of all described infrastructure elements in the common access for universities of Russia through the system WWW - servers will ensure a coordinated development and usage of network resources in all variety their potential.

General Physics Council Universities of Russia,
Moscow State University
119899, Moscow, Russia
alschkvc(at)gateway.phys.msu.su, suhareva(at)gateway.phys.msu.su

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Distribution de l'information dans un centre d'informatique pédagogique

Christel Froissart, Marc Patouillard

Le Centre Informatique Tréfilerie (CIT) de l'université Jean Monnet est un service d'informatique pédagogique issu du plan Informatique Pour Tous. Il est destiné à des enseignants et étudiants du campus, soit 10 000 utilisateurs potentiels. Il regroupe actuellement 130 machines en réseau dans 8 salles avec un libre-accès de 50 places.

Le CIT a acquis une solide expérience en matière de distribution de l'information.

Outre les données qu'on trouve habituellement sur un serveur web, notre serveur joue un rôle important dans la distribution interne de l'information :

- il permet aux étudiants qui travaillent en Libre-Accès, en cours ou en TD autonomes, ainsi qu'aux enseignants, d'utiliser au mieux les ressources qui leur sont proposées :
- plan des salles en liaison avec notre logiciel de gestion de parc, configuration précise et actualisée de chaque machine, logiciels, cédéroms, aides en ligne,
- possibilité de poser des questions par formulaire : constitution d'une F.A.Q.,
- prise de connaissance de notre règlement, et de toutes les informations pratiques,
- aide à la navigation sur le web : pointeurs sur des sites sélectionnés, organisés par discipline, accès aux principaux moteurs de recherche,
- consultation de cours "on line" faits par les enseignants de l'Université,
- consultation de notre base de données documentaire.
- il facilite la gestion du service, en temps réel et de façon interactive grâce à une interface avec notre logiciel de gestion des emplois du temps et des données bureautiques hétérogènes.

Notre système d'information distribuée, grâce à notre intranet RAMANI, est un précieux outil, tant pour les utilisateurs de notre structure auxquels il permet d'être le plus autonome possible, qu'en interne pour assurer une partie de nos activités de gestion.

1. Introduction

1.1. Le système d'information

Notre intervention se situe dans le thème : des systèmes d'information en relation avec l'enseignement, puisque notre structure a pour vocation l'informatique pédagogique et la mise en oeuvre des Nouvelles Technologies Educatives à l'Université Jean Monnet ; mais il s'inscrit aussi, de façon transversale, dans le thème de la distribution de l'information puisque nous parlerons de l'accès aux informations pour les étudiants et le personnel.

Notre objectif est de montrer comment, à l'aide de moyens logiciels communs et peu coûteux, nous avons mis en place un système d'information qui a les caractéristiques suivantes :

il est fondé sur des données hétérogènes,

il est destiné à améliorer la communication entre des utilisateurs qui ont à la fois des statuts, des usages, des moyens d'accès et des compétences très variables ; ses fonctionnalités sont donc paramétrées en fonction des profils d'utilisateurs et des fonctions : communication interne et externe, apprentissage et enseignement, gestion,

il a considérablement évolué depuis dix ans, mais dans la continuité : le système d'information mis en place initialement, qui repose sur un SGBDR, est toujours au coeur de système, et nous lui avons ajouté des "couches" qui permettent d'améliorer l'accès distribué aux données, pour favoriser chez les étudiants et chez les enseignants la pratique des nouvelles technologies.

1.2. Le CIT

1.2.1. Activités pédagogiques

Le Centre Informatique Tréfilerie est le centre de ressources informatiques destinées aux enseignants et aux étudiants du site Tréfilerie, soit 10 000 utilisateurs potentiels. Ces utilisateurs, relevant des sciences humaines et sociales, n'envisagent pas l'informatique comme une fin en soit, mais plutôt comme un outil au service de leur discipline (cartographie, statistiques, infographie).

En 1996-97, le CIT a accueilli 3 000 heures de cours dispensées dans cinq salles ; il offre de plus un service de Libre-Accès ouvert 55 heures par semaine, avec 43 machines, divers périphériques, les logiciels les plus courants, les logiciels spécifiques utilisés en cours, et un accès en consultation au Web. Certains utilisateurs ont de plus des droits spécifiques pour accéder à d'autres ressources, locales ou distantes.

1.2.2. Gestion technique et administrative

Etant donné la taille de notre structure, nous utilisons les mêmes ressources matérielles, logicielles et réseau pour les activités pédagogiques, et pour notre gestion ; celle-ci est relativement importante : il nous faut en effet assurer à l'informatique :

- la réservation des salles et des machines,
- la gestion du personnel,
- la gestion du parc informatique,
- la logistique,
- la gestion de notre centre documentaire,
- la communication avec les autre structures de l'Université,
- la comptabilité du service.

2. Distribution de l'information

2.1. Les sources

Les données que nous traitons sont hétérogènes, à plusieurs titres : tout d'abord, elles sont émises de plate-formes différentes, elles sont générées par divers logiciels, traitements de texte, tableur, SGBDR, navigateurs web, messagerie électronique, telnet, ou acquises selon différents moyens d'enregistrement. Ce sont donc des données sous toutes sortes de formats. Enfin, il n'y a pas de standardisation dans la production des données dont les usages varient au fil du temps et en fonction des personnes.

2.2. Les moyens

Nous utilisons différents moyens de partage des ressources, en fonction de la nature des données et de leur utilisation :

- des serveur de fichiers (cf ci-après § 3)
- la messagerie : avant même l'utilisation d'Internet dans les sites universitaires, le CIT utilisait abondamment la messagerie en interne. Nous avons mis en place un dispositif pour que tout utilisateur, même s'il n'a pas de compte messagerie, puisse nous communiquer ses suggestions ou doléances.
- les serveurs Internet : après avoir été l'un des premiers sites universitaires à créer un site gopher en France, nous avons créé en 1994 un site Web, qui présente des informations diverses :
    - des informations pratiques (descriptif des ressources, fonctionnement des différents services offerts, règlement, emplois du temps, etc),
    - des aides techniques destinés à favoriser l'autonomie des étudiants dans la réalisation de tâches simples,
    - des aides à l'utilisation d'Internet,
    - des supports de cours.
    - la recherche sur notre serveur peut s'effectuer par navigation, ou par recherche sur chaînes de caractères. Il accueille de plus d'autres sites, réalisés par les composantes pédagogiques du campus.
    - les cédéroms d'autoformation : étant donné la culture des promotions d'étudiants qui arrivent, et d'autre part la convivialité des logiciels courants avec leurs dispositifs d'aide en ligne et leurs interfaces "intuitives", il nous semble que la maîtrise élémentaire de l'outil informatique relève de l'apprentissage autonome. C'est pourquoi nous avons installé sur le réseau un certains nombres de logiciels d'EAO interactifs et multimédia, accessibles des salles de cours et de la salle de Libre-Accès.

2.3. Les différentes familles d'utilisateurs

Les utilisateurs du CIT ont des profils très divers : du point de vue de leur expertise en informatique, du point de vue de la tâche qu'ils ont à réaliser avec nos ressources, du point de vue des données qu'ils ont, ou non, à connaître.

a) Communication externe

Les utilisateurs externes à l'Université, qu'ils soient ou non experts, ne peuvent être que des clients "maigres" de notre système d'information : ils peuvent consulter le serveur Web sur Internet, qui joue alors comme tous les sites Web un rôle de "vitrine". Ils peuvent aussi s'adresser au Webmaster, à charge pour celui-ci de décider s'il faut ou non poursuivre la communication.

b) Communication interne à l'Université

Un certain nombre d'utilisateurs internes à Jean Monnet sont aussi des clients "maigres" : ils consultent le serveur Web sur Internet pour s'informer sur le mode de fonctionnement du CIT (ex. : enseignants qui souhaitent connaître les disponibilités des salles de cours, personnes qui interrogent notre base documentaire,...), ou pour trouver une aide technique. Ces utilisateurs ne sont pas des experts en informatique, et ce mode d'utilisation nous semble une bonne illustration de la transition de l'enseignement à l'apprentissage : ces documents mis à leur disposition et d'accès facile contribuent à leur autonomie.

c) Utilisations pédagogiques

Les autres utilisateurs ont nécessairement des droits spécifiques : un compte de messagerie, l'accès à certains répertoires, la possibilité d'éditer des pages Web. Il s'agit d'enseignants, de chercheurs, de groupes d'étudiants qui ont des tâches spécifiques.

Ils doivent remplir certaine conditions pour avoir ces droits, et être suffisamment experts dans l'utilisation des logiciels dont ils ont besoin.

Sur le plan pédagogique, les étudiants peuvent réaliser des travaux spécifiques, en liaison avec leurs enseignants : construire un site Web et promouvoir leurs productions ; échanger des fichiers, quels qu'en soient la plate-forme émettrice et le format ; profiter de la messagerie comme outil de "téléenseignement".

d) Gestion interne au CIT

La communication entre les membres de l'équipe du CIT, enfin, est considérablement améliorée par RAMANI, que nous exposons ci-dessous. Les utilisateurs sont de deux types bien distincts :

- les experts que sont les techniciens du CIT : ils maîtrisent à la fois les techniques, et le fonctionnement du centre,
- le personnel administratif, qui maîtrise les logiciels de bureautique et de communication qu'il utilise, mais qui a l'habitude de s'appuyer sur les techniciens dès qu'il faut toucher au paramétrage des applications ou à l'architecture du système.

Etant donné la diversité des utilisateurs de notre système d'information et des tâches réalisées, nous avons mis en place cette année le système RAMANI.

3. L'accès à l'information grâce à RAMANI*

** nom de code du projet*

3.1. Situation initiale

L'informatique du centre est organisée autour de serveurs qui assurent :

a) le partage des fichiers:

- se servir les logiciels utilisés sur les 100 micro-ordinateurs Macintosh et PC des salles de cours et du Libre Accès ; il s'agit des applications, mais aussi de ce qui concerne les systèmes d'expoitation (installation partagée de win 3.1 et win95, et distribution de l'installation de Mac OS)
- imprimer sur 8 imprimantes réparties dans tout le centre
- partager la gestion proprement dite du service (secrétariat, messagerie, partage de données).

b) l'utilisation de bases de données structurées

- Le SGBD 4ème Dimension d'ACI a été employé car le centre a été d'abord équipé de Macintoshs : des application ont été réalisées pour :
- la gestion administrative : gérer la base documentaire, les emplois du temps des salles, la planification et les inscriptions en formation IPT et la comptabilité,
- la gestion technique du centre : gérer le Parc Informatique et le réseau (inventaire, maintenance, télédistribution,...).

c) l'utilisation de données non structurées

Ce sont essentiellement des documents bureautiques issus par traitement de textes, de tableur ou de la messagerie.

3.2. Pourquoi changer ?

Le passage du mac au PC a mis en évidence des problèmes de format de documents bureautiques en ce qui concerne les échanges. En outre, de plus en plus d'étudiants sont équipés personnellement de PC.

D'autre part, il n'y avait pas de possibilité simple de partager ces informations avec les utilisateurs du centre : le filtrage et la restriction de l'accès à nos données était très difficile.

Enfin, il n'y avait pas de possibilité d'accès à nos données en dehors de notre réseau local.

3.3. Une solution

La solution choisie est de greffer sur nos serveurs de données des fonctions de serveur Web intranet et internet et de moteurs de recherche : IIS (Microsoft Internet Information Server) + Microsoft Index Server+ Windows NT 4.

Cet ensemble présente de multiples avantages pour répondre au problème posé :

- un navigateur/lecteur universel, gratuit et indépendant du système d'exploitation,
- la distribution de l'information sur le réseau, local ou distant, immédiate,
- la possibilité de restreindre les accès,
- le faible coût.

RAMANI permet (en consultation) l'accès du public à certaines informations choisies, issues de nos bases de données 4D. Pour cela nous avons mis en place deux solutions :

1. produire de l'html à partir de 4D (par programmation) et le distribuer par le serveur Web via des formulaires javascript,
2. réaliser des exports texte et les exploiter via ODBC (Open Database Connectivity) et Internet Information Server.

La diffusion d'informations d'intérêt général (aides, modes d'emploi, mémos, feuilles de références) est facilitée puisqu'elle se réduit à la traduction d'un document en HTML : cette fonction est maintenant intégrée dans les nouvelles versions des logiciels de bureautique.

L'indexation de nos documents bureautique permet l'exploitation de nos archives : elle permet de retrouver rapidement des documents saisis et rangés par d'autres ainsi que de faire des croisements dans nos recherches : nous ébauchons de la sorte un mini DATA WAREHOUSING, puisque nous pouvons proposer à nos utilisateurs une recherche efficace dans une base de connaissances constituée par nos diverses documentations sur support électronique sans effort de structuration de notre part.

RAMANI offre d'autres possibilités de partage, de présentation et de diffusion de l'information :

- présentation graphique HTML des ressources, extraites de la base de données de gestion de parc et mises à jour en temps réel (SNMP),
- Tableaux de bord graphiques réalisés par des applets java qui reflètent en temps réel certains de nos indicateurs : tirages, fréquentation des salles,
- possibilité pour des étudiants sans compte E-mail de nous envoyer des demandes d'aide ou des avis directement à partir d'une page Web.

Conclusion

Notre système d'information est sans prétention, étant donné la taille de notre structure et les moyens dont nous disposons. Nous avons voulu montrer comment, dans ces limites, nous avons pu développer :

- un système de "gestion électronique de documents" qui permet de centraliser des données hétérogènes et d'y accéder de façon transparente,
- un système de "groupware" permettant à l'ensemble d'une équipe de travailler de façon coopérative malgré des compétences diversifiées et des temps de présence variables,
- un système de consultation facile et convivial grâce à RAMANI, ce qui nous semble indispensable sur un site universitaire de Sciences Humaines Sociales,
- un système de communication diversifié, permettant à chacun en fonction de son expertise et de ses besoins de partager l'information au mieux.

Ce système est peu coûteux, simple à gérer, à maintenir et à améliorer, et sûr.

Notre objectif est de favoriser ainsi l'envie, la familiarité, le besoin de faire appel aux technologies de l'information, qu'il s'agisse d'apprendre l'informatique - mais aussi, bien plus largement, pour toutes les activités qu'étudiants, enseignants et gestionnaires ont à pratiquer. Il nous semble que nous contribuons ainsi, à notre échelle, aux recommandations émises tout récemment par M. Dizambourg (B0 n° 18, 1er mai 1997) : Les enseignants voient progressivement leur rôle se transformer : ainsi se renforce leur fonction de guide pour les apprentissages et de référence dans la constructin du sens à partir des choix opérés dans une masse d'informations.

Centre Informatique Tréfilerie,
Université Jean Monnet,
2 rue Tréfilerie, 42023 St Etienne Cedex 2, France
E-Mail : froissart(at)univ-st-etienne.fr, patouillard(at)univ-st-etienne.fr

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An Approach to Teaching Medical Informatics to Students of Medicine

I.Mirtcheva

1. Introduction

One of the most recent definitions of medical informatics defines it as the discipline concerned with the systematic processing of data, information and knowledge in medicine and health care. The domain of medical informatics covers computational and informational aspects of processes and structures in medicine and health care.

The ultimate objective of informatics in health care is the achievement of the highest possible level of health of an individual, a nation and the world at large. The ultimate goal should always be to improve the quality of health care, and of research and education in medicine and health sciences.

2. Aims of the education in medical informatics for students of medicine

Medical computing has been around for more than 30 years. Medicine and medical information has been around since the time of Hippocrates. Until recently, however, most doctors and other health care professionals knew virtually nothing of medical computing and very little of medical information science - and until very recently this did not matter much. However, medical knowledge was simple to know and simple to handle, there was not need for knowledge of technology or computing.

Of course this is now all changed. Modern medicine is complex, often driven by technology, and it is impossible for an individual to learn and retain all the necessary knowledge. Some sort of help is needed, and this is widely recognised. It is already clear and generally acknowledged that doctors and other health care professionals (nurses, midwives, health care managers etc.), will need a thorough working knowledge of the new technology in order to practise medicine effectively or to manage a hospital effectively. It is observed that health care professionals are increasingly confronted with computer systems. Since the professional will always be responsible for the consequences of the use of the results of medical information processing it is important that the students in medicine will be taught both the fundamentals of medical information processing and the essentials of existing applications. In medical education the most important skill for medical students to acquire is the ability to identify gaps in their knowledge and go about finding for themselves the answers to the problems they face.

So, it is obvious that students of medicine should study medical informatics. This basic knowledge of information management physicians should have as early as possible in their career. They should have this from the moment they decide to study medicine. So, the place of medical informatics in the undergraduate curriculum of students of medicine is of great importance.

However, teaching medical informatics is not so easy. There is actually no teaching material available which is specifically tailored to the needs and understanding of medical students, doctors and other health care professionals. Of course, there is a great number of available material which claims to teach information science and technology, but this is usually general and in most cases not oriented towards medicine. Most of the material available in this area is completely unintelligible to the average doctor or medical student. For these reasons, the suggestion arose that a special course should be organised. In fact, this is more difficult than it seems for several reasons.

First, there is no such thing as the average medical student in computing terms. Some students have never seen a computer, others can be classified as computer consultants. Some students appreciate quite easy the role and the importance of the computer technology and knowledge, others keep on wondering why should they obtain this knowledge since their aim is to become doctors or other health care professionals. So, one of the aims of the course in medical informatics must be to explain the need and the importance of medical informatics knowledge to the future medical professionals and at the same time to comply with the knowledge which the students already have or do not have.

There is a second and more important problem - that of providing the students with up to date material. The world of information technology moves with bewildering speed (even more so than the medical world). So, there is always the danger, that teaching material, a book or even a course itself will be out of date before it is published or presented to the students. So, another aim of the education in medical informatics must be to present always an up to date knowledge.

Another problem rises from the nature of the medical education. It is acknowledged that medical education today requires that students accumulate i.e. memorise a multitude of facts. Because of the explosive growth of biomedical knowledge more and more of this knowledge is crammed into the medical curriculum. Ever since students enrol to a medical university or other school for health care professionals, they are forced to learn as soon as possible how to memorise that multitude of facts and this somehow forces them to forget, or rather give up thinking, reasoning and making decisions. Of course, this is obvious. It is much easier for a person with a good memory to memorise the facts than spending some time on considering them. It is however impossible, and also undesirable for a student to learn everything that can be learned. On one side the knowledge presented to the medical students during their formal education will be more or less obsolete at the time they will practice medicine (the duration of this formal education is at least 6 years). On the other hand, it is difficult to teach medicine of the future, since most of the futures technology is probably non-existent today. Having in mind the above considerations as well as the fact that computer science is the last science that can be learned by memorising, trying to present it to memorising students is already a challenge. It is time to de-emphasise the memorisation of facts in favour of independent learning. So, another aim of the education in medical informatics must be to prepare the course and the teaching material in such a form and contents that it should be understandable and acceptable by the students and at the same time it must awaken their abilities to think. It should help the students develop skills that will enable them to learn throughout their professional lives.

The skills associated with information management are essential to facilitate the acquisition of fundamental knowledge, basic learning techniques, clinical skills and methods for the critical appraisal and effective use of research literature. The student has to be taught how to manage information so that he himself can acquire the necessary information when needed. The student should be required to seek information, rather than be given information. Since more and more information can be obtained via information systems the student should be taught how to manage this information systems. So, another aim of the education of medical informatics, which according to the author is the most important, is to facilitate the education process by providing the tools and methods of computer aided learning both for students and teachers. Of course, this requires that the educational tools, i.e. information systems, different computer applications, data bases, knowledge bases etc. should be available to all teachers and all departments. How this can be organised is not the subject of this paper.

3. Education in medical informatics for students of medicine

Here is one proposal for a general curriculum for teaching medical informatics to students of medicine in the Medical University in Varna. It may be divided in two modules.

Module 1 - general introduction (Introduction to informatics and basic computer skills)

Module 2 - methods and applications (Introduction to medical informatics)

3.1. Module 1 - Introduction to informatics and basic computer skills

This module covers the basics of informatics, the general knowledge, or basic computer skills. The aim of this module is to give the students the general knowledge of computers and computer applications, so that after going through this module they would freely use them. The general introduction should cover the following items :

- Classification of the applications: A classification of the different applications of computers, computer technology and information systems in medicine and health care is discussed. In this context the roles of man and computer in information management in the field of medicine and health care are explained. Also the correspondence with applications elsewhere in society is discussed.
- Systems and hardware: The logical and physical design of computer systems is discussed. The various types of computer systems and peripherals are presented. Also an overview of the different operating systems and computer languages are discussed. Attention is paid to basic computer skills covering operating systems, word-processing, spreadsheets, representative graphics, statistics, databases, networks, communication skills, bibliography and different commercially available software packages.
- System theory: A formal approach to the general system theory is presented including system design and life-cycle of a system. The role of the user in a software development process is discussed.
- Information theory: A formal approach to the general information theory is presented including aspects of information (syntactic, semantic and pragmatic).

3.2. Module 2 - Introduction to medical informatics

This module covers the basics, or general knowledge of medical informatics. Of course, as it is aimed to non-computer specialist it should apply with their capacity and abilities. The aim of this module is to increase the sophistication of the future health professionals, so that they know, understand and use in the best possible way the available resources. Students should gain general knowledge on medical information and medical data, how to organise this data so that it will be available and helpful when needed, how to assess the quality of clinical knowledge they are acquiring. This module is divided into two parts - (1) methods and (2) applications.

3.2.1. Methods

- Data documentation
- Data registration, documentation, transfer and communication Medical data and medical information are discussed in terms of types, utilisation, quality and communication. The process of data acquisition, collection, documentation, transfer and methods of storage of medical data in databases are described. Various types of data organisation are discussed. Aspects of structured data entry and natural language processing, recording of temporal patient data, electronic interchange of patient data, interaction between users and computers are presented. Various topics such as ownership, protection, security, confidentiality, accuracy, integrity, reliability and availability of data are discussed.
- Databases: Databases in health care are presented. Classification and coding systems are introduced. Attention is paid to data storage and retrieval, query languages, dictionaries and thesaurus, knowledge bases. It should be clarified that in all areas of society data base management systems with industry- standard query systems are used, including standards for the compact storage of data, signals and images. Health care is no exception in this respect. The main difference between

applications in health care and other areas in society is the wide variety of different patient data that are stored, from purely financial items to radiological pictures, and the large number of potential users of these data. The complexity of the application of the medical data bases coming from the semantic interconnection of these data and the wide variety of different goals that are to be served is explained.

- Computer-based patient records: The transition from paper based medical record to completely electronic patient record is discussed. Advantages and disadvantages of CPR are pointed. The basic principles, structure, and models of computer based patient records are presented.
- Signal and image processing: A description of signals and images in medicine is given. The process of analogue to digital conversion is discussed. The process of signal and image analysis, pattern recognition, classification and interpretation of bio-signals and medical images is explained.
- Decision support: Decision support systems in medicine and health care as computer programs designed to help health professionals make clinical decisions or systems for information management, for bibliographic retrieval and for using patient-specific data are explained. Phases in the diagnostic/therapeutic process (observation, diagnosis, therapy) are explained. Attention is paid to decision support methods : deterministic, statistic and heuristic. The role of decision support systems in relation to patient management, diagnostics, therapy choices, prognosis etc. and the evaluation of these systems are discussed. The processing of data, leading to information, with the help of available knowledge is explained. It is also pointed that in health care many decision problems deal with real patients and that is why they are unique and sometimes highly individual. Therefore one can never achieve full automation of the decision making and should use techniques with built-in man-machine interaction. The questions of formalization of medical knowledge, using of reference standards (knowledge of multiple experts), integration of computer- based patient records with decision support systems, evaluation of decision support systems are discussed.
- Information systems: The basic functions, aims and architecture of information systems in medicine and health care are discussed. Attention is paid to the problem of defining the requirements and the choice of an appropriate information system. Some basic problems concerning access and security of medical data are explained. General legal issues are explained.

3.2.2. Applications

The applications are closely related to the methods and cover the topics described above. They provide for the visualisation (demo versions) or practical experience (whenever possible) with the available software. They can be divided into three main branches :

- Data. The students get acquainted with various types of medical data, systems for standardisation and classification of medical data (e.g. UMLS diagnostic codes, SNOMED, ICD-10, ICPC etc.), different types and structure of computer-based patient record, and databases in medicine and health care.
- Information systems. Information systems in use in hospitals, in departments or clinics etc. or systems in use by personal physicians (general practitioners). The students get acquainted with hospital information systems, computer systems in different clinics, clinical laboratory, pharmacy, nursing applications, clinical/epidemiology research systems as well as computer systems for biosignals -EEG, ECG and medical images - computer tomography, magnetic resonance imaging, digital subtraction angiography, picture archiving and communication systems etc.
- Decision support. The students get acquainted with the main parts of a decision support systems - knowledge base, where the medical knowledge for a domain is stored, a patient database, where clinical data are stored and an interface engine, which is a computer program that uses medical knowledge and patient data in the problem solving process. They get acquainted also with some tools and techniques used in building medical decision support such as (a) clinical protocols, (b) statistical database analysis, (c) mathematical models, (d) pattern recognition, (e) probability calculations, (f) decision theory, (g) symbolic reasoning.

Medical University Varna,
Dept.Public Health and Biostatistics,
55 Marin Drinov str., 9002 Varna, Bulgaria
E-mail: somed(at)mbox.digsys.bg

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Table ronde "logiciels"

Discussion session: software

1Yves MAILLAUX, 2Gérard TUDO, 3Roland WIEST

Depuis 1993, fonctionne auprès du Ministère un organe de négociation avec les éditeurs de logiciels : le " Groupe Logiciels ", coordonné par le Bureau DGRTA.2 du MENESR, et comprenant les représentants de 15 Centres Universitaires de Ressources Informatiques (12 en province et 3 en Ile-de-France) et des représentants des Organismes de recherche dépendant du MENESR.

Quels objectifs pour nos Etablissements ? un double but :

- des tarifs attrayants pour l'Enseignement Supérieur et la Recherche
- des tarifs identiques pour tous, et indépendants du volume d'achat

Pourquoi l'éditeur consentirait-il des prix notablement remisés ?

- l'Université est une vitrine pour ses produits.
- l'Université forme des utilisateurs susceptibles d'introduire le logiciel dans leur future entreprise.
- Les CRI prennent en charge une partie de la logistique (cf infra)
- Quelles conditions de mise en oeuvre, pour décider les éditeurs?
- les circuits de distribution sont hautement allégés : soit les CRI, soit un nombre très limité de distributeurs ; un rapport trimestriel de consommation remplaçant parfois la facturation unitaire.
- la " dématérialisation " des logiciels gérée par les CRI, ou éventuellement un distributeur (vente de licence supplémentaire, les docs et les supports ayant été acquis précédemment) ouvre à l'éditeur un marché supplémentaire à peu de frais.
- Les CRI relayent notablement l'information (promotion indirecte du logiciel)
- Les CRI organisent des Journées d'information ou des séminaires techniques à la demande de l'éditeur.

Quelles sont les principales difficultés rencontrées ?

- Les réticences de l'éditeur, devant notre refus de procéder (en général) par commande groupée (assortie d'un tarif dégressif en fonction du volume de la commande).
- Les réticences de l'éditeur, devant notre refus d'engagement sur un volume total annuel ; nous proposons ce volume comme un pari ou un objectif, mais refusons d'en faire une clause entraînant une éventuelle pénalité ; tout au plus, un écart important peut-il induire une révision des prix pour l'année suivante.
- Les éditeurs étrangers (US, en particulier) ont parfois un distributeur exclusif ; il n'y a plus de réelle concurrence, et par conséquent des prix peu remisés.

Que peut nous apporter EUNIS ?

- Connaître et faire connaître les actions analogues menées en Europe?
- Pourrait-on. au sein d'EUNIS, créer un " Observatoire " des prix?
- En vertu des règles européennes, pourrait-on imaginer que pour les produits US des importateurs de plusieurs pays puissent être mis en concurrence?

[1]MENESR/DGRT, rue Descartes, 75005 Paris, France
E-mail: bmi@dgrt.mesr.fr
[2]Université Pierre et Marie CURIE - Paris VI, Centre de Calcul Recherche et Réseau, case 171, 75252 Paris Cedex 05, france
E-mail: Gerard.Tudo(at)ccr.jussieu.fr
[3]C.U.R.R.I., Université Louis Pasteur , 7 rue Descartes, 67084 Strasbourg, France
E-mail: Roland.Wiest(at)crc.u-strasbg.fr

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Table ronde "logiciels"

Discussion session: software

[1]Gordon Young

The purchase and control of software licences for the growing number of PCs in use both within the University and by students at home has become an ever increasing burden for Computer Centres. The speaker hopes to stimulate discussion of the following points:

- The dominance of Microsoft and is there really any alternative?
- The problems of control and compliance with licence conditions in an academic environment.
- The effect that increased student ownership will have on software purchasing policies
- Is there a need for any European wide action?
-

[1]Limerick University, Plassey Technological Park, Limerick Ireland.
E-mail: gordon.youngg(at)ul.ie fax: +353 (61) 335144

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Administrer un réseau pédagogique sans informaticien : l'expérience "Altaïr

Management of a teaching network without computer specialist: the "Altar" experience

[1]Jean-Michel ADAM, [2]Georges COQUELLE

Introduction

Dans le cadre des plans de rénovation et de construction des établissements scolaires, les collectivités territoriales donnent aux établissements les moyens de se câbler. Ainsi, tous les lieux de travail de l'établissement sont reliés entre eux par des voies de communication. parallèlement, les établissements se dotent d'une connexion à Internet, ce qui, à terme, doit permettre à tous les usagers du réseau d'accéder à ces nouvelles ressources. Les enseignants et les étudiants peuvent alors disposer à tout moment de l'outil informatique. Les pratiques pédagogiques s'en trouvent modifiées, l'ordinateur et le réseau deviennent des outils complémentaires, intégrés par les enseignants dans leurs activités pédagogiques.

Pour réussir cette intégration, les barrières techniques liées aux difficultés d'usage du réseau doivent être brisées. Les usagers doivent pouvoir accéder facilement aux ressources mises à leur disposition ainsi qu'à leurs documents personnels. Souvent, ils n'ont aucune pratique des réseaux, et n'ont qu'une très faible expérience dans l'usage de l'outil informatique. Les systèmes d'exploitation actuels ne fournissent pas de moyens simples pour l'accès à ces ressources. D'autre part, les réseaux pédagogiques ont des caractéristiques particulières qui rendent complexe leur administration. Les établissements d'enseignement ne disposent pas du personnel qualifié pour assurer la gestion d'un tel réseau, le risque d'échec est important.

Notre travail a consisté à étudier ces problèmes et à proposer des méthodes des outils qui permettent à des usagers non informaticiens d'exploiter les ressources pédagogiques mises à leur disposition, aussi facilement que possible.

Après avoir exposé les problèmes posés par l'usage d'un réseau d'établissement, nous décrivons les solutions que nous avons conçues pour permettre l'administration du réseau par des utilisateurs non spécialistes. Nous terminons en décrivant les expérimentations menées actuellement dans plus de 60 établissements de l'Académie de Grenoble.

1.Les problèmes d'exploitation du réseau d'établissement

1.1 Caractéristiques du réseau d'établissement

Les caractéristiques d'un tel réseau diffèrent sensiblement de celles des réseaux locaux des entreprises [1] :

- le nombre des usagers identifiés est important : de 400 à 2000 utilisateurs, en fonction de l'importance de l'établissement ;
- les usagers sont des " nomades " : les étudiants et parfois aussi les enseignants changent de salle de travail plusieurs fois par jour ; ils ne retrouvent donc jamais le même poste de travail d'une séance à l'autre. Les micro-ordinateurs doivent être banalisés : chaque usager doit pouvoir manipuler ses documents personnels depuis n'importe quelle station. Un espace de travail personnel doit donc être mis à la disposition de chaque utilisateur ;
- les groupes d'usagers sont nombreux : aux groupes institutionnels (classes d'élèves) s'ajoutent les groupes de travaux dirigés, les groupes de langues, les sous-groupes de travail, etc. ; un enseignant doit pouvoir construire ses propres groupes et éventuellement restreindre ou étendre les droits d'accès aux ressources partagées pour les membres de ses groupes ;
- le nombre des logiciels mis à la disposition des usagers est important : de 80 à 300 logiciels, mais ces logiciels ne sont pas utilisés par tous les étudiants ;
- la gestion des périphériques est complexe : certaines imprimantes sont attachées à une salle de travail particulière, et ne doivent pas être sélectionnées de n'importe quel point du réseau, d'autres ne doivent être disponibles que pour la sortie de travaux particuliers. De plus, en cas de panne ou de manœuvre erronée, une file d'impression doit pouvoir être vidée, et un usager habilité à le faire doit pouvoir mettre un périphérique de remplacement à la disposition des usagers bloqués.

1.2 Problèmes liés aux systèmes de d'administration du réseau local

Les outils d'administration de réseau fournis par les constructeurs [4] [5] sont des logiciels interactifs qui permettent de gérer les droits, les usagers, les groupes et les ressources partagées. Ces logiciels sont destinés à des informaticiens qui ont été formés à l'administration de réseaux. Une manipulation erronée peut facilement engendrer des dysfonctionnements du réseau. En outre, certaines tâches d'administration sont fastidieuses ou complexes à réaliser :

- l'installation du réseau en phase initiale avec la création de nombreux usagers et de leurs espaces de travail doit pouvoir se faire de manière automatisée ;
- l'ajout ou la suppression d'utilisateurs, la modification des attributs d'un utilisateur, sont des opérations complexes nécessitant parfois plusieurs manipulations, dans un ordre précis ;

- la gestion des droits ne peut être assurée que par un usager disposant des droits d'administration et ayant été formé à la gestion des droits;
- le partage des périphériques n'est pas satisfaisant : un périphérique partagé est accessible par les utilisateurs depuis n'importe quel poste, ce qui n'est pas souhaitable dans un établissement (cf. [[section]]1.1).

1.3 Problèmes liés aux postes de travail

- Le parc des machines est hétérogène : les établissements sont équipés d'un parc de micro-ordinateurs de type PC, acquis à des époques différentes. Aussi, la configuration matérielle (processeur, taille mémoire, équipement multimédia, disque dur) et le système d'exploitation varient suivant les machines. Les postes étant banalisés, des difficultés d'usage supplémentaires apparaissent.
- L'accès aux ressources du réseau pose des problèmes : quelque soit le système d'exploitation utilisé, les procédures d'accès aux ressources partagées ne sont pas évidentes pour un utilisateur non spécialiste, de plus ces procédures changent en fonction du système.
- L'usage de périphériques partagés différents est source d'erreurs : si les imprimantes partagées ne sont pas les mêmes, des pilotes différents doivent être utilisés ; la sélection d'une imprimante partagée n'entraîne pas l'installation du pilote correspondant, une opération supplémentaire doit être faite par l'utilisateur.
- Tous les logiciels de s'exécutent pas sur tous les postes : certaines logiciels partagés sont des applications " 32 bits " qui ne sont pas exécutables sur les machines équipées de Windows 3.1x, certaines applications DOS ne s'exécutent pas sur les systèmes 32 bits.
- L'accès aux logiciels partagés est difficile, étant donné le nombre important de logiciels gérés.

1.4 Problèmes liés aux logiciels d'application utilisés

Aux problèmes énoncés ci-dessus s'ajoutent ceux liés aux applications pédagogiques utilisées.

- Ces logiciels n'ont pas été conçus pour être utilisés sur un même poste par des usagers différents, même lorsqu'il s'agit de versions “réseau”.
- L'exécution de certains logiciels nécessite une configuration matérielle minimale (taille mémoire, carte son, CD-ROM, système d'exploitation) ; le lancement d'un tel logiciel depuis un poste non conforme peut engendrer un blocage de la machine.
- Certains logiciels sont installés sur le poste de travail (logiciels mono-poste), alors que d'autres sont installés sur un serveur (logiciels en version réseau), le lieu d'implantation doit être transparent pour l'utilisateur.
- Tous les logiciels ne doivent pas être mis à la disposition de tous les utilisateurs : certains logiciels partagés concernent des publics particuliers ; ils doivent être occultés aux usagers non concernés.

2. Solution proposée : l'environnement Altaïr

Toutes les difficultés décrites ci-dessus nous ont amenés à concevoir l'environnement Altaïr pour faciliter l'usage du réseau et résoudre au mieux les problèmes posés, sans pour autant imposer à l'utilisateur d'acquérir les connaissances techniques habituellement nécessaires.

L'environnement Altaïr est composé de trois outils :

- un outil d'installation du réseau pédagogique,
- une interface facilitant l'usage du réseau et réalisant certaines fonctions d'administration,
- un outil pour la gestion courante du réseau.

2.1. Un outil d'installation entièrement automatisé

Pour faciliter l'administration des réseaux, nous proposons une organisation standard des serveurs de tous les établissements. Cette organisation comprend :

- une base de données représentant toutes les entités gérées par le réseau : utilisateurs, groupes institutionnels (classes), groupes définis par les utilisateurs, droits des utilisateurs, logiciels, imprimantes, stations ; afin d'optimiser les accès aux serveurs, la base de données est répartie entre un serveur et les postes clients ;
- des hiérarchies de répertoires représentant les espaces de travail des utilisateurs référencés, et auxquels sont associés les droits d'accès adéquats ;
- un espace réservé à la communication et aux interactions entre les usagers ;
- un espace système hébergeant la base de données et les profils des utilisateurs.

Un outil d'installation initiale met en place toute cette organisation. Il a été conçu pour une installation sur plusieurs serveurs. Il réalise la création automatique de tous les usagers, à partir du fichier des élèves et des professeurs de l'établissement (GEP) ; ce fichier existe sous le même format dans tous les établissements français de l'enseignement secondaire. Les classes d'élèves peuvent être réparties entre plusieurs serveurs, de même que les logiciels.

L'application crée également les espaces de travail personnels, les boîtes aux lettres, les zones d'installation des logiciels, les droits associés aux répertoires créés, les groupes institutionnels, la base données Altaïr.

2.2. Une interface utilisateur intégrant des fonctions d'administration

L'interface Altaïr, a été conçue pour répondre aux difficultés d'usage du réseau exposées ci-dessus. La description de l'interface et de ses fonctions a déjà fait l'objet de présentations [2] [3]. Nous n'exposons ici que les fonctions qui libèrent les usagers des problèmes techniques et celles, destinées aux enseignants, qui relèvent de l'administration du réseau.

- Accès simplifié aux logiciels : l'usager lance un logiciel par simple sélection dans une liste, sans avoir à connaître le son d'implantation ; les seuls logiciels exécutables sur la station sont présentés à l'utilisateur. Si celui-ci n'est pas connecté au réseau, il ne voit que les logiciels installés localement sur la station. Les paramètres d'utilisation des logiciels sont conservés et restaurés à la prochaine utilisation du logiciel.
- Accès simplifié aux périphériques partagés : l'utilisateur sélectionne un périphérique parmi ceux qu'il est autorisé à utiliser depuis son poste de travail. Le pilote de l'imprimante sélectionnée est automatiquement mis en place. A l'installation du réseau, seul un petit sous-ensemble des périphériques est attaché à chaque poste de travail ; les autres ne sont pas accessibles, ce qui évite les impressions parasites vers les autres salles de l'établissement.
- Contrôle des imprimantes : l'enseignant a la possibilité de vider une file d'impression, ce qui permet d'annuler l'impression d'un document volumineux ou erroné par exemple ; il peut également mettre temporairement un autre périphérique à la disposition des usagers qu'il désigne : ceux-ci disposent alors de l'imprimante pour la session de travail en cours.
- Gestion de groupes personnels : l'enseignant peut gérer ses propres groupes d'usagers ; cette fonction lui est indispensable, notamment si ses élèves dépendent de différentes classes de l'établissement, comme c'est souvent le cas pour les classes de langue. Les groupes sont disponibles pour toutes les opérations qui nécessitent de spécifier des usagers : définition des droits, partage de périphériques, communication).
- Gestion des droits des autres usagers : l'enseignant peut agir sur les activités de ses élèves ; il a la possibilité d'interdire ou d'autoriser l'utilisation de certains logiciels ou des opérations de communication ; cette fonction est utile notamment pendant un examen.

L'interdiction est valable tant qu'elle n'a pas été levée par l'enseignant ou par un autre enseignant. Nous avons pris le parti de ne pas créer de hiérarchie de privilèges entre les enseignants pour ne pas compliquer les concepts proposés. Tout enseignant peut défaire les interdictions posées par un autre enseignant ; dans ce cas, un message indiquant la levée de l'interdiction est automatiquement envoyé à l'enseignant qui l'avait posée. Cette fonction d'envoi automatique de message est couramment utilisée dans les systèmes de gestion de processus logiciel [6] [7].

2.3. Un outil de gestion courante du réseau

Les opérations les plus courantes d'administration du réseau d'établissement ont été bien identifiées. Nous avons développé un outil qui permette à un utilisateur non informaticien d'effectuer simplement ces tâche courantes. Elles consistent à renseigner la base de données Altaïr et à modifier le réseau en conséquence. Ces opérations sont les suivantes :

- gestion des utilisateurs : ajout ou suppression d'un utilisateur, et mise à jour de l'ensemble des structures en conséquence ; modification des informations concernant un utilisateur ; modification du mot de passe d'un utilisateur.
- gestion des classes d'utilisateurs : consultation et mise à jour de la liste des membres d'une classe ; les enseignants sont déclarés dans une classe d'utilisateurs privilégiés disposant de fonctions d'administration (cf. [[section]] 2.2).
- Installation ou suppression d'un logiciel : mise à jour de la base de données décrivant les logiciels installés ; l'installation d'un nouveau logiciel consiste à effectuer la procédure d'installation préconisée par l'éditeur du logiciel, puis à renseigner la base de données Altaïr (voir figure 1).
- installation ou suppression d'une imprimante : chaque imprimante présente sur le réseau est décrite dans la base de données ; le logiciel permet d'indiquer au système les imprimantes attachées par défaut au poste de travail.
- édition de listes : possibilité d'imprimer tous les objets et toutes les relations le base de données Altaïr.

Cet outil n'est pas mis à la disposition de tous les enseignants. La gestion courante du réseau est confiée à un animateur local, qui est un enseignant volontaire.

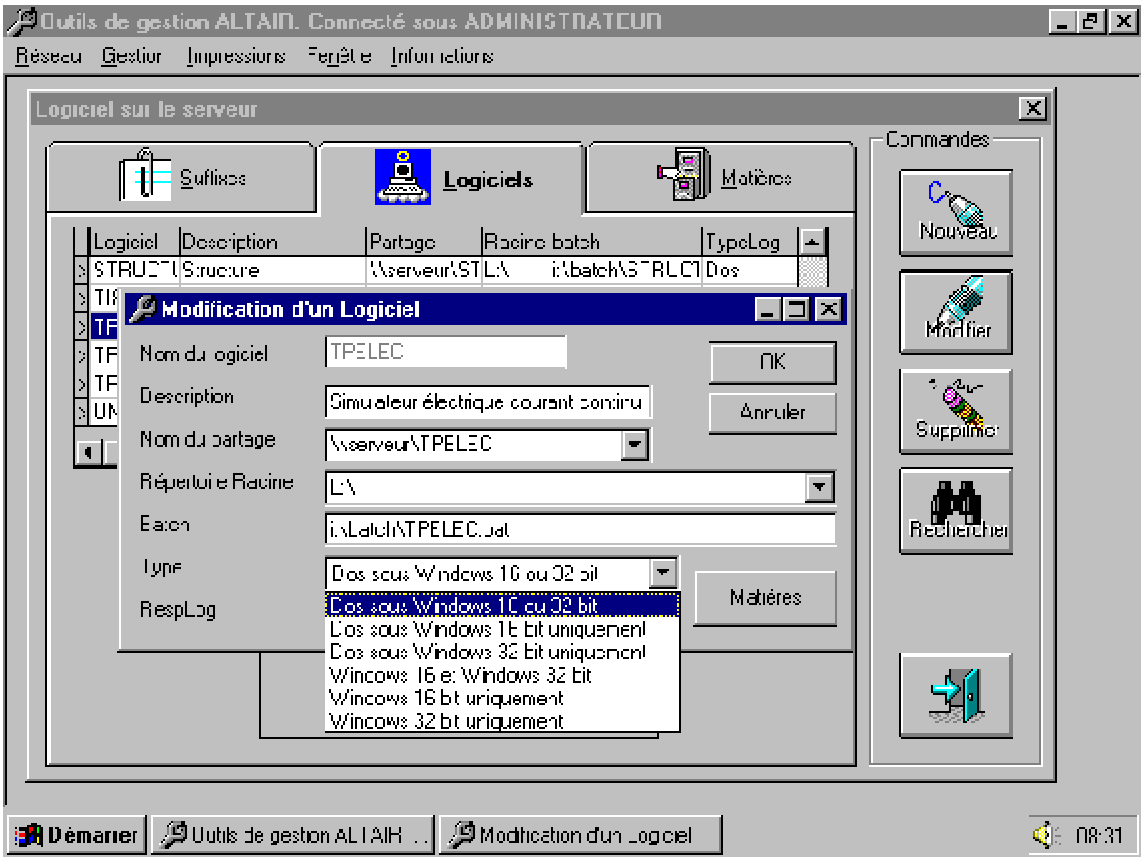

Figure 1 : Gestion courante du réseau : ajout d'un logiciel

3. Expérimentation et industrialisation

Une première version de l'interface et de l'outil d'installation, opérationnelle sur les réseaux Lan Manager puis WindowsNT-Serveur, a été réalisée en 1994. Depuis, des expérimentations ont été menées dans une cinquantaine d'établissements de l'Académie de Grenoble.

Elles font apparaître qu'Altaïr permet à l'usager de mieux se centrer sur ses activités. La fiabilité du réseau dissipe les inquiétudes des enseignants face à cette nouvelle technologie. Deux demi-journées de formation suffisent à la prise en main de l'interface par les usagers. La fonction d'animation et d'assistance locale est nécessaire pour assurer la gestion courante du réseau, mais la qualification d'administrateur de haut niveau devient inutile. L'animateur analyse les anomalies, identifie les opérations exceptionnelles à effectuer et, si nécessaire, fait appel au Centre Académique de Ressources qui offre un support technique aux établissements pour résoudre les problèmes complexes.

Ce dispositif a fait ses preuves : environ 70 sites sont installés actuellement, ce qui correspond à un potentiel d'environ 25000 utilisateurs.

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Université Pierre Mendès France,
Centre Académique de Ressources,
Laboratoire CLIPS - IMAG Grenoble, France
E-mail: Jean-Michel.Adam(at)imag.fr
Lycée Marie Curie - Echirolles, France
E-mail: coquelle(at)ac-grenoble.fr

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Information Infrastructure of the Poznan Science Society

Artur Binczewski, Cezary Mazurek, Norbert Meyer,

Jaroslaw Nabrzyski, Slawomir Niwiñski, Maciej Stroiñski

1. Introduction

The Poznan Supercomputing and Networking Center (PSNC) was brought to life in November 1993 by an initiative of the Committee for Scientific Research (CSR). This initiative was part of CSR's contributions to coordinate the development of the computer science infrastructure in Poland. The Center acts as both the POZnan Metropolitan Area Network (POZMAN)operator and as a high performance computing provider. Besides its day to day activities PSNC is also a significant research center. It concentrates all the scientific research in the city of Poznan.

In this paper we briefly describe both the POZMAN network and the computing resources of PSNC. The services of PSNC and its research activities will also be described.

2. High performance networking in PSNC

PSNC is the operator of the POZMAN network. The POZMAN network is based on its own cable structure and uses two technologies: ATM and FDDI.

PSNC currently owns, within the POZMAN network, a fibre optic cable infrastructure of a total length of 129 km and it leases an additional 47 km from other Poznan institutions. The backbone network was built with monomode (SM) fibre optic wire, however, the access network was built with mixed wires: monomode and multimode (MM). This infrastructure connects all of the scientific institutions in Poznan and 11 Town Offices. The backbone of the FDDI network consists of 21 3COM NetBuilder II routers. In parallel to the FDDI network there are 4 ATM nodes. The ATM network consists of 2 Fore ASX-200BX switches with 2 PowerHub 6000 access switches and 2 3COM CELLplex 7000 switches with 5 LinkSwitch 2700 access switches and 1 Lanplex 2500 access switch. The connection between switches and NetBuilder II routers is of type OC-3 and is based on SM and MM fibre optic cables. Within this network some virtual networks based on the LANE 1.0 standard have been set up: network for city administration and network for connecting the scientific community. Users are connected to the POZMAN network using the following interfaces: ATM (12 ports), FDDI (16 ports), Ethernet (213 ports), synchronous interfaces with a maximum speed of 2 Mb/s (10 ports) and asynchronous interfaces with maximum speed of 33.6 kb/s (48 ports). Currently there are more than 4000 computers connected to the network according to a DNS statistic. POZMAN is connected to the following national operators: NASK, POLPAK-T, TEL-ENERGO and KOLPAK.

The center for managing the network is equipment with 2 management platforms: SunNet Manager on the SUN IPX workstation and NetView 6000 on the IBM RISC/6000 390 workstation. On these platforms the following applications for managing the network devices were installed: Transcend Enterprise Manager for Unix, for 3COM equipment; ForeView for Fore System equipment and one of our own which supports network operators.

Each node of the POZMAN network is equipped with UPS 2000VA from APC with a SNMP based protocol for remote control and a humidity and temperature module. PSNC maintains 24 hour supervision over the functioning of the network and computing resources. Technical team dispose of protocol analyzer type K1102 from Siemens, optical reflectometer type MW9070A and optical powermeter type ML9002A from Anritsu and an automatic fusion slicer type FSU 925RTC from Ericsson.

Further development of the POZMAN network will eventually change to ATM technology. The planned backbone structure of the POZMAN network will be built with ATM switches connecting OC-12 interfaces working with data transfer 622 Mb/s in 1997-98. NetBuilder II routers with FDDI interfaces will be moved to campus networks and ATM switches will be installed in their place.

At the same time PSNC is designing a new kind of access to its resources via cable television (HFC structured CATV), additionally, PSNC conducts research and development programs like: implementation of the environment control applications (remote control and graphical viewing of UPS, air conditioning and security systems) and trap management systems as well as an application which enables the viewing of the FDDI ring. PSNC is also a beta test site for 3COM equipment. PSNC is the organiser of the largest conference on networking (Metropolitan Area Network in Science, Industry and Government - POLMAN) in Poland . During this conference there was an exhibition of network products which were being used to maintain the conference. This year the network illustrated the usage of the virtual net concept in a heterogeneous environment. Also at this conference PSNC presented the pilot ATM 34 Mb/s network which was built in SDH 622 Mb/s communication environment of TEL-ENERGO operators. The network connected 4 cities: Warsaw, Poznan, Lodz and Katowice.

3. High performance computing in PSNC

The scientific environment of Poznan requires a large amount of computations. The activities of some scientific areas such as chemistry, physics, mathematics, biotechnology, computer science and engineering require computational services.

Some examples of the research conducted by the above mentioned include:

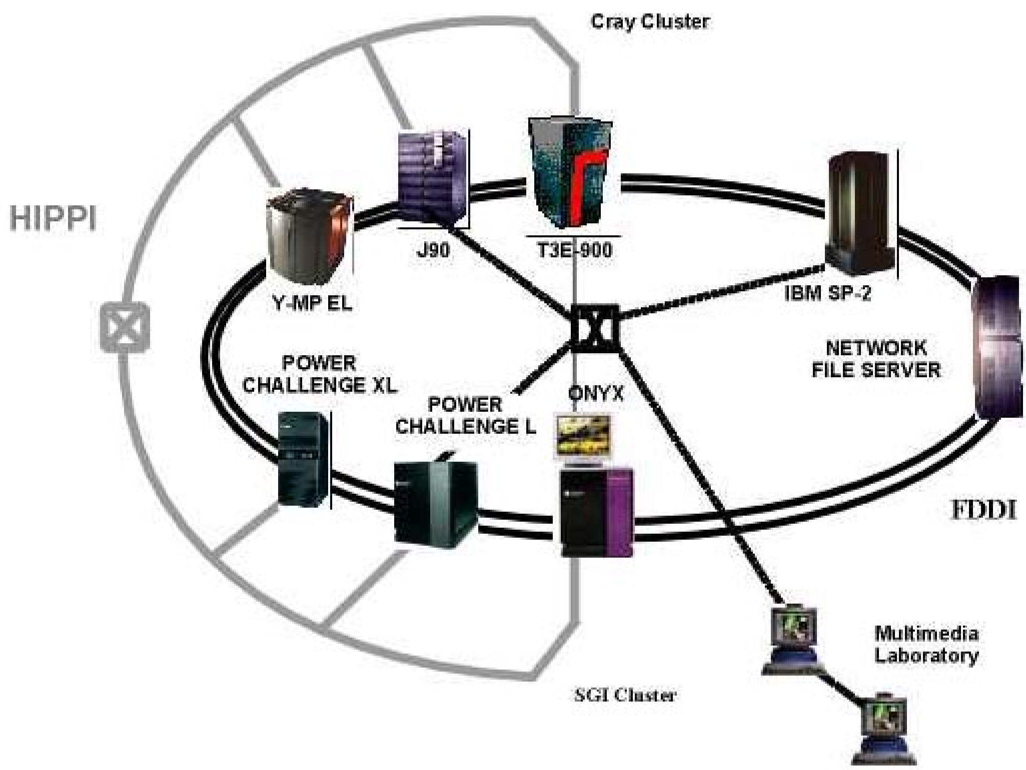
- Optimization and artificial intelligence in science, technology and medicine,
- Sequential and pararallel algorithms for DNA sequencing,
- The genetic backgrounds of laying hen performance traits,
- The theoretical studies of structure, energetics and thermodynamic properties of molecules and anions containing heavy elements,
- Computer simulations of selected models of condensed matter systems,
- Ab initio calculations of small molecules,<
- Statics and dynamics of shell structures.

Our Center also gives access to its computational resources to other scientific communities in Poland. The current number of all users on all systems is 1500 and is increasing. To fulfill the requirements of such different groups of users, PSNC has installed a whole range of computer architectures :

- Scalar
- SGI Power Challenge with 12 R8000 processors and 1 GB of RAM,
- SGI Power Challenge with 4 R10000 processors and 256 MB of RAM,
- Parallel vector
- Cray J90 with 16 processors and 4 GB of RAM,
- Cray Y-MP EL with 4 processors and 512 MB of RAM,
- Distributed memory system
- IBM SP-2 with 1 wide (128 MB) and 14 thin nodes (64 MB).

It is being installed as a massive parallel processing system: Cray T3E-900. This gives our users a new kind of architecture, with 6 processor elements and 6*128 MB of RAM.

The average performance of all of the computer systems (installed at PSNC) is about 18 GFlops. Keeping in mind the requirements of our users and the high efficiency of computer systems, the computers were connected with fast networks : FDDI, ATM, HIPPI.



The FDDI resource ring is used mainly by users to access computers. The ATM network is used for graphics and multimedia applications and the HIPPI network allows an increase in the performance of process-process communications in a distributed environment as well as connecting computer systems into clusters.

The network server (AUSPEX NS 7000/500) fills an important role: The archive system (tape and optical disk archives with a capacity up to 2 TB) and a multimedia laboratory (SGI Onyx, 5 SGI Indigo-2, 3 SGI Indy workstations). The multimedia laboratory allows the results of computations to be seen and animated as well as organizes some tutorials and training sessions for users who then present the knowledge obtained on the WWW as a kind of self-learning tool.

PSNC meets the requirements of users by offering a wide range of software :

- system software
- facilitating the managing and tuning of operating systems,
- allowing to perform tasks in a batch environment (NQS, LSF, Load Leveler),
- programming tools
- programming languages (Fortran 77, Fortran 90, HPF, C, C++, Pascal),
- programming support (debuggers, preprocessors and packages which allows the user to optimize and to parallel written source code),
- libraries of math, scientific, graphic and distributed programming,
- specialized applications for data visualization (AVS, Open Inventor), chemistry and molecular physics (Gaussian 94, BIOSYM, SYBYL, GAMESS, AMBER),
- engineering (NASTRAN, ABAQUS),
- mathematics (MAPLE, MATLAB, SAS, NAG Library, NAG Graphics).

The above described complex environment needs some software tools that will enable a user to access it in the simplest manner and use it with the highest efficiency and performance. Thus, we have started our way to the metacomputing idea. The realization of this idea is one of the main research objectives in PSNC. It requires extensive research to be conducted in the fields of algorithms and tools which will enable the computation in a heterogeneous metacomputing environment.

Our first step in this direction is to unify the access to different metacomputer resources. We propose using Web technology to achieve this goal. This proposal comes from the belief that the explosive turnover in Web languages and protocols has begun to cool down. Today HTML, Java and VRML have now emerged as relatively stable basis for long term planning and development. It seems obvious that, if we are to build, maintain and use such a complex high performance metacomputing (HPM) environment effectively, the Web must be incorporated into it. Our primary challenge is to retarget World Wide Web-computing models to meet the performance and reliability requirements of the (HPM) environment and applications.

We therefore propose that our metacomputer is a collaboratory, multi-user, multi-server, problem solving environment on the local (or wide) area network. This would be based on the existing HPM technologies for local computational backends and the evolving Web technologies for user interfaces, system-wide coordination within the local, national and even world-wide basis. Thus, in our view the metacomputer is a set of specialized Web servers. We link these servers together using generalized Web technologies to allow executable program components to be published as services, and so create a distributed problem solving environment.

The system architecture is built in three layers. The first layer defines computation and communication primitives, initially based on existing Web standards (HTML, CGI, Java) to provide a publication model of computation. It is nothing more than an extension of a computing environment for heterogeneous and distributed high performance computing extended by Web technology.

As the system grows, rather than building problem solving environments on top of the software, the second layer will add more advanced client paradigms to this basis. In this layer, advanced client codes, called agents, may take on server functionality thus becoming autonomous participants in the computing. Increases in client-code mobility and flexibility will also require the addition of "brokers" to mediate the interchange of different data formats between participants in a computing process. This interpolating environment will be a collection of agent based programs to implement interoperability. This layer is still under construction and covers a large part of our research activities.

The third layer serves for running the applications and writing parallel, distributed programs by users. It provides a set of programming tools (i.e. tools for programming with MPI) and environments for computing specific problems. These domain-specific environments range from computational chemistry, biology and other applications to complex ones including weather forecasting, image processing etc.

4. PSNC services

The advanced networking infrastructure increases the user's requirements regarding network services. Therefore, together with familiar, easy to implement Internet services and some information systems based on the WWW interface, more research is being conducted at PSNC regarding telematic services which is aimed at widening the range of services provided with a new generation of applications.

The standard Internet services provided by POZMAN are: WWW, DNS, News, Anonymous FTP, X.500 and e-mail. The WWW server in the POZMAN network has been operating since 1995; providing information about resources and services which also includes a mirror of the Windows Network Application Index. The extended anonymous ftp server provides system and application software either as a local resource on the network server or as a mirror of the most interesting servers in the world. Thanks to this, the quality of the user's access to these types of resources is enhanced as well as there being a decreased load of national and international connections. PSNC also performs the regional coordination of the X.500 service, which provides data on scientists from the Poznan scientific community.

Special attention is given to allow users to have interactive access to bibliographic databases installed at PSNC. The databases installed are: Current Contents (all 6 series), Science Citation Index and the Arts & Humanities Index. The Metropolitan Area Network is also an integrated platform for the Poznan Scientific Libraries Foundation established by 12 Poznan universities and academies with financial support from the Mellon Foundation.

Included in the group of information services developed at PSNC is the Multimedia City Guide (MCG). It is accessible in the

Internet within WWW services. The basic goal of MCG is to collect all information regarding the city of Poznan and to store it in one electronic publication guide which broadcasts it in a natural, multimedia form: when a new film is released, you see a clip from this film; when a musical concert is announced, there are audio fragments of some of the music, etc. MCG has an open structure, designed in such a way that each new piece of information is matched to its existing section. Therefore, in the MCG there is a place for information regarding business, culture, science and education, health and social care, tourism, administration, communication, etc. To help citizens to get the most from their city, PSNC is in close cooperation with the City Administration. Thanks to this the content of the MCG is filled with information provided by different branches of the city: newspaper and magazine press editors, statistic offices, communication, administration as well as museums, theaters, cinemas and entertainment institutions. Additionally, part of the information presented by the service is held in databases. Information stored there is used for the dynamic generation of WWW pages which asks the user to answer questions thereby creating a page in real time. This kind of service is based on automatic data updating created by an information provider, also remotely via the network. Services provided in this way include the city communication guide and the weather forecast for the region and the country.

In the multimedia laboratory there are some projects being developing related to the preparation of broadband services which will provide users with new telematic applications, interactive work, videoconferencing, cooperation within the network, entertainment, etc. The project is being developed in close association with the local CATV operator.

5. Summary

The Poznan Supercomputing and Networking Center plays a significant role in the Polish science information infrastructure. Still, the growing needs of the Poznan academic society are always fulfilled by the increasing computational power of the metacomputer together with the high throughput and low latency of both local and metropolitan area networks. PSNC, as always, is hungry for new technology and solutions. This guarantees that all users can conduct scientific research on a world-wide level.

Poznan Supercomputing and Networking Centeri,
Wieniawskiego 17/19, 61-704
Poznan, Poland
URL: http://www.man.poznan.pl
E-mail: naber(at)rose.man.poznan.pl

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Applying Risk Analysis Methods to University Systems

W R Chisnall

Introduction.

The words "Risk Analysis" are used today in several different contexts. In safety critical situations such as the design and operation of nuclear power plants or oil and gas rigs, risk analysis is part of the process of making the chance of a disaster as small as possible. The same thinking applies to the design of aircraft blind landing systems and modern "fly-by-wire" avionics. In these cases the consequences of an accident are so horrendous, and therefore costly, that the chance of one happening must be made almost vanishingly small. The problem is to build a system where components are replicated and human actions are checked so that overall the system will meet its reliability targets.

If, on the other hand, you are a manager on a civil engineering or software development project you will want to know how the actual cost and time to completion of your project might differ from the nominal values. Large projects are composed of hundreds or even thousands of individual jobs, each of which will have had a separate estimate made of its likely duration and cost. But as the work proceeds these individual jobs will each take more or less time and cost more or less than was originally estimated. And the separate jobs are not all independent; some cannot be started until certain others have been completed. And if other constraints such as limited access to scarce resources are taken into account it is easy to understand how project slippages can easily get out of hand. In these circumstances every project manager wants to understand how sensitive his project is to the accuracy of the original estimates and how much freedom of action he will have if things start to go wrong.

Risk analysis in the computer security context is different again. It is accepted that, in a computer system, both equipment and staff may fail, often in ways that are difficult to predict. There may be natural disasters and there may also be deliberate attacks against the system. Countermeasures are, of course, available and the most common ones are found in most installations. But very few installations are set up to safety critical standards to ensure uninterruptable working or to be totally impregnable against hacking or denial of service attacks. Instead they tend to focus on being reasonably resistant to attacks and able to restore normal working as soon as possible after an incident. The issue, of course, is one of cost. What is spent on countermeasures should be appropriate to the risks and to the costs that might arise following any disruption to normal service.

In this paper I shall discuss a particular risk analysis method that I have been using and which originated in UK government circles. I shall highlight some of the areas in which its use in academia differs from how it is used in the civil service and in commerce and discuss some of the benefits that would arise if it were applied more widely across the higher education sector.

Risk Analysis in Government

The UK Government operates very many commercial computer systems either directly or through its various agencies. In the mid 1980s, computer security became recognised as a subject that needed to be taken seriously, even in non-military circumstances, and there was the inevitable competition for limited funds to spend on improved countermeasures. In 1985 the Central Computer and Telecommunications Agency (CCTA), part of the Treasury, studied existing methods of carrying out security reviews so that it could recommend one for use in government departments. None of the methods investigated met all the requirements so a new one was developed to meet the specification written for the study. This became known as CRAMM, the CCTA Risk Analysis and Management Method. Originally it was just that - a method, but soon the method was implemented as a computer program that would run on standard PCs and the package was made available to public and private organisations.

CRAMM's aims are to:

1. Ensure that security requirements are fully analysed and documented for any type or size of IT system.
2. Avoid unnecessary expenditure on unjustified security measures which can arise through the use of subjective and pragmatic risk assessments.
3. Avoid inconsistencies associated with improvised risk assessments.
4. Involve and aid management in planning and implementing security throughout the various stages spanning the life cycle of IT systems.
5. Aid security reviewers to plan and carry out assessments in a reasonable time.
6. Reduce the need for clerical effort by implementing the method as a software tool for standard PCs.

These aims have, in general, been met. But CRAMM's critics said that it nevertheless betrayed its origins by being unnecessarily long winded and prone to generating lots of paper output. It was also seen as being good for large systems with lots of data and many users but unwieldy for the typical systems found in smaller companies. A further criticism was that the system was designed for government-style administrative operations and this flavoured all the interactions with the reviewer and the customer.

More recently, following several internal government reorganisations, the range of available risk analysis packages was reviewed. And CRAMM, in an updated form, again emerged victorious. There are now two major versions. One is for UK Government use only, including the military sector, and includes classified countermeasures in its data base. But alongside this is the commercial product, freely available to anyone wishing to buy a licence. Both products are now the responsibility of the UK Security Services - with the names, addresses and telephone numbers of the relevant management staff freely available.

The General Method.

Computer security is about three things:

Confidentiality:

That information is only disclosed to those who are authorised to receive it.

Integrity:

That information can only be modified by those authorised to do so.

Availability:

That information and other IT resources are available to authorised users when needed.

Security risk analysis and management consists of two related but separate activities.

Risk analysis involves the identification and assessment of the levels of risks calculated from the known values of assets and the levels of threats to, and vulnerabilities of, those assets.

Risk management involves the identification, selection and adoption of countermeasures justified by the identified risks to assets and the reduction of those risks to acceptable levels.

Asset Valuation

There are three principal types of asset involved in an operational IT system:

1. Physical i.e. equipment, buildings and staff
2. Software i.e. the system and application software
3. Data i.e. the information stored and processed

Valuing the physical assets is relatively easy; one simply records the replacement cost. In many cases it may not be possible to buy exact replacements for lost or destroyed items but it is usually possible to find functionally equivalent pieces of equipment - often at less than the original price. And it isn't necessary to be very precise. CRAMM reduces all items to a non-linear "value scale" of between 1 and 10. For example, anything valued at less than 1K UKP is valued as 1; for values between 1K UKP and 10K UKP the scale value is 2. Losses of over 30M UKP are scored as a 10.

This use of a scale of values is important since it allows intangible losses to be equated with those which have a simple cash cost associated with them. We shall see how this is achieved when valuing the data assets is discussed.

Buildings and staff are listed as physical assets and one can readily see how losses in these categories can be just as serious as equipment losses. But risk assessments can easily get too big to manage and one golden rule is to define, at the beginning, the scope of an assessment; and for the purposes of this paper I shall exclude buildings and staff from the discussion.

Similarly, it is easy to understand the value of software to an IT system. An installation that uses standard packaged software which is properly licensed and supported is at little risk since in the worst case new copies can be obtained from the vendor. But sites using bespoke software which may be old, written in an obscure programming language and inadequately documented are clearly much more vulnerable. An example of this is the "millennium" problem - even COBOL has become obscure to many of today's programmers.

To value data assets, the method looks at the impacts of accidental or deliberate :

1. Disclosure
2. Modification
3. Unavailability
4. Destruction.

There are many possible impacts which may be relevant:

1. Political or corporate embarrassment
2. Loss of commercial confidentiality
3. Infringement of personal privacy
4. Personal safety hazard
5. Failure to meet legal obligations
6. Financial loss
7. Disruption to activities.

The CRAMM method leads the reviewer through all combinations of the elements from the two tables above for each data asset that has been identified.

For example, the total loss of a company's payroll file would cause considerable embarrassment and disruption to activities but would not cause a personal safety hazard. It is unlikely to cause a financial loss directly, although there would be considerable cost associated with the disruption to normal activities while the file was rebuilt.

A different example, and one which actually happened, concerns the deliberate modification by a hacker of patient treatment data in a hospital system. In this case at least one patient died. There would also have been direct financial loss to meet compensation claims and extreme corporate embarrassment.

CRAMM deals with all these circumstances by using a series of guidelines which map the scale of the impact onto the scale of 1 to 10 as used for simple asset values. One example is the "Embarrassment Guideline" as shown below:

Effect	Value
Contained in department	1
Other departments aware	2
Public made aware	3
Complaints to Members of Parliament	5
Widespread adverse publicity	7
Calls for Minister to resign	9
Minister obliged to resign	10

This is one table where the civil service wording is most obvious. But substituting "director" for "Member of Parliament" and "Managing Director" for "Minister" makes it quite usable in industry and commerce. It is also clear how it could easily be made compliant with the management structures in universities and other higher education establishments.

The equivalent "Personal Safety Guideline" is shown below:

Effect	Value
Minor injury to an individual	2
More serious injury to an individual	4
Injury to several people	6
Death to an individual	8
Death to several people	10

(Cynics have pointed out that it is apparently less serious to kill someone than to call for a Minister of the Crown to resign)

In making an assessment of a particular data asset, it is important that the reviewer does not make his own judgements about the possible impacts. He should interview the "data owner" and extract the information in this way, preferably without exposing the scoring tables. In this way the assessment becomes a collaborative effort; the reviewer simply the master of the process.

Threats and Vulnerabilities

When all the data assets have been examined it is necessary to consider the Threats and Vulnerabilities. The threats considered are:

1. Natural disasters e.g. fire, flood etc
2. Deliberate threats from outsiders
3. Deliberate threats from staff
4. IT equipment failures
5. Errors by staff

The likelihood of a threat manifesting is assessed by reference to known conditions and recent experience. For example, computer installations in earthquake zones or in the basement of a building below the flood level of a nearby river would be considered to have a significant threat level. Computer installations in buildings which are open to the public are at risk as are installations using old equipment and with a poor staff training record.

Vulnerabilities also need to be considered, and it is frequently difficult to separate a lack of vulnerability from the application of a countermeasure. For example, a computer in a wooden building and where the management of waste paper is poor is very vulnerable to fire. Appropriate countermeasures would be the installation of fire detection and extinguishing equipment - but these would not reduce the intrinsic vulnerability. Another example, particularly relevant in universities, would be that computer installations themselves should be secured, particularly in buildings which have public access.

Countermeasures

At this stage the CRAMM process has information about the physical installation and the totality of the systems that run on it and their overall sensitivities. The package goes into its "expert system" mode and makes reference to its data base of countermeasures to find those which are known to be effective in the circumstances that have been identified. These are listed, cross referenced against the particular threats, and presented as recommendations to management.

For example, base line countermeasures which are generated in almost all assessments include doing back-ups of data and using passwords. In slightly riskier situations the use machine generated passwords and the formal examination of the audit logs might be recommended. At a higher level still the installation of trusted firewalls, encrypted message transfers and the positive vetting of operations staff might be suggested.

As with all consultancy reports, management reserves the right to accept or reject all or part of the report. Countermeasures cost money, some a great deal of money, and management may have important knowledge that was outside CRAMM's data gathering exercise and which, in its judgement, affects CRAMM's conclusions. Or it may just decide to accept the risks.

Conclusions

So, what are the advantages of using a method such as CRAMM? Well, it injects a strong measure of objectivity into the risk analysis process. Universities are multi-faceted institutions. Gone are the days when a university had a single computer installation. There are the machines which support the business functions of a university, those which are used by researchers, often on a faculty by faculty basis, and those which have moved into the basic teaching and learning processes. Institutions are being pressed to operate more and more effectively as businesses while the sources of revenue depend increasingly on quality assessments made of the teaching and research processes - certainly in the UK. And usually the entire campus is wired into the global internet with all the additional risks that brings.

CRAMM enables the relative risks and threats to be assessed so that countermeasures appropriate to the particular system can be selected. It can also be used to show how the risks change with time as the systems evolve. But perhaps most importantly it provides new insights for IS Directors and other university managers about the ever increasing importance of computer based systems in academic life.

Manchester Computing
The University of Manchester
Oxford Road
Manchester M13 9PL
UK
E-mail: ron.chisnall(at)mcc.ac.uk

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Du DOS à Windows NT : émergence d'une nouvelle génération de stations de travail et de serveurs.

[1]François Collin, [2]Khac-Binh Su

I. Introduction

Ce fut avec la création par Microsoft (MS) du DOS, système d'exploitation sur disque pour microordinateur à microprocesseur Intel 8086, que cette famille de puces prenait définitivement sa place incontournable dans le fonctionnement de nouveaux ordinateurs de bureau. Ces derniers jouaient encore modestement leur rôle en bureautique individuelle ou comme terminaux intelligents connectables aux systèmes centraux. L'évolution matérielle, tant en puissance des microprocesseurs et en capacité de mémoire - mémoire vive ou mémoire de masse - qu'en diminution de coût d'acquisition et de maintenance, faisait naître de nouvelles applications sur plate-formes microordinateurs. Mais c'était surtout la concurrence induite par l'interface conviviale du Macintosh de la Société Apple et la prolifération des réseaux informatiques, dont principalement l'Internet qui ont présidé à la conception de la famille des systèmes d'exploitation Windows 3.x de MS. Parallèlement à cette évolution, apparaissait le phénomène du "down sizing" dans le domaine des systèmes informatiques, faisant des miniordinateurs les concurrents directs d'anciens gros systèmes des centres de calculs, avec la prédominance d'Unix sur le front des systèmes d'exploitation. L'autonomie des postes de travail était en augmentation parallèlement à leur capacité à partager des ressources. En 1993, MS lança Windows NT comme son cheval de bataille en cette fin de siècle dans la poursuite du down-sizing au niveau cette fois des systèmes d'exploitation, visant simultanément les deux segments du marché que sont les stations de travail et les serveurs. Comme pour célébrer son quatrième anniversaire à la fin de 1997, Windows NT est apparu dans sa version 4, qui s'avère être fondamentalement différente des versions précédentes en ce qui concerne l'interface utilisateur identique à celle de Windows 95, ainsi que les performances globalement améliorées. Dans ce qui suit, nous présenterons les fonctionalités marquantes de Windows NT 4.0 dont la croissance en unités installées a dépassé toute projection théorique. Nous aborderons ensuite les aspects relatifs à son intégration dans d'autres environnements, à la migration d'autres systèmes vers NT, à son enseignement dans le cadre des services informatiques de l'Enseignement supérieur et de la Recherche, et à la perspective de l'avènement de la version 5.

II. Fonctionnalités marquantes de Windows NT

1. Interface graphique

En adoptant l'interface de Windows 95, Windows NT 4.0 ouvre véritablement l'ère graphique des systèmes d'exploitation dignes de ce nom. Son administration se fait désormais à l'aide de fenêtres graphiques, de menus déroulants, d'icônes, etc.., mettant ainsi fin à la nécessité de recourir à des commandes en ligne rébarbatives, même si l'objectif " zéro administrateur " n'est pas encore pour demain. En effet, l'aspect graphique offre une apparence de convivialité inégalée, mais c'est pour mieux cacher la complexité des mécanismes mis en jeu, dont la maîtrise passera par une bonne connaissance de tout ce qui fait un grand système d'exploitation. Si l'on veut, il est toujours possible de quitter l'environnement graphique pour se plonger dans les profondeurs du Registre, dont on ne sortira pas toujours gagnant, à moins d'être un expert ! Il n'en reste pas moins que la convivialité offerte par le système permettra une exploitation plus facile des possibilités de l'ordinateur, réduisant à la fois le coût de formation des utilisateurs et le coût global de possession du parc informatique. Il convient également de noter que l'homogénéité des interfaces utilisateurs, allant des stations de travail aux serveurs, plus particulièrement sur le plan applicatif, contribue à la popularité croissante de Windows NT.

2. Multitâches

Avec les versions précédentes de Windows 3.x, la technique multitâche utilisée est de type coopératif, c'est-à-dire que le contrôle du processus est assuré par les applications elles-mêmes, d'où possibilité de blocage en cas de défaillance d'une application. Sous Windows NT, c'est le système qui exerce le contrôle (multitâche préemptif). De plus, le multithread est disponible, permettant à une application de lancer en parallèle d'autres sous-tâches : on peut par exemple travailler sur une feuille de calcul Excel tout en soumettant une requête d'impression depuis Excel. Mais Windows NT ne supporte pas le multi-utilisateur : en ouvrant une session sur un domaine, l'utilisateur accède aux différents services offerts (partage de fichiers, partage d'imprimantes,...), sans pouvoir utiliser directement le temps CPU du serveur. Il ne peut donc pas faire tourner un programme Fortran par exemple sur le serveur.

3. Sécurité

La sécurité a évolué de manière fondamentale avec Windows NT. On peut examiner différents composants: la sécurité des données, la sécurité d'accès, le contrôle des utilisateurs et le contrôle des réseaux. Totalement absents sous MS-DOS, ces différents points ont commencé à être traités sous WINDOWS 3 et 95 ; la notion de groupe de travail sur le réseau est apparue avec le contrôle d'accès au niveau de la ressource. Le partage des ressource apparaît à tout utilisateur connecté sur le segment de réseau. Avec Windows NT 4, la sécurité est un point fortement développé :

- L'accès aux postes de travail en local ou par le réseau peut être contrôlé de manière totale sur le base de nom et de mot de passe individuel par un administrateur.
- Les fichiers sur une station peuvent être protégées de manière totale par leur possesseur de tous les autres utilisateurs de la même station.
- Les données partagées sur le réseau ne sont vues que des utilisateurs qui ont accès au domaine et ils ne peuvent y accéder qu'en fonction de leur droit, enregistrés dans la liste d'accès à la ressource sur le serveur.

Les utilisateurs sont administrés de manière centralisée dans un domaine. Un éditeur de stratégie permet de définir une politique de gestion des utilisateurs aussi bien sur la base individuelle que par groupe : il permet de définir les droits et les environnements des utilisateurs ou des stations de travail. Les outils de sécurité au niveau de la gestion des comptes utilisateurs sont diversifiés : durée de validité, période de connexion autorisée, structure des mots de passe...;

Tout accès aux ressources - fichiers, connexions, impressions...; - peut être audité.

Des outils de mise en oeuvre de sauvegardes physiques des données sont proposés. Plusieurs niveaux de technologie RAID permettent d'offrir un bon degré de fiabilité de l'exploitation et de conservation des fichiers.

Le service d'accès distant par réseau téléphonique autorise l'identification et le transfert des données codées.

L'énoncé de ces quelques points, totalement absents avec MS-DOS apportent un éclairage sur l'évolution de la sécurité avec WINDOWS NT 4. Ils lui permettent de se mesurer avec les grands systèmes.

4. Outils d'administration

WINDOWS NT est fourni avec plusieurs outils d'administration de serveur. On peut citer : l'administrateur d'accès distant, l'administrateur de client réseau, l'analyseur de performance, le gestionnaire des utilisateurs pour les domaines, le gestionnaire de licences, le gestionnaires de sauvegarde, le gestionnaire de serveur, l'observateur d'avènement, le gestionnaire de serveur WEB, le gestionnaire de sauvegarde et le gestionnaire de disque.

Ces outils permettent d'administrer un serveur et sur ce serveur un ensemble de services offerts à une communauté d'utilisateurs accédant à un domaine.

Toutes ces fonctions sont apparues avec WINDOWS NT.

5. Réseaux

La transformation des objectifs de fonctionnement est tout à fait claire dans les fonctions réseaux. De poste de travail individuel autonome ou connecté en émulation de terminal passif, on est passé à un poste actif sur le réseau avec Windows for Workgroup puis à un système d'exploitation de réseau avec WINDOWS NT; ce dernier

- fournit comme pour les autres familles de système MS-DOS et WINDOWS l'accès, le partage et le contrôle d'un réseau Microsoft (SMB)
- apporte de manière native les outils d'intégration et de support complet d'un réseau Internet (TCP/IP, WINS, DHCP, SNMP, SMP, DNS...;)
- permet de s'intégrer dans un réseau NetWare.

Le support d'Internet complet peut être réalisé en n'utilisant que des serveurs NT.

III. Intégration

1. Environnement Unix

Le système d'exploitation Unix développé depuis 1969 est traditionnellement considéré comme bien adapté aux serveurs multi-postes d'envergure, grâre en grande partie à la disponibilité de matériel haut de gamme spécifiquement conçu pour Unix. Il faut cependant noter que malgré son appellation générique, ce système n'apparaît toujours pas comme un standard unique et qu'il n'est pas facile à maîtriser.

Comme Unix, Windows NT utilise par défaut le fameux protocole TCP/IP ; il offre en standard les fonctionnalités de serveurs Web, FTP, Gopher et DNS. Il gère de plus les serveurs DHCP et WINS.

Compte tenu des investissements considérables déjà consentis sous Unix ainsi que la jeunesse de Windows NT, il s'avère sage à l'heure actuelle d'envisager plutôt la cohabitation de Windows NT avec Unix. Une intégration complète entre ces deux systèmes nécessite toutefois des produits tiers-partie. C'est vrai pour le serveur Telnet, les client et serveur NFS, et le serveur des terminaux X

2. Environnement Netware

Netware de Novell existait depuis le tout début des microordinateurs IBM PC et compatibles. Il visait l'implémentation du partage des ressources (fichiers et périphériques) gérées par le serveur. Dans une organisation déjà équippée de réseau Netware, la solution à envisager serait l'intégration des serveurs Netware et NT. Etant donné que ces deux systèmes supportent le protocole IPX, les clients Netware peuvent utiliser le serveur NT comme point d'accès aux applications client-serveur basées sur NETBIOS, telles que ORACLE ou SQL Server. Avec l'ajout du Service client pour Netware, Windows NT Workstation peut accéder aux disques et queues d'impression gérées par un serveur Netware.

IV. Migration

Comme il a été indiqué plus haut, la migration d'Unix vers Windows NT n'est pas un choix simple dans l'état actuel de développement de Windows NT.

Par contre, les outils standard existent qui permettent une migration complète de l'environnement Netware vers NT.

V. Enseignement

Depuis pratiquement un an, nous avons mis en place cinq sessions de formation à Windows NT dans le cadre du CSIESR (Comité des Services Informatiques de l'Enseignement Supérieur) et des centres de formation du CNRS (Centre National de la Recherche Scientifique, Garchy, Gif-sur-Yvette et prochainement Luminy). Le but principal en est d'offrir en quatre jours une introduction pratique à Windows NT, traitant des aspects à la fois généraux et techniques, tels que les concepts de base, les méthodes d'installation et de dépannage, les outils d'administration et de réseau ainsi que les principaux services (impression, Macintosh, sauvegarde). Les travaux pratiques sont effectués sur des PC à base de processeur Intel, bien que dans certains stages, des processeurs Alpha aient aussi été utilisés*. S'adressant aux informaticiens des centre de calcul ainsi qu'aux enseignants et chercheurs des établissements d'Enseignement supérieur et de Recherche, les stages de type résidentiel offerts jusqu'à ce jour sont de niveau 1 : ils ont permis aux participants de démarrer plus facilement une première installation de Windows NT dans leur environnement de travail. Un forum privé d'échange d'informations et d'idées a aussi été créé à leur intention. Des stages de niveau 2 sont prévus permettant d'approfondir les possibilités de Windows NT. Notons que selon une récente étude publiée dans la presse spécialisée, la formation complète conduisant à la maîtrise de Windows NT nécessiterait 21 jours. Pour notre part, nous pensons que deux stages de niveaux 1 et 2, d'une durée maximale de 5 jours chacun, suffiraient aux participants venant des mêmes horizons universitaires, d'acquérir des connaissances solides et indispensables à leurs tâches quotidiennes. La structure d'organisation que nous avons mise en oeuvre présente un grand avantage de coüt, ce qui a permis à un nombre plus important d'intéressés d'assister aux stages.

VI. Perspective

Windows NT évolue vite. C'est là un gage de qualité pour tout système d'exploitation de haut niveau. Parant au plus pressé, MS visait en premier lieu le marché alléchant des serveurs de réseaux locaux dont plus de deux tiers sont aujourd'hui encore occupés par Netware de Novell. Pour pouvoir se mesurer à Unix voire le concurrencer avec quelque chance de succès, Windows NT devra intégrer la technologie multi-poste développée par Citrix (http://www.citrix.com), qui la distribue à l'heure actuelle sous la marque Winframe et autres variantes. Une telle éventualité serait envisageable dans les prochaines mises à jour de Windows NT 4.x+.

Windows NT fait largement appel à la notion de domaine qui lui est propre. La complexité de gestion introduite par les relations d'approbation afin de créer de grands réseaux sous Windows NT, conduit rapidement à des difficultés pratiques, rendant cette approche délicate. Des changements à cet égard seraient incorporés dans la future version Windows NT 5, dont la disponibilité ne serait effective que vers la fin de 1998. De même, la technologie des clusters serait incluse dans la version de base.

VII. Conclusion

Il apparaît bien que le système WINDOWS NT fait émerger une nouvelle génération de poste de travail et de serveur. Supporté sur deux plate-formes principales, à savoir Pentium d'Intel et Alpha de DEC, Windows NT offre deux environnements de travail distincts. Dans la version Workstation, il permet de déployer des postes de travail individuels avec un niveau de sécurité satisfaisant et des performances très importantes en regard des applications. Ainsi des stations Alpha tournant à 500 MHz sous Windows NT s'avèrent être des concurrentes sérieuses des stations de travail sous Unix, avec en prime l'environnement applicatif de Windows (Word, Excel,...). En ce qui concerne les serveurs départementaux, Windows NT offre tout l'éventail des outils d'administration, d'intégration et de migration, lui permettant à terme de concurrencer directement Unix, compte tenu des évolutions en cours et à venir. C'est donc un système d'exploitation à surveiller de près, d'autant plus que le coüt des matériels et des logiciels est celui qui est pratiqué pour la microinformatique où la grande diffusion et la multiplicité des offres entraînent des coûts plus faibles.

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*Ceci a été possible grâce au prêt de matériel par la Société DEC.

+Selon une récente annonce de presse faite par la Société Citrix au salon Networks 97 à Birmingham, Royaume Uni.

[1]Service informatique,
Université Denis Diderot,
2 place Jussieu, 75251 Paris Cedex 05, France
E-mail: collin(at)paris7.jussieu.fr

[2]Laboratoire d'Electrochimie Moléculaire,
Université Paris 7, 2 place Jussieu,
75251 Paris Cedex 05, France
E-mail: su(at)paris7.jussieu.f

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Erfahrungen beim Einsatz einer Breitband-Richtfunkverbindung zwischen dem Collegium Polonicum und der Europa-Universität Viadrina Frankfurt (Oder)

Werner Fitzner

1. Einleitung

Ein Erfahrungsbericht zum Einsatz einer terristischen Richtfunkverbindung zwischen zwei universitären Einrichtungen ist normalerweise aus wissenschaftlich-technischer Sicht nichts Neues. An der deutsch-polnischen Grenze, die in Frankfurt (Oder) . a. durch die Zusammenarbeit der Europa-Universität Viadrina mit dem Collegium Polonicum gekennzeichnet ist, ist es schon ein Pilotprojekt, das beispielgebenden Charakter hat. Aus diesem Grunde sind die technischen Aspekte des Ausbaus der Informations- und Kommunikationsinfrastruktur vielleicht von nachgeordneter Bedeutung im Rahmen des EUNIS, d. h. der Rahmen in dem sich die Zusammenarbeit vollzieht erklärt das besondere Anliegen des Projektes.

Am 21.12.1993 wurde die Euroregion „Pro Europa Viadrina“ gegründet. Der Region gehören von der deutschen Seite die Landkreise Oder-Spree und Märkisch Oderland und die Stadt Frankfurt (Oder) an. Die Region umfaßt auf polnischer Seite ca. 5.000 und auf deutscher Seite ca. 4.700 Quadratkilometer. In der Region leben 345.000 polnische und 449.000 deutsche Bürger. Die Pro Europa Viadrina-Region ist etwas Besonderes, da sie an der EG-Außengrenze liegt und ein gemeinsamer Aufbau sich besonders kompliziert gestaltet. Die Infrastruktur in der Grenzregion ist unterentwickelt und es gibt Störungen in der wirtschaftlichen Zusammenarbeit infolge der Wiedervereinigung Deutschlands, insbesondere durch weitgehende Entindustriealisierung in Ostbrandenburg. Ziel ist es in der Grenz- und Euroregion durch die Arbeit der Adam-Mickiewicz-Universität Poznan mit der Einrichtung des Collegium Polonicum und der Europa-Universität Viadrina den wirtschaftlichen, wissenschaftlichen, kulturellen, sozialen und kommunikativen Austausch zu befördern.

2. Historische Aspekte

Die Neugründung der Europa-Universität Viadrina am 15. Juli 1991 knüpft nach 180 Jahren Unterbrechung an die universitären Traditionen der alten Alma mater Viadrina an. Die neuen Aspekte werden durch die Förderung der Europa-Idee im Partnerschaftsvertrag mit dem Collegium Polonicum festgehalten, der am 06. September 1991 abgeschlossen wurde.

Der Studienbetrieb an der Alma mater Viadrina fand von 1506 bis 1811 statt. Frankfurt (Oder) war rund 300 Jahre lang Stadt der ersten Landesuniversität von Brandenburg und die Alma mater Viadrina war die bedeutendste Bildungsstätte für den brandenburg-preußischen Staat. Es wurde an vier Fakultäten, der juristischen, der theologischen, der medizinischen und der philosophischen gelehrt und studiert. In über 25 Disziplinen (. a. in Rhetorik, Geschichte, Astronomie, Mathematik und Chemie) trug die Universität zum Fortschritt der Wissenschaft bei. Über 55.000 junge Leute studierten an der Alma mater Viadrina. Zu den bekanntesten zählten die Gebrüder Humboldt, Ulrich von Hutten, Carl-Philipp-Emanuel Bach, Thomas Münzer und Heinrich von Kleist.

Am 05. Oktober 1990 wurde der Verein der Freunde und Förderer der Frankfurter Universität gegründet und im Dezember des gleichen Jahres wird in der brandenburgischen Regierungserklärung die Gründung der Europa-Universität angekündigt. Das erste Akademische Jahr beginnt am 19. Oktober 1992 und am 22. Januar erfolgt die Aufnahme der Europa-Universität Viadrina in die Anlage zum Hochschulverzeichnis.

Parallel dazu vollzieht sich die Gründung des Collegium Polonicums in Slubice auf der Grundlage einer Übereinkunft zwischen dem Ministerium für Nationale Bildung der Republik Polen und des Ministeriums für Wissenschaft, Forschung und Kultur des Landes Brandenburg. Das Collegium Polonicum ist als gemeinsame Einrichtung der Adam-Mickiewicz-Universität Posnan und der Europa-Universität Viadrina errichtet und wird von beiden Universitäten mit dem Ziel der Ergänzung des Forschungs- und Lehrangebotes der Viadrina und der Entwicklung und Unterstützung der regionalen und überregionalen grenzüberschreitenden Zusammenarbeit errichtet.

Die feierliche Grundsteinlegung für das Gebäude des Collegium Polonicum erfolgt am 16. Oktober 1992 und im Wintersemester 1993/94 veranstaltet die Juristische Fakultät der Viadrina unter Einbeziehung polnischer Wissenschaftler die Zusatzausbildung polnischer Jurastudenten im polnischen Recht.

3. Das heutige Profil der Viadrina

An der Europa-Universität wird an drei Fakultäten (Juristische Fakultät, Kulturwissenschaftliche Fakultät und Wirtschaftswissenschaftliche Fakultät) gelehrt und geforscht. Der besondere Charakter der Zusammenarbeit mit Polen kommt auch in der Studierendenübersicht zum Ausdruck.

Fach	Gesamtzahl	darunter	andere	Ausländer

		Polen	
Rechtswissenschaft	1.024	332	13
Betriebswirtschaftslehre	641	343	21
Volkswirtschaftslehre	119	40	4
Internationale Betriebswirtschaftslehre	91	10	6
Kulturwissenschaften	446	159	40
Summe	2.321	889	84

Es gibt drei Institute an der Europa-Universität Viadrina:

- das Frankfurter Institut für Transformationsforschung (F.I.T. - 1995 gegründet) mit dem Ziel einen wissenschaftlichen Beitrag zur „Transformation von Wirtschaftssystemen und zur Neuordnung der Gesellschaften Mittel- und Osteuropas“ zu leisten
- das Interdisziplinäre Zentrum für Ethik (IZE) mit dem Ziel wissenschaftlich auf dem Gebiet der Ethik und Philosophie mit Osteuropa (insbesondere mit dem Philosophischen Institut der Universität Warschau) zur arbeiten
- das Heinrich von Kleist Institut für Literatur und Politik mit dem Ziel der interdisziplinären Arbeit auf dem Gebiet der Geistes- und Sozialwissenschaften.

4. Das Collegium Polonicum

Das Collegium Polonicum ist eine neue Form grenzüberschreitender Zusammenarbeit auf dem Gebiet der Forschung und Lehre. Es dient der Festigung der wissenschaftlichen Beziehungen und Zusammenarbeit der beiden Universitäten durch gemeinsame wissenschaftliche Tagungen, Konferenzen, Seminare und Kollegien. Das Collegium Polonicum ist darüber hinaus eine wissenschaftliche Begegnungsstätte für die Universitäten der Länder Ost- und Mitteleuropas und stellt besondere Lehrangebote der beteiligten Universitäten zur Verfügung. Im Collegium Polonicum sollen Fachrichtungen zu Wirtschafts- und Regionalstudien, zur Kulturwissenschaft und zur Rechtswissenschaft vertreten sein. Das CP wird auch eine eigene Verwaltungsstruktur besitzen.

5. Die Partneruniversitäten im Überblick

Europa-Universität Viadrina Frankfurt (Oder)

Gründungsjahr: 1991

Fakultäten:Rechtswissenschaften, Wirtschaftswissenschaften (Betriebs- und Volkswirtschaftslehre, Internationale BWL), Kulturwissenschaften (mit interdisziplinärer Ausrichtung unter Beteiligung von Kulturphilosophie, vergleichender Sozialwissenschaft, Kulturgeschichte, Literaturwissenschaft, Lingusiek), interdisziplinäre Forschungsinstitute für Tranzinformationsstudien, Ethik, Literatur, und Politik.

Studentenzahl: 2.300 (1997

Rektor:Prof. Dr. Hans N. Weiler

Profil: Europäisch ausgerichtete Universität, die Brückenform zwischen Ost- und Westeuropa übernimmt; besondere Rolle der deutsch-polnischen Beziehungen; 30 % aller Studenten kommen aus Polen; Verzahnung der Lehprogramme aller Fakultäten; interdisziplinärer Charakter der Kulturwissenschaften; intensiver Fremdsprachenunterricht

AdamMickiewicz-Universität Posnan

Gründungsjahr:1919

Fakultäten: Biologie, Chemie, Polnische und Klassische Philologie, Physik, Geschichte, Mathematik und Informatik, Sozialwissenschaften, Philogie der neuen Sprachen, Rechts- und Verwaltungswissenschaften, Pädagogik

Studentenzahl: 26.700 (1995)

Rektor:Prof. Dr. habil. Stefan Jurga

Profil:Eine modern verwaltete Universität mit starker Beteiligung an internationalen Forschungsprogrammen; 30 Partnereinrichtungen in der ganzen Welt;

2.000 wissenschaftliche Mitarbeiter, darunter 400 Professoren; 200 wissenschaftliche Veröffentlichungen jährlich; Universitätsbibliothek mit 4,3 Mio.

Bänden

6. Information und Kommunikation

Die Realisierung der Anforderungen an Aufgaben an die zentrale universitäre Informationsverarbeitung und an die Kommunikation wird an der Europa-Universität Viadrina durch das Fachreferat Allgemeine Datenverarbeitung (ADV), das dem Kanzler als Verwaltungseinheit unterstellt ist, realisiert. Das Fachreferat ADV arbeitet in den drei Gruppen:

1. PC-Lokale Netzwerke-Novell Administration
2. Netze- und Netzdienste
3. HIS (Hochschulinformationssystem)

Zu den Hauptarbeitsgebieten im Jahre 1996 zählten . a.:

Ausbau der IuK-Infrastruktur

- Einsatzvorbereitung und Inbetriebnahme des WiNShuttle-Anschlusses für Schulen, öffentliche Einrichtungen, Einzelpersonen und Institutionen der Stadt Frankfurt (Oder) und der Region,
- Einsatzvorbereitung und Inbetriebnahme des B-WiN-Anschlusses (Breitband- Wissenschaftsnetz) in Zusammenarbeit mit dem DFN-Verein (Deutsches Forschungsnetz), der Deutschen Telekom und dem Institut für Halbleiterphysik,
- Aufbau und Inbetriebnahme des Universitätsnetzes im Hauptgebäude der Universität und Inbetriebnahme eines zentralen Serverraumes im Fachreferat ADV - Aufbau und Inbetriebnahme einer Richtfunkverbindung zwischen dem Hauptgebäude der Universität und den Gebäudekomplex Robert-Havemann-Str. in Zusammenarbeit mit dem Landesbauamt,
- Ausbau der Informations- und Kommunikations-Infrastruktur für das Dezernat 1 (Logenstr.) und für die Forschung und Lehre in der Robert-Havemann-Str. 1 und 4.

Software für Forschung und Lehre

- Anschluß an den neuen Select-Vertrag der Universität Potsdam über Microsoft Produkte,
- Anschluß an Campuslizenzvertrag für AutoDesk-Produkte, der Brandenburgischen Technischen Universität Cottbus
- Zugangsberechtigung für ASK-Softwareshop
- Symantec Rahmenvertrag mit dazugehöriger Autorisierung der Hochschule durch Symantec GmbH
- Site License von TSP VERS. 4.3
- Borland FuLP-Vertrag
- Anschluß an Campuslizenzvertrag der Universität Potsdam über SPSS für Windows
- Verlängerung der Teilnahme an SAS-Landeslizenz
- Abschluß einer Kyrillica-Mehrfachlizenz

Organisation und Beschaffung

- Einsatzvorbereitung und Beschaffung von SUN-Servern zur Nutzung der jeweiligen Moduln des Hochschulinformationssystem in den Dezernaten 1 und 3
- Beschaffung und Einsatzvorbereitung für zwei Firewallsysteme in der Verwaltung im Rahmen der Bestimmungen zum Datenschutz
- Beschaffung und Einsatzvorbereitung eines Backup-Systems für den Einsatz der Programme des Hochschulinformationssystems
- HBFG-Antragstellung (Hochschulbauförderungsgesetz) zum Ausbau der HIS-Server-Technik (Dezernate 2 und 4) und zur Konkretisierung eines elektronischen Archivsystems
- Einsatzvorbereitung und Inbetriebnahme eines zentralisierten RAID-Systems
- Einsatzvorbereitung und Inbetriebnahme sowie die Novell-Netz-Einbindung eines zentralen Farbkopierers

Support für Forschung und Lehre

- Organisation, Aufbau, Inbetriebnahme und Übergabe von CIP-Pools:

  1 Multimedia-CIP-Pool(Kulturwissenschaftliche Fakultät)

  2 PC-CIP-Pools(Wirtschaftswissenschaftliche Fakultät)

  1 PC-CIP-Pool(Rechtswissenschaftliche Fakultät)

- Organisation, Aufbau, Installation und Inbetriebnahme eines WAP-Clusters für das F.I.T.

Öffentlichkeitsarbeit

Zur aktuellen Information auf dem Gebiet der IuK-Infrastruktur und zur Bekanntgabe von operativen Regelungen und zur Bekanntgabe von operativen Regelungen zum Einsatz der Hard- und Software, gab die ADV zwei Zeitungen heraus. Zur umfassenden Dokumentation der ADV-Leistungen erschien im März 1996 der Jahresbericht ADV-1995.

Mitarbeit in Gremien

Das Fachreferat ADV arbeitete im Jahre 1996 aktiv in folgenden Arbeitsgremien mit:

- ZKI e.V. (Zentren für Kommunikation und Information in Forschung und Lehre)
- DFN - Mitgliederversammlung und Benutzergruppe
- Arbeitsgruppe - Hochschulsoftwarelizenzen des ZKI
- EUNIS (European University Information System)

7. Der Aufbau der Richtfunkverbindung

Die Europa-Universität Viadrina hat zur Zeit fünf Gebäudekomplexe, die durch in den drei Fällen mit Lichtwellenleiterkabel miteinander verbunden sind. Zwei Gebäudekomplexe sind im Rahmen des Aufbaus der Universität derzeit mit einer Richtfunkverbindung an das Hauptgebäude, wo sich der 34 Mbit/s - WiN-Knoten des DFN befindet, angeschlossen.

Auf der Grundlage der Erfahrungen des Einsatzes einer 38 GHz-Richtfunkstrecke wurde die Zusammenarbeit mit dem Collegium Polonicum zum Ausbau der IuK-Infrastruktur organisiert. Im Zusammenhang mit den vorangegangenen Funkinstallationen stand die Auswahl der Technik. Als Übertragungsmedien wurden zunächst:

- die Übertragung auf der Basis eines gebündelten Infrarotlichtes
- eine Laser- Hochleistungsstrecke (optische Übertragungstechnik mit Infrarot-Lasergeräten) und eine 38 GHz-Richtfunkstrecke in Betracht gezogen.

Auf der Grundlage vorliegender Erprobungsberichte anderer Universitäten in Deutschland und wegen der regionalen und örtlichen Besonderheiten (Odertal mit erhöhtem Nebelaufkommen) und der eigenen Erfahrungen eines stabilen Dauerbetriebes zwischen den Gebäudekomplexen der Europa-Universität fiel dann auch die Entscheidung für das Collegium Polonicum eine 38 GHz-Richtfunkstrecke in Betrieb zu nehmen (Aufbau siehe Anlage 1). Das geplante Richtfunksystem bietet eine sofort einsetzbare und kostengünstige Alternative zur Sprach- und Datenübertragung gegenüber herkömmlichen Lichtwellenleiterverkabelungen, was wegen der Situation des Grenzflusses (Oder) und dem Vorhandensein nur eines städtischen Übergangs von Frankfurt (Oder) nach Slubice, viele Probleme durch die Leitungsverlegung (Schachtarbeiten, territoriale und staatliche Hoheiten und damit Genehmigungsverfahren) bereitet.

Die Sendeeinheit (ODU) besteht aus einem kompakten Sende- und Empfangsteil, das mit einer wetterfesten Parabolantenne direkt gekoppelt ist. Die Steuereinheit (IDU) besteht aus einem Gerät, das im Gebäude installiert wird und die Funktion von Schnittstellen, digitalem Multiplexer, Modulator und Zwischenfrequenzgenerator beinhaltet. Gleichzeitig sind Alarm- und Diagnose- sowie Systemüberwachungsmodule eingebaut, auf die über eine spezielle Schnittstelle zugriffen werden kann. Zwischen der Steuer- und Sendeeinheit ist nur eine Koaxialkabel erforderlich. Bis 300 m Abstand ist eine Arbeit ohne Leistungsverlust möglich.

Zur Einführung des System konstituierte sich eine Arbeitsgruppe aus Mitarbeitern des Collegium Polonicums (Verwaltungsdirektor, DV-Mitarbeiter, Bibliotheksmitarbeiter) und dem Fachreferat ADV (Leiter, Gruppenleiter Netze- und Netzdienste, Gruppenleiter PC-LAN-Novell-Administration). Die Arbeitsgruppe definierte die Zusammenarbeit (gemeine Arbeiten), die Etappen nach denen geplant wird und die Einzelaktivitäten auf der jeweiligen nationalen Seite. Zu den definierten Etappen gehört:

- Gründung der Arbeitsgruppe und Festlegung des Arbeitsplanes und Organisation der Zusammenarbeit20. Januar 1997
- Definition der technischen Parameter und Ausschreibung der Technik 02. Mai 1997
- Vergabe des Auftrages mit definierten Leistungsumfang 20. Juni 1997
- Beginn des Montagebeginns auf der deutschen und polnischen Seite 04. Juli 1997
- Geplante Inbetriebnahme der Richtfunkstrecke und Erprobung bis zur Aufnahme des Lehrbetriebes im ersten Bauabschnitt des Collegiums Polonicums ab 24. Oktober 1997.

Mit dieser Aufgabenstellung und monatlichen Beratungsterminen stellte sich die Arbeitsgruppe ein terminlich, fachlich und organisatorisch ein sehr ehrgeiziges Projektziel.

Im Vorfeld der technischen Realisierung konnte die Finanzierung mit ca. 160.000 DM aus dem Programm Interreg II sichergestellt werden. Die Kofinanzierung übernahm die Europa-Universität Viadrina.

8. Fazit

Die Realisierung eines solchen Projektes ist gewissermaßen Neuland in der universitären Zusammenarbeit im Informations- und Kommunikationsbereich und zugleich ein Musterbeispiel für die Verflechtung der Wissenschaft zwischen einem EU-Mitgliedsstaat und einem mitteleuropäischen Reformstaat. Vielfach nicht geklärte Rechtsfragen bereiten hin und wieder Zuständigkeits- und Koordinierungsprobleme, wie beispielsweise finanzielle Regelungen, Fragen des Warenverkehrs und der zeitweisen Überlassung von Hard- und Software, Genehmigungsverfahren der zuständigen Einrichtungen für die Frequenzvergabe und die Standortvergabe (BAPT-Bundesamt für Post und Telekommunikation in Deutschland oder PAR-Polnische Agentur für Radiokommunikation) in der Republik Polen.

Mit dem Aufbau einer terristischen Richtfunkstrecke wird ein Beitrag zur Zusammenarbeit auf dem Gebiet der IuK-Infrastruktur geleistet. Der Beitrag ordnet sich ein in eine grenzüberschreitende Zusammenarbeit der Pro Europa Viadrina-Region und schafft eine Basis zur Zusammenarbeit in den unterschiedlichsten wissenschaftlichen Disziplinen.

Europa-Universität Viadrina Frankfurt (Oder),
Große Scharrnstr. 59,

Fachreferat Allgemeine Datenverarbeitung,
15230 Frankfurt (Oder), Deutschland
E-mail: fitzner(at)euv-frankfurt-o.de

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Integrated information infrastructure at the Eotvos Lorand University, Budapest

[1]F. Telbisz, [2]L. Daruházi, [3]G. Gyori, [4]Z. Onder, [5]O. Pintér

1. Introduction

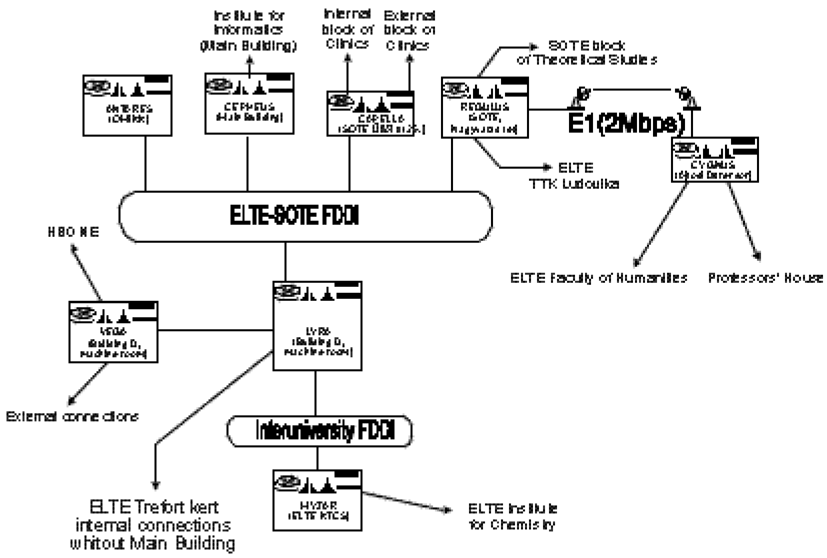
Eotvos Lorand University (ELTE) is one of the largest universities in Hungary with about 12 thousand students. It has four faculties: Faculty of Arts, Faculty of Law and Political Sciemces, Faculty of Sciences, Teachers Training College and a postgraduate Institute of Sociology. The evolution as well as the present state of the information infrastructure is described in this paper. It has evolved gradually with much vigour since 1989 till it reached the present state. The university, like any old one is dispersed in the capital of Hungary, with many distant campuses, even some of them placed in other villages. This was a serious drawback in building a coherent infrastructure.

2. The data communication infrastructure

Although there existed in Hungary an X.25 packet switched network since 1987, the political changes have brought dramatic developments in networking, too. The large universities and research institutes have built their Ethernet based LANs in a very short time.

The data communication network of the University was started in 1989. At that time it consisted of two tiny local area Ethernet networks, the LAN of the Institute for Physics placed in the City (Trefort kert/garden) and the LAN of the Institute for Chemistry. These two institutes are separated by a considerable distance and located on two different sides of the Danube. When the planning was started in 1990, the dispersed structure of the university campuses was a serious problem. Due to this fact, about 8 km of optical cable had to be laid down by the University during the fall of 1991 and by the spring of 1992 the optical backbone was operational. Since then only minor extensions to it were necessary. Now it is connecting 23 buildings at 11 distant campuses. Still in 1992 the main campuses of three universities in Budapest (Eotvos Lorand University, University of Economy and the Semmelweis Medical University) were connected by fiber optics with Ethernet speed.

In 1994 the Eotvos Lorand University (ELTE) and the Semmelweis Medical University (SOTE) have built a common FDDI backbone, connecting the Trefort campus of ELTE (Sciences), the clinics and the Block for Theoretical Studies of SOTE (Nagyvárad tér). This backbone is prolonged by a microwave link in order to connect some Institutes of the Faculty of Arts (Humanities) of ELTE. The ELTE-SOTE network contains 13 CISCO routers, one of them is a CISCO 7000 router.



The internal backbone of the ELTE-SOTE network before the installation of ATM

In the course of the following years the number of nodes connected to the network of the university was increased gradually. By now about 2000 nodes are connected to the network, the majority of them are PC-s, but about 200 workstations are connected, too. Later the optical Ethernet backbone had to be replaced by an FDDI backbone, with microwave extensions to the far distant campuses.

In parallel to the internal network of the University external network connections were also installed. As a first step to a high speed global connectivity at a national level an inter- university optical backbone was laid down in Budapest connecting the University with two other ones: the Technical University and the University for Economy. Using this optical infrastructure an

FDDI backbone was operational in February 1993. A CISCO 7000 router is connecting the ELTE-SOTE network and the so called Interuniversity FDDI backbone, as well as the distant campuses of ELTE. E.g. the Institute for Chemistry of ELTE was connected to the central campuses by this Interuniversity FDDI backbone until 1997.

The international internet connections were also started in 1993, since then with ever growing capacity. By 1994 a national internet backbone was also founded, the external connections at national as well as at international level are provided now by the Hungarian IP Backbone (HBONE), operated by the HUNGARNET Society. ELTE provides connections to the national IP backbone also to a lot of other high schools, grammar schools as well as public libraries and other institutes.

3. Number crunching and other services.

The public central service is provided by a VAX cluster, consisting of a VAX 6125 with 128 MByte memory and 8 GByte disk capacity and of a VAX 9000 with 256 MByte memory and 32 GByte disk capacity. Due to a cluster coupler the disks can be used by both computers. There is an IBM Risk cluster, too, consisting of an SP1 parallel computer with 8 processors and of four RS6000 model 580 computers. These computers offer services for the whole community of the University.

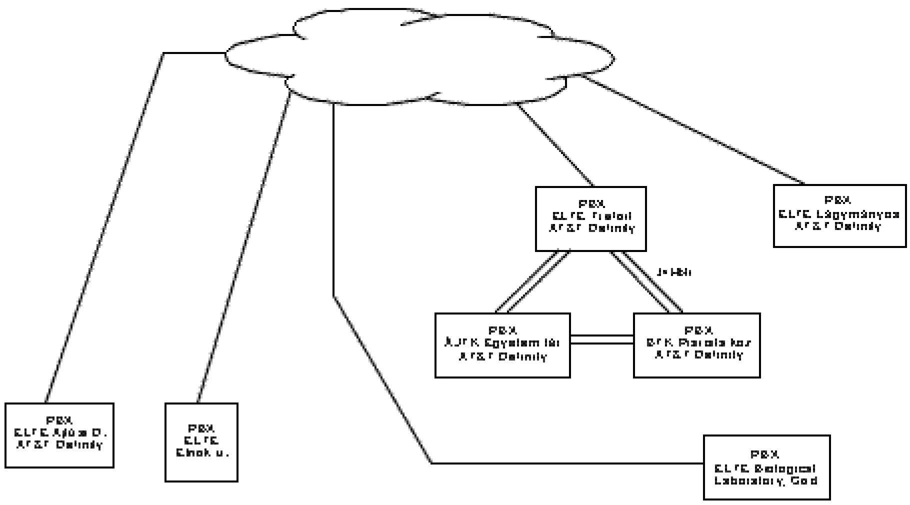
In addition to the central facilities all of the Faculties and Institutes have their more or less powerful servers, too. There is also a further IBM SP2 (with 7 processors) at the institute for Chemistry, but this is used only by this institute.

The central facilities offer not only number crunching service this is mostly done with the departmental computers and workstations but also different other new services like World Wide Web, Gopher, Eletronic Phone Directory, etc..

The distributed library services are based on two IBM RS/6000-370 computers, using the library software from DYNIX Corp. (USA). The system management of these computers is provided by the Center of Information Technologies, while the management of library data is done by the librarians.

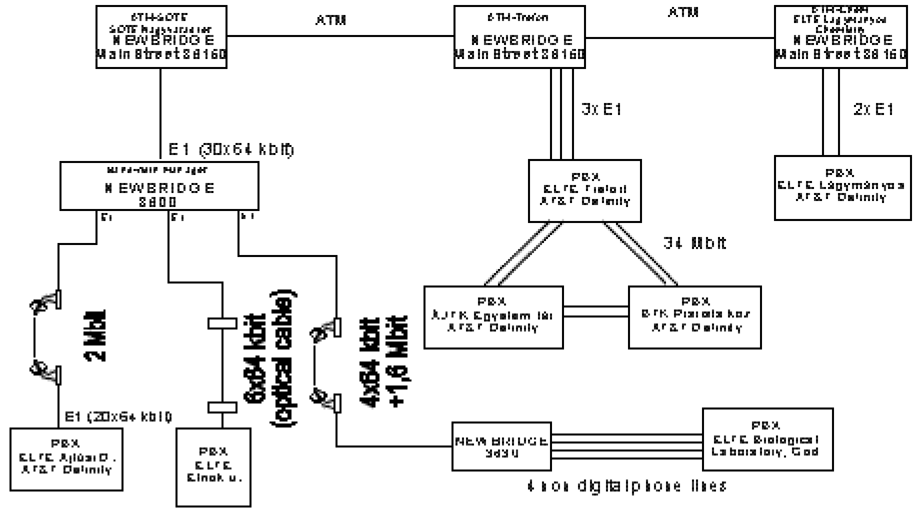
4. Voice communications

The voice communication of the University was also gradually modernised in parallel to the data communications. In 1993 the university started a phone development project in order to exchange the obsolete PBX-s to up-to-date digital exchanges. In the course of this project as a first phase two satellite exchanges were replaced by digital PBX systems. In the second phase in 1995 a second major and several smaller exchanges were installed, and in the third phase, in 1995-96 two further major digital exchanges were installed. (This is a homogenous system as Exchanges of AT&T are installed on each place, Definity G3i systems used as major systems.)



Interconnection of the PBX-s before the installation of ATM

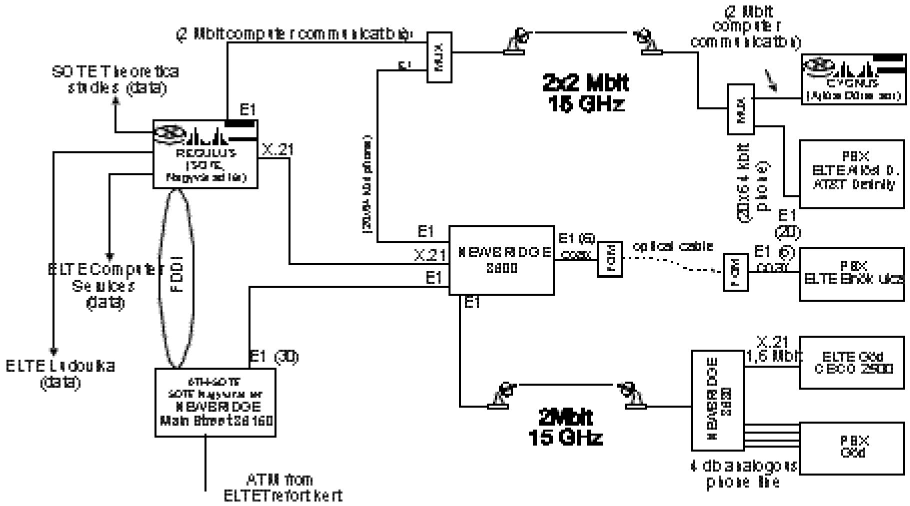
In order to economise the phone expenses the University wanted to connect these exchanges by internal lines, thus avoiding the calls passing through the public phone network. In some cases it could be carried out with the help of the spare fibres of the optical cables laid down for data communication, but just in the direction of the ELTE-SOTE FDDI backbone there were no such facility. This was the time when the idea of using a common infrastructure for voice and data communication emerged.



Phone system of ELTE after the installation of ATM

According to this conception a large section of the ELTE-SOTE fast data communication FDDI backbone was replaced by an ATM connection by installing two mainstream 36150 Type ATM switches maid by New Bridge both in the Trefort Campus and in the SOTE Institute for Theoretical Studies. A similar switch was placed in the Institute for Chemistry. This was connected to the Trefort Campus by the optical fibres of the interuniversity optical connection. All of the ATM switches have E1, FDDI and ATM interfaces.

At one end of the ATM backbone (the node of Nagyvárad tér) a bandwidth manager was also installed, in order to split the phone backbone connections to three different directions. With the help of this facility a remote biological experimental station of ELTE, situated in the countryside could also be connected to the urban network of the University.



ELTE-SOTE data and voice communication system

This integrated communication system works without any serious problem since March 1996.

5. Organisational changes

The technical developments were followed by organisational changes, too. The role of the former Computer Centre was gradually transformed, and by 1995 it gave services for the economic management of the University, only. This changing role was acknowledged by regrouping it from the Center of Information Technologies to the Chancellery of the University, and in contrast the phone services were formally integrated with the Data Communications Services.

A serious management problem for the informatics services at the Universities is the notorious lack of expert peoples who can operate their information infrastructure. Although the Universities are well equipped with up-to-date infrastructure, they can not compete with the much higher salaries offered by the fast growing profit sphere.

6. Conclusion

The case of the Eötvos Lorand University shows an information infrastructure which is comparable to that of many other Universities in Europe, probably struggling with similar problems, too.

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[1]Present address: KFKI Institute for Measurement and Computing Techniques,
H-1525 Budapest, P.O.Box 49. Hungary

E-mail: telbisz(at)caesar.elte.hu
[2]Present address: Hungarian Telecommunication Co.,
PKI-FI FSA, H-1456 Budapest. P.O.Box 2., Hungary
E-mail: daru(at)ludens.elte.hu
[3]Eotvos Lorand University,
Center of Information Technologies,
H-1088 Budapest, Muzeum krt 4/C, Hungary
E-mail: gaga(at)hovirag.csoma.elte.hu
[4]Present address: Hungarian Telecommunication Co.,
PKI-FI FSA, H-1456 Budapest. P.O.Box 2., Hungary
E-mail: onder(at)ludens.elte.hu
[5]E-mail: pinterodon(at)ludens.elte.hu

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The problems of MOLDNET

Nicolae Andronaty, Inna Andronaty

First attempts to create computer networks in Moldova start at the end of 70's.

The work was carried out at Ministry of Communication, the Planification Institute of Gosplan, Academy of Science, etc.

Even some practical positive results were obtained about it.

And some expirience was accumulated it this branch.

But living under the iron curtain of that period, not having access to the technologies used in developed countries, all of the trials to create computer networks failed. Computers and Operational Systems we were having were at the level of IBM 360 and 370 systems but the necessary facilities for network were partially or even completely missing. So naturally in a situation like that it was almost impossible to construct network capable of functioning in real conditions.

The first e-mail systems in Moldova appeared only at the begging of 90's; it was the soviet network - Relcom.

There was not a single leased line at that time, the Relcom servers were working in UUPC mode, that means that they were both accumulating information and interconnecting at certain intervals of time for information transfer on the bases of telecommunication access method. The central computer node of Relcom network, situated in Moscow, were having a connection to West Europe.

It was primitive, but it was a start. And in my opnion an especial importance of that network consisted in the fact that it realised two main objectives:

1. The network were respecting international standards;
2. It was an efficient and cheap means to communicate with the colleagues from all over the world, therefore it contributed to the free exchange of information (For instance, a message by e-mail were getting the Western Europe in a couple of hours, while a letter sent by usual air-mail was covering all of the distance in a couple of months).

The faster and more efficient communication let a group of persons (not too large), who were having access to e-mail, know the developed countries achievements in the branch of electronic communications.

At the time when USSR had disappeared and the iron curtain had fallen, exchanges with all of the countries have intesified; advanced technique and technologies have begun to penetrate our society.

The economical slump was not that bad yet; lots of computers of class PC 286 and 386 (which still work now) were mandated at that time. And the majority of Relcom computer nodes were based on PC 386 and Free BSD operational system.

When western technologies penetrated our market the disparity between West and ex-soviet areas became extremely visible. Soviet technology couldn't face in competition with Western ones and little by little were taken away. At the moment there are no soviet production computers in use anymore.

The first Internet server was constructed in 1993 at Republican Centre of Informatics. It was a PC-based server, rolling the Linux operational system and the most important ! a leased line at 19,2 kbps to EARN network was provided.

Despite the low rate of data transfer, it became possible to make experiments and even to work with utilities like Telnet, FTP, Gopher, WWW in textual mode. In a short time two more computer nodes branched out : one was at the University and another one at Academy of Science. Both the research and the implementations of Internet tecnologies started. The main weakness consisted in low performances of communication canal - for example , it almost imposible to work in graphic mode with WWW.

The work on constructing a computer network for educational and research institutes started in 1995. It was sponsored by Soros Foundation. The network became operational in the first half of the 1996 and it is known as Moldnet (though it would be more correct to be called MoldEduNet, for instance).

The important fact is that this network has a chanel of 64 kbps through satellite to Stockholm, to TideNet and which permits to use graphic mode (of course for video in real-time 64 kbps it isn't enough)

The structure of Moldnet network consists of 5 nodes which are the following:

- Soros Foundation in Moldova
- State University of Moldova
- Technical University of Moldova
- Academy of Economy of Moldova
- Academy of Science of Moldova

(all of them are in Kishinau).

Each of these nodes has: a server, a router and one or more radiomodems.

Routers are connected between them through radiochanels at a speed of 128 kbps.

Moreover, the Soros Foundation router is connected to Internet node in Stockholm trough a cosmic channel at a speed of 64 kbps.

Network is under estension; the equipment for Pedagogical University is already received; connectin of University of Medicine and of other medical institutes is stipulated. I would like to mention the distinct importance of physicians adheration to Internet - there are high quality physicians in Moldova who colligate with Europe and USA but a serious obstacle for this colaboration is the lack of an adequate system of eficient communication between partners. And in this case access to Internet would have a good effect too.

Besides those 2 academic networks we were talking about, that is EARN and MoldNet there are two more providers of Internet services in Kishinau:

1. UNDP. They have a satellite antenna , a canal of 64 kbps. Also through this link local network has access to Internet from UNO office and UNO representatives in Moldova - through dial-up. Do not perform services for some persons . At the moment they provide connection to Internet for External Economical Relations Department of the Government. Also a work on an ample project of connecting some ministries and departments to Internet is carried out. Moldpack. It is a commercial provider. It performs X25 services. Uses an optical fibre canal. Has two more computer nodes in republic.
2. Apriory SRL. Commercial provider. Satellite canal of 64 kbps to TaideNet Stockholm.
3. And the old services performers - Relcom. At the moment besides the UUPC use the leased-lines described upper.

The network problems and their technicak solutions are specific for Universities too. The main specific features that should be underlined are:

The connection of Academic Campus to Soros Foundation Anntena is made through radio-modems at a frequency of 2.4 GHz.

There is a partial functioning of structure based on Thick Ethernet between buildings of different institutes of Academic campus on the str. Academical. Moreover this process is under extention.

Repeaters are used to cover the entire campus. The connection of Botanic Garden, Institute of Genetics, Institute of Plant Physiology and Institute of Biological Protection of Plants which are situated at a considerable distance from academic campus and which are too far to be visible directly by radio-modems will be made through a leased-line.

Also the Praesidium of Academy and the Institute of History and the Institute of Linguistics which are in different corners of the town too will be connected through a leased-line.

The following operational systems are used:

- HP-UX - for the server donated fy Soros Foundation
- Solaris - for SUN workstations and servers
- Linux - for servers based on Intel strusture
- Windows 95 and 3.11 - for users's PC

For navigation through Internet we use Netscape Navigator and Microsoft Internet Explorer, Scripter for MS Windows 95, etc.

The development of Moldnet is supposed to follow like this:

- to connect new users to Moldnet, especially other academies and univeristies, nonprofit scientific-research organizations and different colleges.
- to increase the channel speed ; Possible rate through satellite anntena of the donated by Soros equipment is up to 256 kbps;
- to create a new powerful channel to Internet; At the moment Moldtelecom, the operator of national telecommunications has installed a channel based on optical fibre which connects Kishinau to Western Europe; it is also going to connect Kishinau to Nothern Caucas and Baltic Sea area. Use of optical fibre channel will substantialy improve the quality of communications. But in this case a problem of payment for channel appears.
- to research, develop and adopt modern technologies of using the Moldnet and Internet networks;

Hard and soft solutions adopted in Moldnet network are good solutions, but we are already facing the necessity of some more performant equipment - server's parameters and storrage capacity need to be enlarged.

- to develop and create new databases and new Internet servers; We appreciate the thing that in the very next future the number of such servers will be increased.
- to upgrade technical base of Moldnet; The problems of development of academic and university information systems in Moldova are similar to the ones described by Guntas Barzdins and Janis Kikutis in “BALTNET Project: Current Network Status in Latvia”, but the situation in Moldova is worse (for instance, Moldnet has access to Internet at a speed of only 64 kbps).

The most important are indicated lower:

1. Not modern and insufficient technical base (there are computers as IBM PC and just a few workstations, so therefore a main part of scientists, researchers and students do not have a free access to Internet). Actualy there is a set of obsolete PS-s at educational and research institutes, and about 40% of them do not allow instalation of some modern softs like

Netscape, Windows 95, Unix, etc., talking about servers the situation is even worse - the number of servers and workstations is under 10.

2. We do not have a good (powerful) link to Internet (a rate of 64 kbps isn't enough for a normal work, as you know). It should be taken into consideration that there are about 10.000 people (professors and students) who want to be connected (the channel is only at 64 kbps). Because of this reason universities are looking for resourses to mandate their own satellite antenna and to pay for channels and for data transffer.
3. The number of skilled service personnel for working with Internet is little. Some groups of people who know Internet technologies have been formed at institutes which have access to Internet . There are even Internet courses at some of these institutes.
4. Help for Moldnet was recieved from Soros Foundation, EuroAsia Fond and NATO (not from European structures).

So our suggestion would sound as follows:

- to apply to European Commission and INTAS Countries on behalf of EUNIS to increase the amount of funds INCO, COPERNICUS, INTAS and other programs for support of developing of information systems in the Countries of Central Europe and the New Indepent States and for integration them into European information systems;
- to create working group (from all EUNIS countries) which will:

1. develop a common database of EUNIS Web server using also Web servers of EUNIS countries (topics may be legislation, scientific programs, education programs and so on). This may be suggested as a project to European Commission;
2. to develop the conception of common European academic and university system (including NIS and CEE countries).

Academy of Science of Moldova,
Department of Technical Science,
Stefan cel Mare av., 1, Kishinau,
277612, Moldova
E-mail: andronat(at)tech.moldova.su

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EXPANDING ACADEMIC NETWORKING SERVICES IN St.PETERSBURG AND THE NORTH-WEST REGION OF RUSSIA: ROKSON NW PROJECT

N.V.Borisov, A.Y.Glebovsky, V.A.Kapustin, G.N.Losev, Y.F.Ryabov

The immense scientific, academic and cultural potentials of St.Petersburg -- combined with its advantageous geographical position -- distinguish the city as a strategic point in academic networking in the NW region and the whole of Russia. Academic networking in St.Petersburg originated over a decade ago with fiber-optical trunk lines connecting a number of Academy of Science institutions. The new era in networking development started with the advent of Internet in Russia. A number of projects are underway in the region in allied effort to bring academic networking to a new, advanced level. The paper reports on general activities in the area and focuses on the development of the new-generation Regional Associated Computer Network for Education, Research and Culture in the North-West of Russia (ROKSON NW).

BACKGROUND It is hardly necessary to stress the importance of Internet connectivity for integration of Russian universities into the world-wide academic media, which is the vital prerequisite for all ongoing or planned Distance Learning projects on every level -- regional, national and international.

Co-operative efforts to develop an advanced regional computer network serving the needs of the wide academic and research community of St.Petersburg and its environs started in 1993. At the time a number of organisations have initiated collaboration in the framework of the Russian Space Science Internet (RSSI) project with support offered by NASA, DOE (USA) and Russian Foundation for Basic Research (RFBR). The central site of the RSSI in St.Petersburg was established at the A.F.Ioffe Physics-Technical Institute (PTI) bringing Internet connectivity over a leased telephone line via the Moscow Institute of Space research (ISR) that already had a satellite channel to Europe.

A new impulse in networking collaboration was introduced when Federal Technical University of St.Petersburg (FTUSP) has perceived the great potentials in extending co-operation with its traditional partner LENENERGO -- the leading regional power supply enterprise. The company -- with its vast corporate communications infrastructure built over fiber-optic (F/O), microwave and copper wire lines across the city and environs and a F/O link to Finland -- soon became the strategic provider of wide-band channels for the academic metropolitan backbone and a fast access to Ebone via FUNet and NORDUNet. Development plans reported at ICDED'94 [2] were fulfilled and transcended. LENENERGO together with the Presidium of Russian Academy of Sciences (RAS), the State Committee for Higher Education of Russian Federation (SCHE RF) and Ministry of Science and Technology of Russia (MinSci RF) have all signed the General Agreement on Co-operation in Developing the Regional Academic Computer Network. The Agreement laid the foundation for alliance in future diverse metropolitan and regional computer network projects and initiatives.

The first sites that were linked into a metropolitan academic network, are located on the premises of the St.Petersburg State University (SPbSU) that is resides on its two main campus areas: one on Neva embankment in the central part of St.Petersburg, the other in Peterhof environs. So the problem of connecting both campus networks and linking them to the Internet arose. The connection was completed by fall 1994 in the framework of RFBR project. According to the project a 64 Kbps digital microwave channel was deployed. The channel linked Peterhof Campus with the site at the LENENERGO headquarters in the Field of Mars in the centre of St.Petersburg. The City Campus of SPbSU has been plugged into RELCOM computer network with rented access to the Internet. Linking of the two main computer and communications centres brought forth mutual connectivity of LANs and allowed SPbSU faculties to gain access to the Internet.>

Other important networking projects in the area were underway in parallel contributing to development of academic networking infrastructure in St.Petersburg.

In 1994 FTUSP in co-operation with LENENERGO has started a project to establish a fiber-optic high-bitrate 100 Mbps channel between FTUSP and the Field of Mars site. The channel was later implemented and other organisations will soon be linked to it.

The same year SCHE RF research program “Universities of Russia” announced a special telecommunication direction (Direction V) and St.Petersburg Institute for Fine Mechanics and Optics (SPIFMO) has been assigned the Co-ordinator of the Direction. Direction V was aimed at the development of the nation-wide Russian Universities Computer Network (RUNNet); the network would connect Russian universities via satellite channels. In the framework of the program SPIFMO installed a teleport that connected St.Petersburg with universities of other Russian cities via satellite channels. Also a fiber-optic cable was laid down; the cable linked SPIFMO with the Field of Mars site at LENENERGO premises.

Thus, in 1994, due to the combined initiatives the primary components of the future academic computer network in St.Petersburg were fleshed out and the task to associate these components into a united metropolitan computer telecommunication infrastructure became vital. Representatives of SPbSU, FTUSP, SPIFMO, PTI, B.P.Konstantinov Nuclear Physics Institute (PINP), St.Petersburg Institute of Informatics and Automation RAS (SPIARAS) and St.Petersburg Department of Mathematical Institute (PDMI) actively participated in launching the project; the latter was named ROKSON NW [1].

Consolidation of academic networking activities on the higher, federal level started late in 1995 when the chief participants -- MinSci RF, SCHE RF, RAS, and RFBR -- have come to a collectively settled strategy in telecommunications development. As a result, the State Inter-Agency Programme “Development of the National computer telecommunication networks for science and academia in the 1995-96 period” was forged. According to the Programme the national academic networking infrastructure is based on the inter-regional backbone principle.

ROKSON NW PROJECT PARTICIPANTS AND GOALS

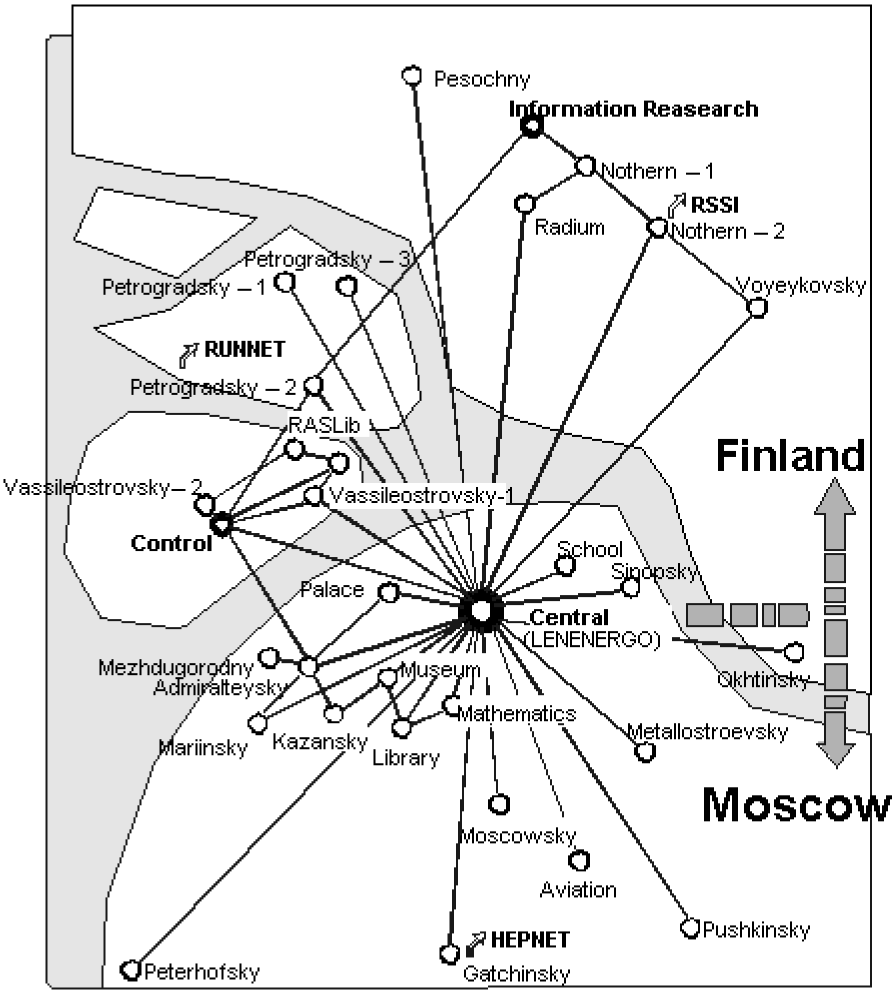
The above principle was to be implemented In the St.Petersburg region in the framework of the Regional Associated Computer Network for Education, Research and Culture (in transliterated abbreviation -- ROKSON NW) Project; the St.Petersburg State University (SPbSU) was nominated as the principal organisation in charge of the Project implementation. Collaborating parties are the leading universities, RAS institutes and cultural institutions, among them: FTUSP, SPIFMO, PTI, PINP, SPIARAS, State university of telecommunications (SPSUT), the State "Hermitage" museum, RAS Library, Russian National Library, and others -- in total over 150 organisations. The project solicited financial support from RFBR and from International Science Foundation (ISF). From 1995 the project is being supported by RFBR. According to the State Inter-Agency Programme, the ROKSON NW network was authorized to become the regional segment of the National network.

The chief objectives and range of activities of ROKSON NW are not limited to providing connectivity and developing the backbone, but extend further in the following directions:

- development and maintenance of information resources of St.Petersburg academic and research organisations, museums and libraries;
- providing access to such resources through the regional computer network;
- informational and methodical support of education;
- introduction of Distant Learning methods and techniques;
- academic network user training and support.

ROKSON NW NETWORK TOPOLOGY

The topology of the metropolitan ROKSON network is star-shaped with rays projecting from the building of LENENERGO headquarters at the Field of Mars in the centre of St.Petersburg. Points of presence (PoP) of several major telecommunication companies of St.Petersburg are resident in the building also. From here start digital channels to Moscow and to Finland.



The topology reflects both architecture and infrastructure of ROKSON NW network. They form a tree-like hierarchical pattern (layout) of the backbone stemming from the central point. Hub nodes are located at strategic points in several selected academic and research organisations across the city and its suburbs. The hub-nodes have fast links with the Central site where all routing is performed - both internal between hub-nodes and external to other networks and to the Internet.

Recently the Central ROKSON NW site is linked to Moscow Backbone network via a 128 Kbps channel provided by the Department of Mathematics of RAS. The Moscow Backbone has a terrestrial 128 Kbps channel from Moscow State University (MSU) to Paris and two satellite channels: one from Nuclear Physics Institute of MSU to HEPNET and the other from ISR to NASA Internet. In addition, the Central site uses a 64 Kbps EUNet/RELARN channel to NORDUNet through Finland. In the nearest future ROKSON NW will have access to a 256 Kbps channel to NORDUNet that has been put into operation in the course of RUNNet project.

The span of ROKSON NW hub-nodes across St.Petersburg steadily expands. The nodes at SPbSU Peterhof Campus, PTI, PINP, PDMI, SPIARAS and RAS Library are already operational. By the summer of 1996 the additional hub-nodes at FTUSP and at SPSUT are to be put into operation. A joint node of SPbSU and ROKSON NW in the former building of the SPbSU Department of Chemistry in the centre of Vassilievsky Ostrov is in the design stage. The nodes at Vassilievsky Ostrov will be interconnected into a highthroughput fiber-optic backbone network. At this stage of development are also used the refurbished old fiber-optic channels of the first-generation Academic Network that was deployed in the eighties. The set of the ROKSON NW hub-nodes will allow full-fledged access to the Internet for scores of scientific, research, educational and cultural organisations in St.Petersburg.

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ROKSON NW Project Headquarters
199178, Russia, St.Petersburg, 14th Line Vassilievsky Ostrov, 29, office 2
Tel: 7(812) 218-4451
Fax: 7(812) 213-7175
E-mail: admin(at)rokson.nw.ru

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An analysis of the e-mail traffic by a server called TIGRIS.KLTE.HU

György Terdik and Péter Erdõsi

Introduction

One of the first use of Internet is the electronic mailing. Messages are sent between users of computer systems and the computer systems are used to hold and transport essages. There are several advantages of electronic mailing as it is fast, cheap, comfortable and so on. The number of Internet users increasing exponentially therefore more and more people is able to get and send e-mails. There is no doubt about that the academic staff and university students are used to it very much. It is a part of not only research work but of the everyday life as well and stooping services of e-mail would cause unimaginable difficulties at keeping in touch. Electronic mail is an important component of an office automation system. There is a problem one should pay attention to writing an e-mail it is the problem of usage of special characters of languages different from English. The Hungarian Umlaut Û, say, supposed to be encoded and decoded as well before reading it. Most of the client software's are providing automatic coding services. The most popular one at our University is The Pegasus mail with Uuen/decoding possibilities among others. Newer systems support the composition and delivery of multimedia mail, which can combine text, graphics, voice, facsimile, and other forms of information in a single message

The mail server called Tigris

In 1991 a VAX6000/510 was installed at our University it was one of the strongest server that time in the country with one VAX processor, 128 MB RAM, 6 Gigabyte DSSI Winchester later an extra 6 Gigabyte SCSI Winchester was added. The main job of the server is providing Internet services for more then 4000 users and it is playing the role of mailgateway for some other servers. It can be reached by Ethernet (10 Mbit/sec) from the campus and by FDDI Ring (100 Mbit/sec) from all others institutions of higher education of the our city Debrecen end by 512 Kbit/sec leased line from Budapest. Besides the protocols TCP/IP and DECnet the protocol POP3 has also been implemented because of the extensive use of the clients Exchange and Pegasus Mail.

Logging of e-mails

The logging of e-mails gives information about the e-mail traffic. On the base of logging one may monitor the most popular mailing lists the activity of users and so on. The number of outgoing e-mails is not the same as the number of e-mails sent by the users of the server because of the mailgateway function. Note here that the e-mail traffic of the server is sum of its users mailing and the e-mail traffic some other servers. The e-mail traffic of the University is larger then the traffic of this server because there are servers not using the Tigris as mailgateway. The public domain message transport system called Message Exchange 4.2 is taking the responsibility for the mailing function of Tigris. It is familiar with several protocols as SMTP, NJE, UUCP and so on. As the gateway it is used to carry out necessary protocol conversion if it necessary. It is reliable and is running for several months without any problems. In 1996 two protocols were used by Tigris for transferring mails

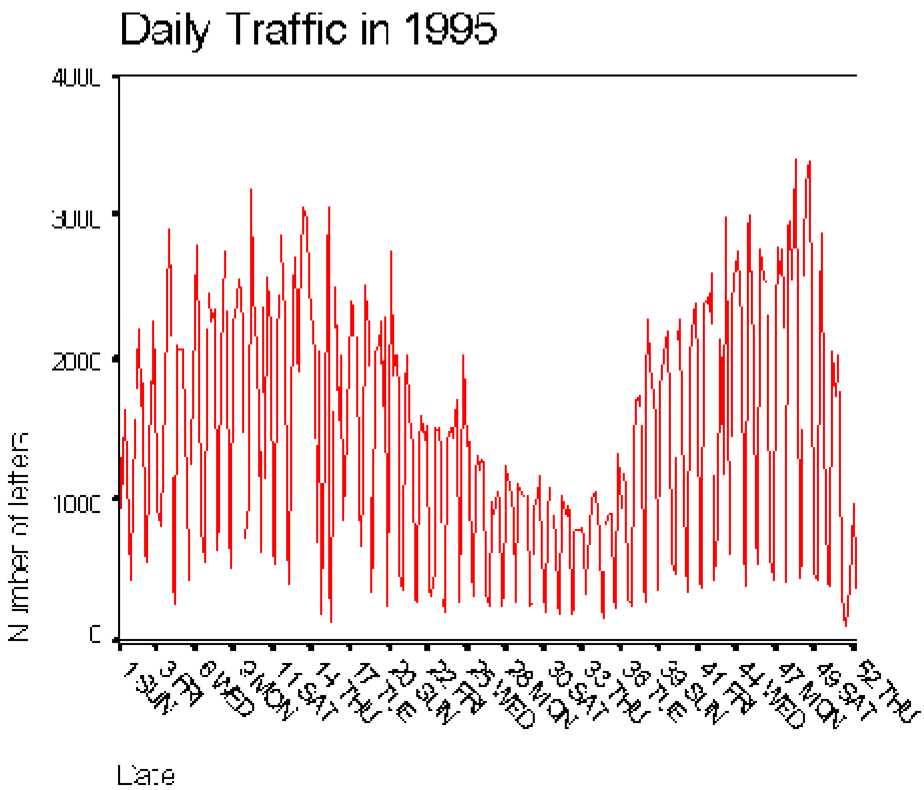
- SMTP: Simple Mail Transfer Protocol for TCP/IP and
- LOCAL one for local users.

During logging several data are recorded according to the protocols. The choice of data to be recorded is depending on the postmaster. In our case the data are collected by the following table.

Protocol	SOURCE	HOST	USER	SENT	SIZE	DATE	TIME
LOCAL	+	-	+	-	+	+	+
SMTP	+	+	-	+	+	+	+

The agents of MX are registering the data of an e-mail when it leaves the MX-queue. The only outgoing mails are logged so every mail is logged once. The logged data are transferred to an Oracle data base V7 and tables are made by SQL questioning. The MX system was installed in 1994 therefore the time series of daily traffic of the Tigris available for three years 1994, 1996 and 1996. The data are analyzed by the help of MS Excel and SPSS using standard methods of time series.

The following figure shows the daily traffic in 1995 the number of letters are plotted against days.

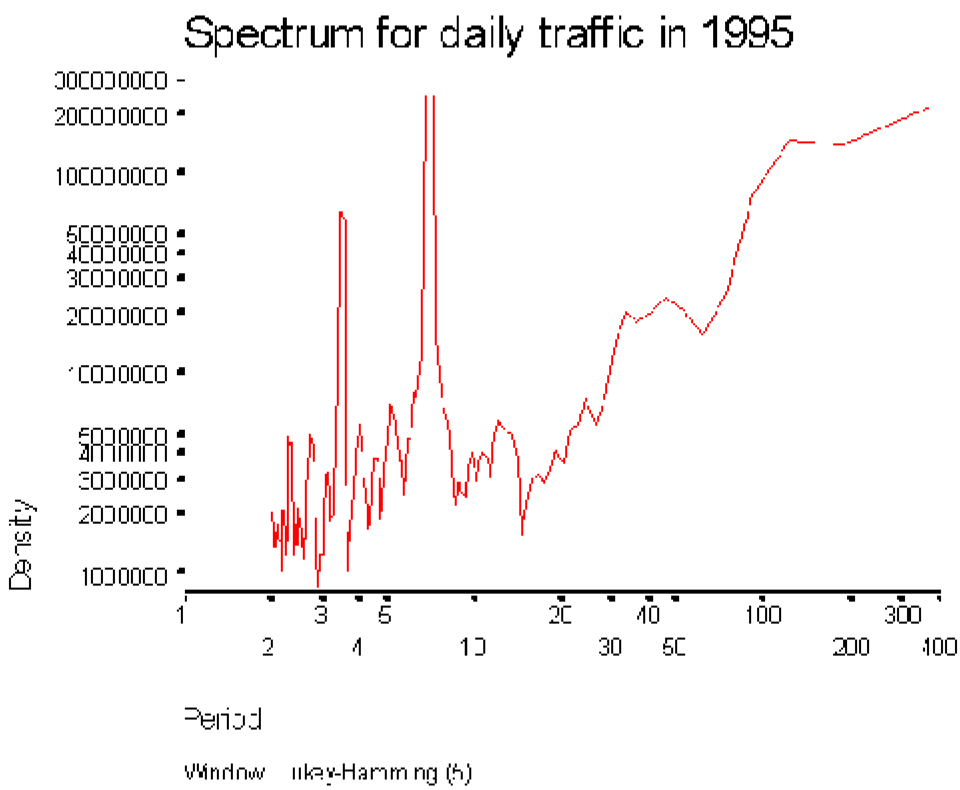


One may realize the increasing number of letters at the beginning and decreasing by the end of the semesters. It is a pity that there is no period by semesters because of the difference in the length of the winter and summer holidays.

We summarizing the e-mail traffic by years and by protocols. In 1994 Bitnet SMTP and DECnet SMTP was also running. It is seen that there is not too much difference between the average size of the letters. The first step of the statistical analysis was preliminary transformation to get rid of outliers. The cause of outlier data is the problems with network, server and mailing system. The outliers was changed by a regression method using the data neighboring it.

The number of letters increasing of cause and maximal value is decreasing it is because the stability of the leased line and the mailing system became better and better. The minimal value in 1996 was 37 showing that practically there was no fault in the delivery.

For the detection of periods the estimated and smoothed spectrum is considered.



The figure above contains the plot of the spectrum for the time series of the daily traffic in 1995. The values of the spectrum, i. e. the spectral density is plotted versus periods in days. It has a high peak at 7 which means not surprisingly that there is a weakly period.

The table of the descriptives statistics concerning to the seven day period shows that the working days in each year are significantly different form the holidays, the minimum p-value is 0.4. The means of the working days traffic are different nevertheless theses difference are not significant. This is the case for the holidays as well. It was checked by t-test.

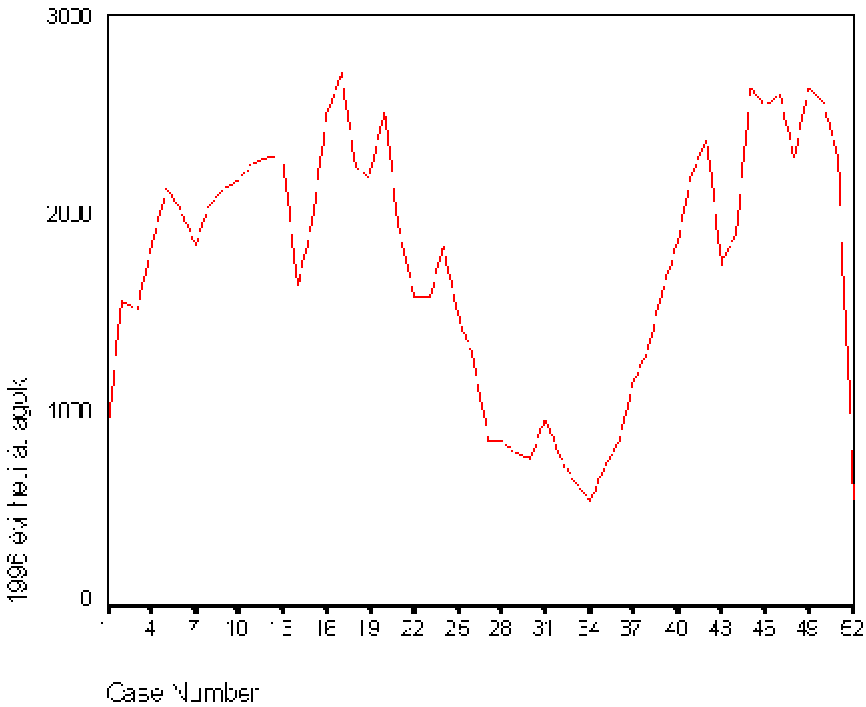
The time series of the weakly averages does not contain the period any more and allows us to make further analysis. The correlation between the time series of 1994, 1995 and 1995 was calculated. The data of 1994 proved to be independent from both series of 1995 and of 1996. Therefore the base of the decision about trend in the series of weakly averages was the years 1995 and 1996. The question is whether the series contains trend i.e. Y_t can be put into the form

$$y_t = a + bt + \varepsilon_t$$

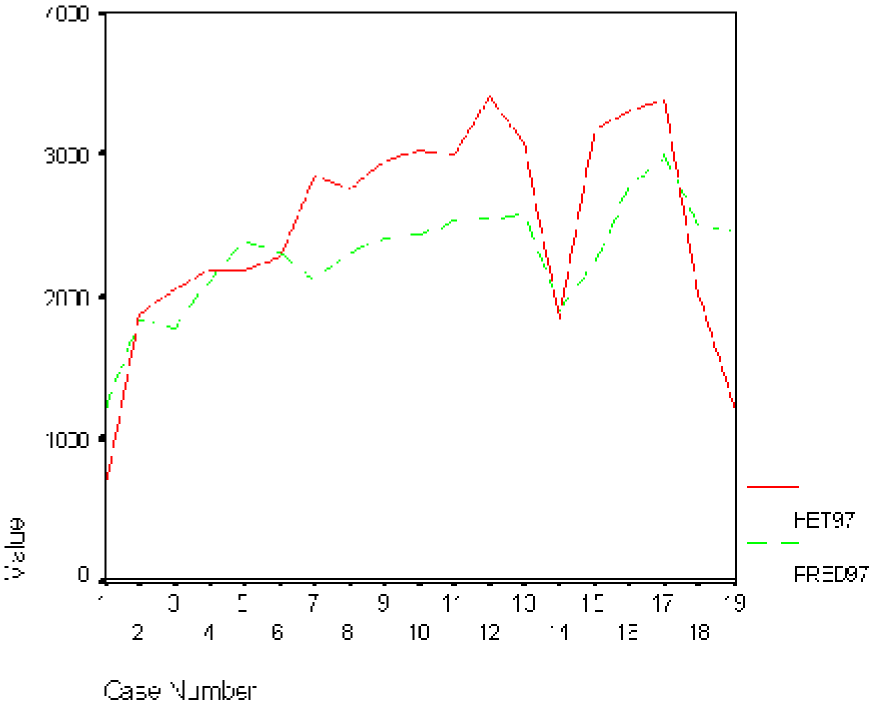
Testing the hypothesis b=0 we differentiated the series once

$$y_{t+1} - y_t = b + \varepsilon_{t+1} - \varepsilon_t$$

and used the one sample t-test for testing $H_0 : b = 0$. The estimated value for b is 3,8 -with 2-tailed p-value 0,94 therefore there is no reason to assume that there is any trend around.



Now we are in the position to predict the weakly average series in 1997.



Denote X_t the traffic in 96 and $\hat{Z}_t$ the prediction for 97. It is calculated by the formula

$$\hat{Z}_t = X_t + a$$

, t=1,2,....,52

where a = 279,5. The measured and the predicted values for the first 19 weeks is plotted above.

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Center for Informatics and Computing,
Lajos Kossuth University of Debrecen,
4010 Debrecen, Pf. 58, Hungary
E-mail: terdik(at)cic.klte.hu, perdosi(at)cic.klte.hu

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Ref: 022810

AMNET: Experience of use in researches and training

[1]C. Gaindric, [2]G.Secrieru

Always, the information is key moment in activity both of scientific and other structures of society, and of individuals. The modern representation of the information was expanded on the basis of computer technologies from simple textual messages up to complex structured documents of formalized data. The search of the necessary information is the beginning of the beginnings when any problem has to be solved. Now anybody can find the interesting information not rising from the computer, connected to the network. This complex organization of computers, networks and people has become quite accessible and in this the major role belongs to a global information network Internet.

The activity of any organization represents complex internal and external interrelations, inducing appropriate information flows. The information is understood as scientific- technical and socio-economical process of optimum conditions creation for satisfaction of information needs of all the structures of the society on the basis of organization of information systems with advanced infrastructure on the basis of perspective and flexible information technologies. Under these conditions a role of information as unique and unlimited resource, being simultaneously raw material and result of labor of the person, increases considerably.

The problems of development of telecommunications in Moldova are very important for maintenance of informational support of scientific researches and integration into European and world community. In the present report a real situation and development of an infrastructure of the information system of the Academy of Sciences of Moldova (ASM) is considered, on the basis of which the essential new approaches of international scientific cooperation, promoting improvement of a situation of the academic society, the development of professional direct connections, interpenetration of ideas and exchange by experience can be developed.

Now ASM consists of research institutes and centers, in which more than 4000 persons, including more than 1000 scientific employees, work. The fundamental and applied scientific researches cover many directions of humanitarian and natural sciences. Simultaneously ASM is the coordinator of a science of Universities of Moldova.

The achievement of a high level of researches assumes operative access to scientific publications, databases and other information, together with intensive exchange of the information and close coordination between scientists and experts, both inside the country, and with other various countries. In this connection the main problems of the ASM on support of information maintenance of fundamental and applied researches are:

- development of an infrastructure of information system of ASM and creation of conditions for access to the Internet and other global networks information resources;
- preparation and raising the level of skill of the staff in the field of effective utilization of new information computer technologies.

In order to solve these problems in 1995-96 years the creation of an academic information computer network AMNET connected with Internet is begun thanks to the financial and technical support of NATO, UNESCO, SOROS and EURASIA funds. Creation of such corporative information systems claims the availability of flexible and reliable network organism. The system engineering, with help of which the problems of access to information are solved includes the following main directions:

- creation of system of the complete solution for Internet/ Intranet;
- maintenance of universal access to all types of the information;
- development of means and methods of automation of research process.

The modern telecommunications infrastructure of the ASM is oriented to application of high-speed communication channels (cable and radiochannels), communication servers in separate buildings of the ASM, information servers and databases servers, to which Local Area Network (LAN) of institutes and separate workstations are connected. This permits to create an advanced network of telecommunications AMNET, and to grant to a wide range of the users in the Academy and other organizations modern telecommunication information services: E-mail, ftp, Telnet, World Wide Web (WWW), access to databases, remote training and raising the level of skill. The arrangement of the communication servers of a network AMNET is based on building principle, which has the following characteristics:

- necessity of connection of a plenty LAN (20 and more LAN);
- significant number of workstations in network;
- necessity of cover by a network of territory of the significant urban area (maximum distance 15-20 km).

As a rule in one building several institutes and establishments with different intensity of users work with means of telecommunications are located. On Fig.1. the topology of a network AMNET is shown, which interacts with Internet through head knot, situated in the Computer Center (CC), having 64 Kbps satellite channel connection with the network MOLDNET.

The network MOLDNET created under project of Soros fund, provides for ASM and leading universities (Moldova's state university, Moldova's technical university, Academy of economic studies), connection to Internet on 64 Kbps satellite channel, which can be increased up to 128 Kbps. This channel connects central unit of a network MOLDNET to unit of a network European Backbone in Stocholm (Sweden),

The AMNET Network Infrastructure

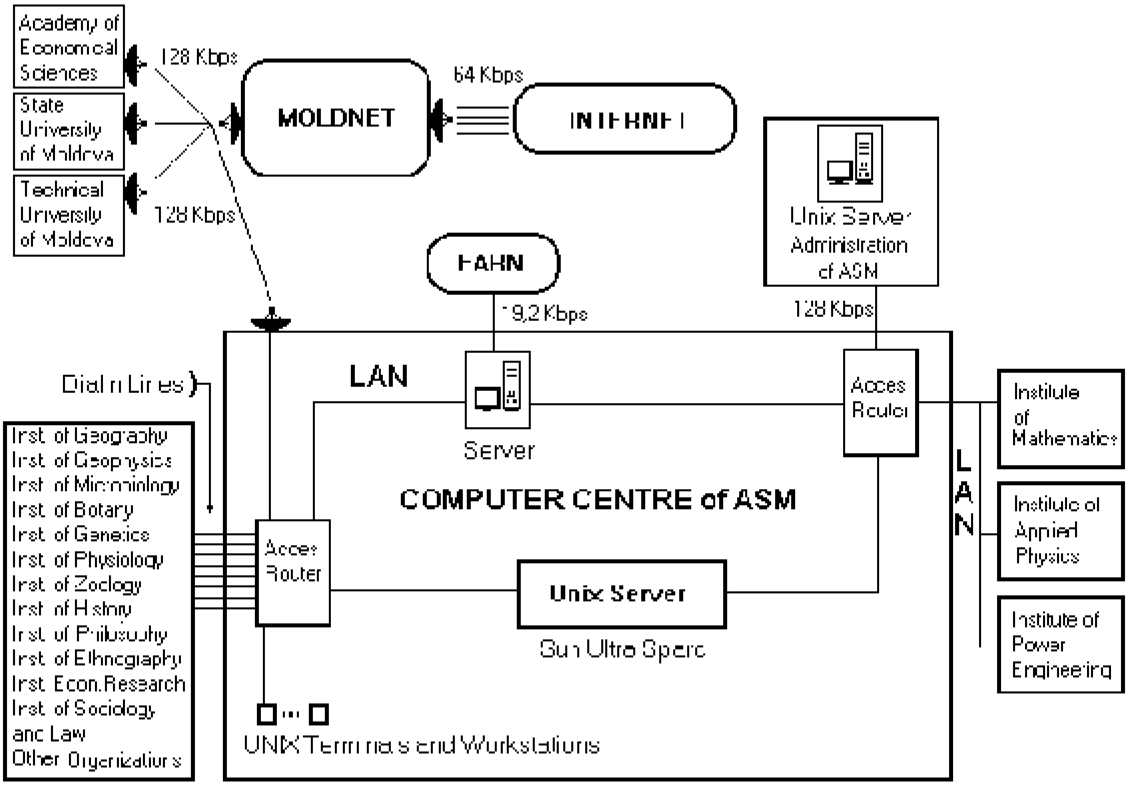


Fig. 1

being part of a network Internet. Taking into account, that the use of radiomeans for data transfer is one of perspective directions of development of telecommunications means in city the connection of central unit of a network MOLDNET with ASM and universities is carried out with use of radiomodems with data transfer speed 128 Kbps.

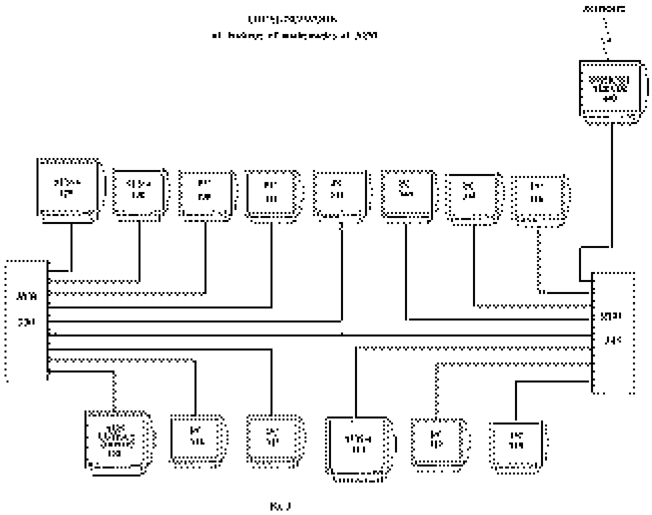
The central information servers and databases servers are organized on the basis of computers of a type SUN Ultra Sparc and Sun SparcStation 5, located in CC and granted by NATO.

Both dedicated, and switched channels are used for connection of various fragments of a network AMNET in one telecommunication infrastructure. On the main directions of the network (connection between buildings) the dedicated channels with speed 19200 bps are used and in the long term the optical and radiochannels will be used. On user's directions are used both as dedicated, as nondedicated channels with speed from 14400 up to 19200 bps. The network organizational infrastructure bases on the use of modems, routers and other communication equipment of the known firms Cisco, Telebit, ZyXEL and other leading manufacturers of such systems.

The workstations of Institutes are united in LAN, which are connected to communication servers of the building. The Ethernet cards, coaxial cable, twisted pair and other components, ensuring on some segments of the network the speed 10 Mbps are used for this purpose.

More than 50 workstations and local network of the Institute of Mathematics (MATNET) are now supported, which cover more than 700 users. On Fig.2. A network MATNET, created within the framework of project " Creation of Educational research in Computer science " (IIP UNESCO) is shown, which is the base for realization of joint researches of the specialists of the Institute and teir colleagues from the universities of Moldova and from other countries (virtual laboratory), for post-graduate students training, teaching of talented students and schoolchildren the computer

science bases. Researches in such areas, as expert systems of new generation, designing and development of the software, natural language processing, decision support systems are elaborated.



The work in Internet is influenced by some factors:

- the capacity of the satellite channel;
- the quantity of telephone numbers and quality of telephone lines;
- the speed data transfer by modems;
- the number of the users and time of day;
- the distance from an information source.

The network AMNET is created to be used by various scientific and educational organizations of Moldova. Separate workstations and LAN of institutes and organizations are connected to the network. The connection of the user is provided by a complex of services dealing with communication, adjustment, connection and training of the users. In the network services, the installation of equipment and software connection to a network on dedicated and non-dedicated lines are stipulated.

The faculty of computer sciences of the ASM carries out training of the specialists to bases of computer science and use of modern information technologies, ensuring a new level of researches and of development. More than 130 post-graduated students, researchers and specialists from institutes of the ASM and other organizations of republic trained are annually.

The main kinds of services offered in network AMNET include: E-mail, ftp, telnet, usenet and WWW. The Web of CC is created, which has the following address: http://acad.moldnet.md

However, each psychological group of the researchers has, frequently completely, various sights on world: physicists, biologists, humanitists. Therefore when separate WWW pages are created it is necessary to take into account the special sight of the future audience: the contents, design, convenience of work with documents given on server and so on. But if to generalize all these approaches, it is possible to make a conclusion, that server to which frequently address is considered to be good server.

The development of modern computer technologies opens the whole world of new applications, strengthens the process of integration of Moldova in international scientific and information community, accelerates gradual transition to information society. The special attention is paid to questions of organization of training and raising the level of skill of the users, including methods of remote training. It permits to realize the policy of Upgrade for those institutes and working groups, which already have sufficient experience of use of network technologies and Internet resources, taking into account that Internet is possible to consider as "society" with own convictions, traditions and rules of behavior, which is necessary to be taken into consideration. If institutes of a humanitarian structure only begin to join to new technology, the Institute of mathematics, Institute of Applied Physics, Institute of Chemistry and other have sharply increased number of the scientists and researchers, which want to work in now already open libraries and to use Internet resources. E-mail and on-line are the mostly used services.

The application of new information technologies in all spheres of activity forces us to pay close attention to opportunity of their use at all stages of development of a science, social and economic reforms, becoming characteristic feature of our time.

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[1] Institute of Mathematics of MAS
[2]Computer Center of MAS
Academy of Sciences of Moldova
Academy str. 5, MD-2028, Kishinev, Moldova
gaindr(at)mathem.moldova.su, secrieru(at)cc.acad.md

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TEN-34 CZ-- High Speed ATM Network at Czech Republic

Ludek Matyska

Introduction

Not unlike in the USA, the nation wide computer network infrastructure of the Czech Republic was founded and built by universities and other academic institutes. While the first lines connecting Prague, Brno, and Bratislava were provided as an off-spring of the IBM Academic Initiative of 1990, the universities, financially supported by the Ministry of Education soon established an informal consortium under the name of CESNET (Czech Educational and Scientific NETwork) which took care of the Internet connectivity of gradually all 23 Czech universities. Since the last year, the intercity connections were based on leased lines (lend from IBM and SPT Telecom, and later on using microwave links from Czech Radiocommunications) with capacity ranging between 64kb/s to 2Mb/s (between Prague and Brno). This must be compared with the much higher throughput of local and especially metropolitan area networks, where FDDI (at 100Mb/s) or even ATM on 155Mb/s were already used. The largest metropolitan networks of Prague and Brno were both using fibre optic (leased at Prague, owned by Masaryk university Technical university in Brno) and gradually upgraded the whole MANs from 64kb/s metalic leased lines through 10Mb/s Ethernet to 155Mb/s ATM.

In the last year, under the pressure of inevitable changes in the ministerial financing policy the CESNET transformed from an informal consortium to a legal body. The company is fully owned by universities and Academy of Sciences (they all have a kind of share relative to their annual subscription) and it is a non-profit organization whose primary goal is to provide infrastructure for academic community of the Czech Republic. To some extent CESNET is also providing usual Internet services to commercial customers.

Through the CESNET liaison Czech Republic was an active member of initial stages of the pan-European high speed networking project, the TEN-34, Trans-European scientific Network (as a parallel infrastructure to the Americas' 45Mb/s lines). It was not possible for CESNET to proceed further the initial stage as joining the TEN-34 project required an existence of national high speed network (operating at 34Mb/s at least), a commitment from the telecommunication operator and an appropriate financial budget. This all was beyond the that time Czech republic (and CESNET) capabilities. However, the steps initiated by the European Union had their influence on the Czech government as well, and it launched the TEN-34 CZ program at Spring 1996.

TEN-34 CZ program

This program was officially supervised by the Ministry of Education and it had two parts:

1. To build a national high speed network connected via an appropriate link to the trans-european high speed backbone.
2. To support research projects requiring and utilizing the high bandwidth.

While there were 33 projects submitted in the second category, the first one was covered by just one proposer--the CESNET company. After some hesitation, which was primary caused by the fact that no else decided to submit a project in the first category, and which postponed the start of the project till October 1996, Ministry of Education accepted the proposal and gave the project realization to CESNET. This have started the era of high speed nationwide academic backbone in the Czech Republic.

A total of 16 projects were accepted in the second category, with different subjects belonging roughly to the following categories:

- The remote access to high performance computing facilities, including the trial to use them synchronized for large scale distributed computing. A representative of these projects is the META Center project, presented at this conference [1].
- The videoconferencing, telepresence and teleworking.
- Web-based multimedia storage and retrieval systems, both for research and educational activities.

The final decision to support the projects was taken in October, 1996, when the Minister of Education signed the projects' acceptance.

TEN-34 CZ infrastructure

The primary goal of the TEN-34 CZ program was to build the national high speed computer network and to connect it directly to the TEN-34 European backbone.

While six companies took part in the initial CESNET tender for the intercity lines provider, only the proposal from Czech Radiocommunication was acceptable. The Czech national telecommunication operator, SPT Telecom, took part in the bid, but offered lines with just 2Mb/s at the usual commercial price (without any reductions). The Czech Radiocommunications offered leased microwave lines for 34Mb/s with the promise for 155Mb/s lines in 1997 (if requested in advance). As there was very good experience with their 2Mb/s lines, the challenge was taken to be part of the research and development nature of the whole project and the TEN-34 CZ backbone is built on top of microwave lines. The lease conditions require that there is no transfer error during 72 hour period before the line is accepted.

The initial international connectivity was provided by SPT Telecom, because there was no other possibility. However, as SPT Telecom offers only 2Mb/s lines and the TEN-34 backbone requires at least 10Mb/s for the national link, two 2Mb/s lines were leased for the first half of the year 1997. They connect Prague with Munich and Stockholm European Internet crossroads. The new tender for international connectivity, which will join Prague with the TEN-34 point of presence at Frankfurt am Main, was won by Global One, the consortium of German Telecom, France Telecom, and Sprint. While they offered full 34Mb/s fiber optic based leased line, just 10Mb/s will be used, the remaining capacity being free for some experiments and/or for direct transatlantic link.

The national TEN-34 CZ backbone connects metropolitan area networks in nine cities, covering thus a substantial majority of all the universities in Czech Republic. The MANs connected are operated by individual universities or their consortia and in this way the whole TEN-34 CZ network is directly or indirectly operated (and mostly also owned) by Czech universities. The cities connected are Prague, Brno, Ceské Budejovice, Hradec Králové, Liberec, Olomouc, Ostrava, Plzen and Pardubice. The largest MANs, located in Prague and Brno, are already running on up to 155Mb/s, but the smaller MANs and university networks are close behind them (some running FDDI rings, other upgrading gradually to ATM on 155Mb/s; at Liberec two main switches are already connected by a 622Mb/s ATM link).

Technical realization

The TEN-34 CZ is realized as a pure ATM network with IP services on top of it. The TEN-34 CZ backbone connects the above mentioned cities and each connection point is equipped by one ATM switch and one ATM router. All the switches and routers are provided by CISCO systems, the TEN-34 CZ uses CISCO Lightstream 1010 ATM switches and the CISCO 7500 series ATM routers. Each switch is equipped with at least one E3 link, connecting it to the radiowave backbone, and at least two OC-3 (155Mb/s) links, one to the router and the second one connecting the TEN-34 CZ backbone to the metropolitan (local) area network. The routers primary serve as virtual LAN routers, but they are also providing a connection point for the local FDDI rings (as, e.g., at Ceské Budejovice or Plzen) and they usually have several Ethernet ports as well for diagnostic, maintenance and experimental purposes.

Although ATM is its primary interconnection protocol, currently only IP services are provided by the TEN-34 CZ network. The primary protocols are LANE version 1.0 with SSR (Simple Server redundancy, the enhancement implemented by CISCO), classical IP (as specified by RFC 1577) and RFC 1483. The TEN-34 CZ backbone routers use PNNI Phase I dynamic routing with support for quality of services. The same signalling protocol is used by some of the metropolitan area network routers connecting these MANs to the TEN-34 CZ backbone. The remaining MANs use IISP static routing, which is redistributed to PNNI.

One of the most serious problems in building the TEN-34 CZ network was the separation of the pure academic network traffic from the commercial traffic of companies using CESNET as their Internet provider. The TEN-34 CZ project is a purely academic undertaking and, according to the rules, no commercial traffic may use TEN-34 links for transit. While the TEN-34 CZ backbone is built as a parallel network to the already existing CESNET intercity infrastructure, metropolitan area networks were used to transfer both academic and commercial traffic. Two basic approaches were implemented:

- The MAN was ``purified'', i.e., the academic and commercial traffic use different physical lines. The lines with non-academic traffic are connected to the original CESNET backbone, while the academic (TEN-34 compliant) lines are connected both to the original and the new TEN-34 CZ backbone. This is the preferred realization.
- The MAN uses virtual LAN technology to logically (although not physically) separate academic and non-academic traffic. Special internal routing policy is adopted in these cases, with ``policy routing'' (where the routes are selected with respected to the originating address) and selective redistribution of OSPF/EIGRP routing information to avoid commercial packet transit through the TEN-34 CZ backbone. A non negligible increase in router load was observed by the use of policy routing (a 20% load increase is not uncommon), and the tables needs a lot of maintenance to work properly.

The original CESNET intercity infrastructure is used as a ``backup'' of the TEN-34 CZ backbone. All MANs (or, more precisely, all the academic parts of MANs) are connected to two autonomous systems: the TEN-34 CZ backbone and the original CESNET backbone. The commercial parts may use only the original CESNET backbone. Both backbones use the OSPFv2 routing protocol.

While MANs usually provide connectivity for both the academic and non-academic users, they are not used for transfer between the TEN-34 CZ and Internet. There is only one peering place between original CESNET and TEN-34 CZ networks, at the CESNET headquarters in Prague. The OSPF and ``backdoor'' BGP protocols are used for this purpose. The dual connectivity of MANs is used for TEN-34 CZ backup only.

Use

The whole TEN-34 CZ backbone serves two main purposes: (i) providing an appropriate high speed infrastructure for research projects and (ii) providing a high speed academic interconnect. Internally, the TEN-34 CZ network is also used to test new up-to-date information technology in slightly unusual conditions: (i) pure ATM over radiowave links on E3 (with planned increase to

OC-3 in 1998 for the Prague-Brno link), (ii) the use of QoS in a mostly IP over ATM environment.

Due to the lack of interest from the national teleoperator, the whole TEN-34 CZ infrastructure is in fact operated by the academic company CESNET. There are plans to use this unique situation for experiments with dynamic bandwidth management and allocation, with the aim to combine the "best effort'' services of the classical Internet IP protocol with the new more advanced possibilities provided by ATM networks. A part of the total capacity will probably be used for www caches and ftp mirroring services, while the rest will be divided between the "usual'' (unspecified) academic traffic (using UBR and/or ABR) and dedicated "links'' for the individual scientific experiments (videoconferences, wide area distributed computing[1], telework, vizualization, ...). It is expected that experience on dynamic bandwidth splitting and allocation gained during this "experimental'' stage will be used as a basis of future academic infrastructure management.

As already mentioned, the TEN-34 CZ program encompasses not only the infrastructure building, but its use as well. These ``pilot'' projects will test the feasibility of adopted infrastructure implementation while opening to researchers an easy access to the high speed network. These projects may be also seen as forerunners for the rest of academic community, serving as examples of potential advantage of high speed interconnects.

Conclusion

The TEN-34 CZ project is a part of a trans-european activity to increase the general network throughput on both the national and international levels. The backbone was officially ``opened'' on June 17th in Prague in the presence of representatives of government and Parliament of the Czech republic. The backbone uses E3 radiowave transmitted links, with pure ATM and IP over ATM as the primary services. The whole backbone, which connects nine cities in the Czech republic, is operated by CESNET, a non-profit company founded and fully owned by Czech universities and Academy of Sciences. The TEN-34 CZ is fully financially supported by a three year grant from Ministry of Education.

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Faculty of Informatics and Institute of Computer Science,
Masaryk University, Botanická 68a, 602 00 Brno, Czech Republic
E-mail: ludek(at)ics.muni.cz

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TUM-Net: an Internet/Intranet Project

Veacheslav Sidorenco

Abstract

The background, main objectives, topological particularities, troubles and problems of TUM-Net Project as the University Area Network at Technical University of Moldova are presented.

Technical University of Moldova.

Technical University of Moldova (TUM) is a single technical high education unit of the New Independent State (NIS): Republic of Moldova. During all the period of its history Moldova, been geographically placed between Romania and Ukraine, continue to exists as a basic agriculture-oriented country, having significantly old and traditional wine-making infrastructure and foods industry. During last years of its development Moldovan national economy has been redirected toward modern electronic devices and apparatus industry, microelectronics, industrial and civil building, energetic. In order to cover the needs of various branches of growing national economy in specialists of engineering-oriented profiles TUM is preparing a wide range of scientific and technically skilled people having the technological, energetical, mechanical, radioelectronical, electrotechnical, civil and industrial building, architectural and other knowledge. Great attention is paid now to prepare specialists ready to work in the conditions of free market relations. This is because a number of new specialities include new subjects related to economical aspects of engineering: management, marketing, business etc.

TUM is placed in Chisinau, the green and picturesque capital city of Moldova Republic. Before 1993 TUM has the name and the state of Polytechnic Institute of Chisinau. The campus of TUM is divided into next four regions, displaced in different parts of Chisinau:

- Northern - placed at the northern periphery of Chisinau and formed from relatively new modern buildings. This part is planned to become main TUM place.
- Western - placed in the old building in western part of Chisinau's centre and been main administrative establishment of TUM.
- Central - placed also in an old building in the centre of Chisinau.
- Southern - placed in a new microregion of south part of Chishinau.

The development of integrated information service for all regions of TUM becomes an acute problem and real up to date necessity.

Current state of information services

Computer and information systems (CIS) used at TUM must be studied from both historical and economical points of view. Polytechnic Institute of Chisinau was formed, mainly developed and equipped during historical period of Moldavian Soviet Socialist Republic as part of former USSR (1944-1990). During last period of Moldovan independence governmental support of TUM's technical infrastructure development significantly decreased in amount and now is practically stopped. The current state of CIS at TUM can be characterised by:

- old and very old computers used, great part of which been produced in exUSSR as copies of IBM/XT's clones: ISKRA-1030, NEIRON I9-66, ES-1840/41; or DEC's LSI-11 clones: ELECTRONICA-60, 85. Another part has been built by second PC/XT/AT producers from Asian states (China, Taiwan and other). Such kind of computers cannot be used for modern Windows-oriented software packages.
- the absence of mainframes and powerful servers/workstations platforms. The biggest machine is SM-1420 (very old Soviet copy of DEC's PDP-11 mini-machine);
- very insufficient quantity of computers used: every PC is extracharged by collective form of personal computers using with strong time scheduling and queuing. A very hard task consists in providing of individual students work;
- mostly stand alone using of computers without any kind of networking;
- significantly far distance displacement of faculties: Northern, Central and Southern TUM's regions resides at the distances of 2 to 6 km one from another without any kind of electronic data communications;
- lack of sufficient Internet connectivity for mass teaching, learning and individual using by students and staff. The first Internet connection was made by "utm.md " domain via Moldavian/Romanian branch of European Academic and Research Network (MD/ROEARN - "mdearn.cri.md") based on the very slow coaxial cable connection between Moldova and Romania

at only 9.6 Kbps. This branch is used only for dial-up e-mail service and cannot serve for serious web online browsing [1].

The main impacts of computer and information systems used at TUM are caused by next external factors:

- difficult economic situation of Moldova's transition period as a tiny independent state;
- extremely small state budget allocations invested year-by-year in all education's branches;
- practical impossibility to allocate budget for technical information service improvement and modern reequipment of higher education;
- impossibility to get help from the Moldovan state industry, which is also in serious economic troubles.
- practical absence of new private industry, interested in making investigations in and/or support of technical higher education in Moldova;
- near-to-zero presence of powerful Western Europe and USA industry collaboration with Moldova's economical infrastructure due to inconvenient conditions for foreign investors;
- very small support from higher education units of developed countries due to consequence of political insulation of Moldova as part of exUSSR in past and informational and economical insulation of Moldovan education from the rest of the educational world at present;
- main activity of foreign foundations in Moldova capable to support education needs are not oriented toward helping technical education development. Their programs include support only for language, art, culture, and journalistic projects, which are also important but not directly for TUM.

Networking: TUM-Net Project

Partial solving of the above mentioned problems is planned to be made by a series of consequential CIS improvement projects and, first of all, by the TUM-Net project, which has next main architecture, hardware and functionality subjects of tasks:

increasing of the number and the diversity of computers used. The equipment of every faculty becomes to be on the responsibility of faculty's deans, their adjunct staff and chiefs of education departments.

local integration of computing resources via building of local area computer subnetworks for teaching, library and administrative purposes. Local area networks must be preferably made on the base of Intranet conceptions in order to be easily and natur ally connected to Internet resources when the conditions of their availability will become reality. From this point of view, all local servers are planned to be equipped by computers, capable to run Microsoft Windows NT (Open NT for UNIX applications) operating system as most appropriate and fast growing modern Intranet/Internet platform, supporting TCP/IP protocols.

integration of local area distributed information system's resources of TUM into University Area / Metropolitan Area Network (UAN/MAN). In order to implement this task a number of information transport channels is need to be built/leased. On the first stage of project conventional copper telephone lines are planned to be mounted. On the next stages is planned to improve connectivity by using radiochannels or optical channels. The problem of in-regional and between-regional routing is also planned to be solved on the open architecture platform. On the first stage of TUM-Net project a star-topology of UAN Intranet will be realised.

connection of regional Intranets to Internet accesses points in Moldova. On the star topological schema all links will be concentrated to the MoldNET access point's router placed at the Faculty of Computers, Informatics and Microelectronics.

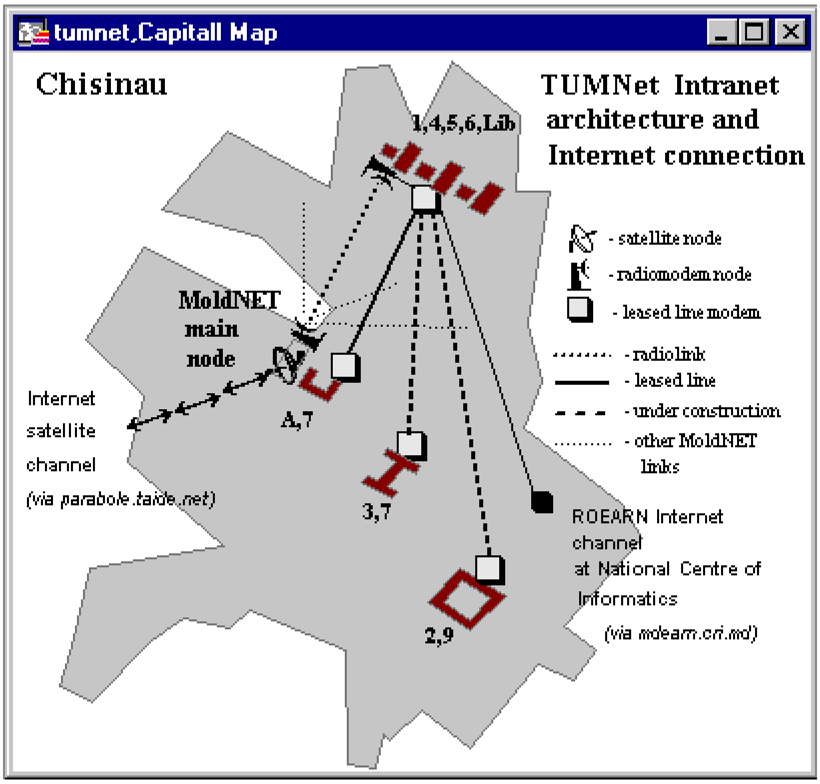
introduction of new Internet-related and Internet technologies based curricula.

The local integration will be made by faculty-level subprojects, implemented on the independent base by computer science specialists from every faculty. The interfaculty integration is expected to be constructed by the team of university-level specialists, using the Moldovan Telecom's leased lines under special agreement.

The most important part of the project: relatively fast Internet connection - is based on the new educational branch of Internet in Moldova: MoldNET - Academic and Research Network of Moldova. This network covers the next IP addresses range: 193.219.21 5.0 - 193.219.215.127. The upper layer of Internet access to MoldNET is ready to be used now and the other parts are under construction. MoldNET creation and maintenance was proposed and supported by Moldovan department of International Soros Foundation (ISF) (having next domains: "moldnet.md", "soros.moldova.su").

The main MoldNET server now is connected via 64 Kbps cosmic satellite line provided by "taide.net" branch with Stockholm's Internet access node. A local switch makes star-distribution of the main satellite line via 128 Kbps radiomodem-based equipment and lines between next end-points in Chisinau city:

- Soros Foundation, Moldova, Open World Society ("moldnet.md" - 193.219.215.18);
- Academy of Sciences of Moldova ("acad.moldnet.md" - 193.219.215.75);
- State University of Moldova ("univ.moldnet.md" - 193.219.215.83);
- Technical University of Moldova ("poli.moldnet.md" - 193.219.215.91);
- Academy of Economical Studies ("econ.moldnet.md" - 193.219.215.99);



On the above figure the general topology of TUM-Net together with the main Internet access nodes are presented. The figure shows that TUM-Net can be characterised by significant territorial distribution of information service resources and clients. It must be viewed and treated as a metropolitan area network (MAN).

Numerical marks, placed near projections of TUM's buildings have next significance:

1. Faculty of Computers, Informatics and Microelectronics
2. Faculty of Industrial Construction
3. Faculty of Energetic
4. Faculty of Light Industry
5. Faculty of Engineering and Management in Machine-Building
6. Faculty of Engineering and Management in Mechanics
7. Faculty of Radioelectronics
8. Faculty of Technology and Management in Food Industry
9. Faculty of Urbanistics and Architecture

A - is main Administrative building of TUM, having the residency of rector and staff service.

Lib - is main TUM's library.

Two of nine faculties support the main responsibility for TUM-Net implementation, management and providing. The first is the Faculty of Computers, Informatics and Microelectronics together with the University Computer Centre, equipped with radiomodem connection node to MoldNET and cable connection node to ROEARN, having powerful HP-UX - based server and star - distribution equipment for TUM-Net connectivity support. The second is the Faculty of Radioelectronics, which is placed in two central regions of TUM, which is responsible for connectivity maintaining tasks and for making practical and laboratory networking students training work.

For today only one ray of TUM-Net star is practically realised and is working: the link between Northern and Western regions is implemented via leased cooper underground line and a pair of external modems. This link is dedicated only for the administrative using by TUM's Rectory Computer Centre LAN and the respective infrastructure. Students and teaching stuff don't have access to above resources. The rest of TUM-Net is under construction now and encounter significant troubles in searching support for leased lines, servers, modems, routing and switching equipment and for financial support of the implementation of this part of project.

Great support can be obtained from IBM Corporation for the Faculty of Radioelectronics, which promised to offer AS/400 machine together with the 15 users places classroom equipment for free in order to make the faculty-level Internet server. Unfortunately, for the long time the sponsorisation for this part of project, concerning the software license purchasing from IBM Corporation cannot be found.

Unit Hengelo Centrum Techniek from ROC Oost-Nederland has supported the Faculty of Radioelectronics by a pair of 28.8 Kbps internal "Bullet" modems, which can be used at the first steps of connectivity establishing between Northern and Central regions of TUM. This throughput is very far from to be enough for the purposes of 2 to 3 LANs Internet providing but is much more than nothing.

Nevertheless TUM-Net project continue to be realised. Now Internet-related subjects has been introduced in the curricula of modern telecommunications studies for the specialities of the Faculty of Radioelectronics and are teached off-line in the frame of

LAN:

- Internet structure, management and services;
- HTML language basics and WWW services programming;
- JAVA programming course (under projection).

In order to improve the efficiency of the TUM-Net management, maintenance and monitoring a Geoinformation System (GIS) based Telecommunication Management Network System is under projection now. The network topology is reflected onto the database of the electronic maps used as background and provided by MapInfo Professional v.4.01 package. Network structure, current states of lines and network elements will be continuously monitored by active distributed network agents (sniffers) [2]. MapInfo Package is also planned to be used for exceptional events signalling and for statistics of network events displaying on the network topology base. It can be notified, that figures of current report was made by means of MapInfo package.

Conclusion

The success of implementation of TUM-Net project as an open window into the infinite world of information is based on the efforts and enthusiasm of future users and is highly conditioned by the possibility to get real international help and assistance. And the role of EUNIS as experience exchange and international collaboration organisation is expected to be very fruitful on this road.

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Technical University of Moldova, Stefan cel Mare 168, 2004 Chisinau, Moldova
e-mail: svv(at)cinf.usm.md
http://www.geocities.com/CapeCanaveral/7656/

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Grenoble Network Initiative (GNI) : un environnement pour le développement des TIC.

Gérald DULAC

Je salue les membres d'Eunis et je leur souhaite un grand succès pour ce congrès Eunis 97 à Grenoble.

Tous ceux qui s'expriment sur le développement des technologies de l'information et de la communication citent toujours la formation comme une des premières priorités à investir.

Le succès que je souhaite à Eunis est donc nécessaire pour répondre à cette priorité : quelle responsabilité!

Il ne se passe pas une semaine sans que paraisse en France, un livre, plusieurs articles qui réclament une mobilisation en faveur des TIC.

Ces analyses, par un mimétisme commode, convergent souvent : ce serait la faute du minitel (alors que la fonction kiosque est géniale), ce serait la faute de nos élites (ben voyons, c'est bien connu ce sont eux qui font évoluer la France), ce serait parce que les français ont peur d'entrer dans la société post industrielle (dans les années 80 on nous a fait déjà le coup du secteur des finances plus important que l'industrie).

Et si le graal était ailleurs. Et si le graal était simplement d'analyser les freins, de les résoudre en se donnant des objectifs de moyens.

Et si nous tentions d'approcher la situation par les problèmes plutôt que par des solutions.

A Grenoble nous avons choisi la voie du travail collectif, du travail coopératif pour aborder cette question du développement des TIC.

Cela se passe au sein de Grenoble Network Initiative. Je ne saurais que vous inciter à taper immédiatement www.gni.fr.

Lors de ma conférence je vous expliquerais les trois phases que nous avons vécu à GNI et celle que nous devrions vivre sous peu.

Revenons aux freins et aux problèmes.

- Tout d'abord la question philosophique : mondialisation ; remise en cause des Etats-nation démocratiques ; érosion et parfois destruction brutale de cultures pour citer Philippe Engelhard.
- Ensuite la question sociale : risques d'exclusion culturelle, d'emploi, confusions entre les demandes ultra libérales et les libertaires.
- Enfin la question des coûts : le paiement à la durée n'est-il pas vraiment le frein?

En posant la problématique des TIC comme cela on aborde la situation radicalement différemment.

Il faut créer de la compétence et faire naître des médiateurs (et notamment dans le domaine de la formation), d'abord pour ne pas dire n'importe quoi et ensuite pour créer des expérimentations communes qui font avancer tous les intéressés.

Il faut créer des lieux d'accès qui éliminent le risque de l'élitisme que, pour la grande majorité d'entre nous, nous n'acceptons pas.

Il faut se mobiliser pour que se créent des infrastructures de communications flexibles, à coût forfaitaire pour tirer le réseau et je cite Jean Pierre Verjus président scientifique de GNI << vers le haut (le numérique à fort débit) et vers le large (la majorité des gens) >>.

Enfin il faut se faire une vision partagée de cette société de l'information, en y entrant dedans mais en ne jetant pas aux orties notre histoire et nos valeurs.

Voilà le travail de GNI, il est ambitieux.

Ce n'est donc pas un hasard si c'est à Grenoble qu'est partie l'initiative de la création de la section française de l'ISOC, si il y a environ 10% de la population de l'agglomération qui est connectée à Internet.

Il me tarde de vous expliquer cela.

Il me tarde aussi de vous dire comment nous espérons développer encore plus l'utilisation d'Internet dans le secteur de la formation des écoles primaires à l'Université.

Il me tarde aussi de vous dire notre mobilisation pour faciliter le développement et la création de P.M.E. sur ce secteur des TIC.

Président de GNI, Adjoint au Maire de Grenoble
Vice-président de la Communauté de Communes
de l'agglomération grenobloise.

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The Electronic Library

Päivi Kytömäki

1. Change in publishing - Web publishing

Library collection development policy has always aimed at maintaining physically accessible collections that are as extensive and comprehensive as possible. Now the Internet and electronic publishing are revolutionizing the library world to such an extent that the earlier collection development policy and the division of labour agreed within its framework no longer work. We still collect printed materials in our libraries, but they have now been joined by electronic (digital) publications, such as books (with hypertext links), periodicals and databases.

Bibliographic CD-ROM databases have for long been used in libraries either locally or through intranets. Now they can also be accessed via the Internet, as well. The number of electronic journals is growing rapidly. Some of the journals are back issues digitized by the university libraries. Some are published only in the Internet, and they are not at least for the time being considered proper quality journals. Their attractiveness has a lot to do with their multimedia properties, such as hypertext links and 3D images. Their continuity is in doubt, however. The rest of the journals have parallel printed and electronic editions coming out simultaneously. Most of these are refereed journals renowned for their quality. This group is without doubt the most important, since the printed versions are so well-known and frequently used. Among the publishers of the latter type of journal are for example the American Mathematical Society, Academic Press, Springer and the Institute of Physics Publishing. Periodicals are the type of publication that is estimated to grow most quickly in the Internet. In 1995 it was estimated that there were 115 periodicals available on the Internet in the fields of medicine, technology and science (1). Now there are about 2000, according to the information given by the publishers. British Library recently estimated that in five years time approximately half of the currently existing 16000 periodicals in these fields will be published in electronic form (2). In some estimates the rate of growth is expected to be even quicker. According to some estimates the traditional printed journal will disappear altogether and be replaced by its electronic counterpart in 10-20 years (3).

The number of electronic books is growing rapidly due to several digitizing projects around the world (4,5). Such projects in English are for example the Cornell University Projects, Project Gutenberg, the Oxford Text Archive, the Open Book Project, University of Virginia Electronic Text Center and the American Memory Project. The British Library (1996) estimates that there are at least 20 000 books in English already available on the Internet. The Bibliotheque Nationale has (or soon will have) digitized 100 000 works. Smaller publishers are also digitizing books on diskettes. It is estimated that in addition to the printed version publishers will produce parallel electronic editions for the Internet of books, as well.

Some of the material available on the Internet is permanently free of charge, some only for the time being (introductory offers). Some of the leading scientific journals are free to those who subscribe to the printed version, but some are always subject to a charge. Why should we buy expensive electronic journals when recent cuts in library grants and inflation together have made it impossible to buy even the needed printed materials?

The greatest benefit of electronic collections is their excellent availability regardless of space or time. A researcher can browse a scientific journal on his own workstation and print out the articles he wants. The technology also makes it possible to have many concurrent users. Availability in a library is often to a greater extent subject to different kinds of impeding factors; either the journal is in in-house circulation, someone is reading it at the moment or it is missing altogether. It is more than likely that in time researchers will learn to use electronic journals, but since old habits die hard it is necessary to use two overlapping publishing methods for some time to come. As far as CD-ROM databases are concerned, their use via networks has turned out to be technically very difficult to implement and require highly specialized knowledge and skills from the end users. Direct network use through the Internet maintained in collaboration with the vendors has proven considerably easier.

On the other hand a situation where we have collections a) in the library, b) in the university intranet and c) available via the Internet is very demanding both for the user and the library in order for them both to have control of the whole.

From the viewpoint of the library this two-sided situation not only puts more pressure on the funds allocated for the acquisition of new materials, but it also causes additional work in the search, acquisition and organisation of networked materials. The increase of electronic materials available on the Internet means that in addition to the traditional physical collections libraries also maintain virtual or electronic collections which can be accessed via hyperlinks on the libraries' WWW-sites. In addition to the work of individual libraries many countries have nationally funded, large-scale eLib or Electronic Library projects. I will look in detail at the Finnish national electronic library project and briefly at the projects in the United States, England and Denmark.

2. Why to plan a national electronic library ?

The Finnish Ministry of Education appointed in January 1997 a working group to prepare a plan for the development of electronic information services for research and the implementation of a national electronic library as part of the Information Society Programme. The Ministry stated that the goal of the project was to guarantee access to a high-quality, well organised and diversified national and international information resource, and thus improve the conditions for research and education and cater for the needs of trade and industry, as well.

The working group submitted its motion for a national electronic library to the Minister of Education at the end of May (6). The author of this article was a member of the working group.

Why did the Finnish Ministry of Education ask for a group consisting of librarians and computing professionals to prepare a plan for a national electronic library? It can be said that the time was right in many ways. Three factors that have certainly contributed to this are the arrival of the information society, electronic publications and the current situation of the university libraries.

The Ministry of Education has purposefully and systematically built a foundation for a Finnish information society. It has built an effective data communications network especially for universities and research institutes, and schools, universities and libraries have been equipped with modern hardware. It can be said that during the past few years a solid information technology infrastructure has been built for research and education institutions. As the physical framework is now in reasonably good shape, all that is needed is the actual content of the information networks and the information society. With regard to content, the national electronic library could be one of the mainstays of the information society.

Another factor is probably the rapid increase of the number of electronic parallel versions of important scientific journals, which I already described above. Contractual practices with scientific publishers are changing, enabling the creation of a national electronic library. Previously each library purchased a separate site license but now many large publishers are prepared to negotiate over joint nationwide licenses.

A third factor that is certain to have influenced the assignment by the Ministry of Education is the gradual decline of the standard of foreign collections in Finnish university libraries. The financial resources of universities have been cut, which has caused a decrease in the acquisition of new literature. The universities have repeatedly reminded the Ministry of Education of the decline of this resource which is essential for research. The national electronic library could significantly improve the supply of literature required by research and education, as a nationwide license would buy materials that one university alone could not afford.

In addition to the reasons mentioned above and a lot of goodwill, we shall need money, as well. The time is also right in this respect, and this could be one of the reasons for the assignment by the Ministry of Education. The Finnish state is privatising its property, and some of the wealth accumulated from this will be used to improve the conditions of research and education, i.e. libraries and information networks. Examples set in other countries where electronic libraries have been built have naturally had an influence on attitudes. However, the Finnish national library plan is not a copy of any of the above projects.

3. Finnish national electronic library (FeLib)

A committee was appointed to draw up a plan for the outlines of the development of electronic information services for science and research and for the structure of a national electronic library. A national electronic library demands reliable and quick network connections for data transmission and communication between members of the academic community. The main function of the electronic library is to ensure that well organized national and international information meeting customers needs are accessible over networks and other technical information infrastructure.

An electronic library offers many economic, technical and social benefits. It is global and accessible regardless of place, space or opening hours. It speeds up communication and enables purposeful, resource-saving cooperation. Joint purchases of electronic materials can raise the degree of self-sufficiency with regard to information resources in Finland. In the ideal situation the end user is able to access the versatile, decentralized services via a unified and easily accessible virtual library.

3.1. Services of the national electronic library

The main idea of the working group was that the electronic library should form part of an electronic campus of the universities, which is typified by electronic publishing and effective use of networks. The national electronic library will in the future be complemented by various kinds of personal virtual libraries, which can be customized to suit the needs of each user so that only the most relevant materials are retrieved from national and international information resources.

The resources of FeLib consist of both national and international materials, for example special and reference databases, electronic documents available on the Internet, multimedia, electronic educational materials and other networked materials.

All electronic materials must be searchable via an integrated, easy-to-use interface, enabling easy access and use of all the above networked resources. Searchability and personal control of information resources will be facilitated through the use of WWW-indices, program agents, subject catalogues etc.

The goal is to make at least some of the articles and monographies available in full-text form via hyperlinks in reference databases. Thus they can be transferred to the user's own workstation or printed straight away. If the desired materials are not available in electronic form, the user is directed to interlibrary lending services or the collections of other libraries. The system can be used to retrieve all kinds of information materials, which means that the search results may be in the form of hyperlinks to WWW-documents, to various special databases and the data they contain, to reference, multimedia or full text materials.

3.2. Recommendations for the development of the electronic library

The following measures are needed to improve the electronic library:

A. The amount of information available in electronic form is considerably increased by:

- buying and acquiring usage licenses for free electronic materials and recording and making them available for the public
- increasing the volume of electronic publishing in universities

- digitizing materials

B. The availability of both networked and library materials is improved.

- by directing resources to the improvement of retrieval methods, equipment and standards

C. The national electronic library and its operation is organized

- by naming the organs responsible for its development and implementation
- by determining the guidelines for the future funding of the project

Recommendations for the acquisition of electronic materials

1. Electronic materials for university libraries are acquired under joint nationwide contracts. Such contracts are made on electronic journals published by the most important scientific publishers and other electronic primary materials, on reference databases and on the use of foreign joint catalogues and national bibliographies.

2. Long-term storage of electronic publications and their future usability is looked into.

3. The core materials from the national resources are chosen for digitization.

4. All of the most important national reference databases must be accessible via the national electronic library.

5. The research databases of universities and research institutes are part of the national electronic library.

Recommendations for electronic publishing

6. The working group recommends that universities issue their publication series and theses in electronic form. The publications should conform to open standards.

7. Universities should use the print-on-demand system and principles and guidelines for its use should be developed. The objective must be to use existing hardware and software as efficiently as possible.

8. In future the Ministry of Education will publish its own publications also in electronic form. To make the publications easier to retrieve their bibliographic and classification information will be recorded. Standards that are in common use in state administration will be used.

Recommendations for educational materials

9. The electronic library and electronic learning environments are closely connected. They will support and complement each other through the use of hyperlinks.

Recommendations for information retrieval

10. Retrieval of information from the Internet is made easier by developing new, compatible subject indices that cover all the most important disciplines from Finland's point of view. Information retrieval from the indices and their maintenance is facilitated. Applications developed in similar projects abroad can be utilized.

11. The national WWW-index maintained by CSC (Center for Scientific Computing) is developed further so that it will complement global WWW-indices such as Alta Vista.

12. The Ministry of Education facilitates end users' access to public information resources in its own field and furthers the development of a service similar to GILS (Government Information Locator) in Finland by starting a similar project in its own field of administration.

Recommendations for the library system

15. The use of a uniform library system in all university libraries is a unique advantage, which must be maintained. In order to improve the ease of use and searchability of the OPACs the present VTLS-94 applications will be upgraded to new generation versions.

16. The usability of joint databases in Finland and abroad is improved by using a program based on the information retrieval standard used on the Internet (Z39.50).

17. Inter-library lending is rendered more effective by using programs that conform to the international interlibrary lending standard (ISO ILL).

In addition to the above the working group suggested that the Finnish Free Deposit Act should be modified to cover electronic materials, as well. With regard to copyright legislation it was suggested that libraries

- should have the possibility to store electronic materials, as well
- should facilitate the use of materials bound by copyright both in the library and via networks
- should provide facilities for the copying of electronic materials in the library both for personal use and for research purposes.

The National Library has the responsibility for the practical implementation of the operations that require cooperation between several organizations. In technical matters it shares the responsibility with CSC. A separate working group plans and coordinates the information resources and draws up the development plans. Maintenance of the most heavily used document servers is centred as far as possible in Finland, in which case the maintainer could be the Center for Scientific Computing, the National Library or one of the computing centres. The maintenance of special databases in different disciplines will be decentralized should the need arise.

The working group proposed for 1997-1999 budgets of 18, 20 and 22 million Fmk, respectively (approx. 5 million USD per year).

4. Other eLib-projects

One of the most interesting projects is the English eLib (7): " In 1993, an investigation into how to deal with the pressures on library resources caused by the rapid expansions of student numbers and the world-wide explosion in academic knowledge and information was undertaken by the Joint Funding Council's Libraries Review Group, chaired by Sir Brian Follett. This investigation resulted in the famous Follett Repport. One of the key conclusions of this report was that the exploitation if IT is essential to create the effective library service of the future. As a consequence, The Higher Education Funding Bodies in the UK invited proposals for projects which would transform the use and storage of knowledge in higher education institutions. [[sterling]]15 milj. was allocated to the "Electronic Libraries Porgramme", managed by the Joint Electronic Systems Committee on behalf of the funding bodies."

Of several hundred proposals 30 were initially announced in July 1995, lasting up to 3 years in duration. Since then, several other projects have been approved and currently 60 projects are being funded. They are working on the 11 subfields: Access to network resources; Digitisation; Electronic document delivery; Electronic Journal; Electronic short loans; Images; On demand publishing; Pre-prints; Quality assurance; Supporting studies and Training and awareness. The projects have standars to follow and the full day officer and the leading group.

Many relevant scenarios are done too in Denmark. One of these is Info-samfundet år 2000: rapport fra udvalget om Informationssamfundet år 2000 (8), published by Danmark's government (1994). Next year was published Fra vision till handling (9), from the vision to the practice. Following these guidelines there are now in Denmark over 50 organizations including libraries, archieves and museums in the Kulturnet Danmark-project managed by Det Konglige Bibliotek (10). They are bringing a lot of electronic material for citizens to the Internet.

In the USA there is no one leading scenario like in Finland, England and Denmark which to follow. The government of President Clinton published in 1993 the raport "National Information Infrastructure: agenda for action" (11). The importance of electronic libraries are evaluated to be very high: "The ability of digital libraries to store and share knowlegde, history, and culture will be central to the success of the NII" (12). A lot of electronic library projects are going on managed mostly by university libraries. The Library of Congress has a very big American Memory project. Maybe the biggest of eLib-projects in the States is the Digital Library Initiative-project (13). It has six subprojects getting funding for 4 years each 1 million dollars. These projects are very technical, managed by university libraries and funded through a joint initiative of the National Science Foundation (NSF), the Department of Defency Advanced Research Projects Agency (DARPA) and the National Aeronautics and Space Administration (NASA).

Why are all these efforst done in so many countries? Maybe the answer is said in the last mentioned project: "The projects' focus is to dramatically advance the means to collect, store, and organize innformation in digital forms, and make it vailable for searching, retrieval, and processing via comminication networks - all in user-friendly ways." Librarians move the focus away from the library as a physical space to the virtual library with netservices.

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Oulu university library,
PB 450, Linnanmaa, 90571 Oulu, Finland
E-mail: paivi.kytomaki(at)oulu.fi

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Institut IMAG et bibliothèque virtuelle

Jacques Voiron[1], Françoise Renzetti[2]

L'IMAG (Informatique et Mathématiques Appliquées de Grenoble) est un institut fédératif de recherche du CNRS de l'Institut National Polytechnique de Grenoble et de l'Université Joseph Fourier regroupant des chercheurs dans le domaine de l'informatique, des mathématiques appliquées et de leurs applications ; des étudiants de second et troisième cycle dans ces domaines sont directement concernés par les activités de l'IMAG.

Depuis plus de 30 ans cet institut dispose d'un centre de documentation spécialisé commun (Médiathèque IMAG) à l'usage de ses chercheurs et de ses étudiants de troisième cycle. Cette médiathèque a régulièrement évolué avec les besoins des chercheurs et les technologies de l'information. Elle doit actuellement relever le défi de l'" Internet " ou du " Web ", qui transforme profondément les moyens et usages traditionnels de diffusion et d'accès à l'information scientifique spécialisée.

1. L'Institut IMAG

La communauté scientique de l'IMAG a été très active dès le tout début du développement des mathématiques appliquées et de l'informatique en France et en Europe. Ses chercheurs ont toujours participé aux évolutions de la discipline et de la technologie ; ils ont maintenu des équilibres entre les recherches fondamentales et les applications. Ils sont attentifs aux évolutions des usages de l'informatique tant au niveau de la société que dans le monde de l'entreprise.

1.1 Structure

L'Institut IMAG est une fédération de 7 unités mixtes de recherche du CNRS, de l'Institut National Polytechnique de Grenoble INPG et de l'Université Joseph Fourier UJF. Environ 650 personnes travaillent dans les laboratoitres de l'institut.

- L'Institut d'Informatique et Mathématiques Appliquées de Grenoble, IMAG, FR 0071, directeur Jacques VOIRON, b.p. 53, 38041 Grenoble Cedex 9
- Les 7 unités mixtes de recherche du CNRS, de l'INPG et de l'UJF :
  - **CLIPS**, Communication Langagière et Interaction Personne-Système, directeur Yves CHIARAMELLA, UMR 5524, b.p. 53, 38041 Grenoble Cedex 9
  - **GRAVIR**, informatique GRAphique, VIsion et Robotique, directeur Claude PUECH, UMR 5527, b.p. 53, 38041 Grenoble Cedex 9
  - **LEIBNI**Z, informatique fondamentale, mathématiques discrètes et systèmes cognitifs, directeur Philippe JORRAND, UMR 5522, 46 avenue Félix Viallet, 38031 Grenoble Cedex 1
  - **LMC**, Laboratoire Modélisation et Calcul, UMR 5523, directeur Patrick WITOMSKI, b.p. 53, 38041 Grenoble Cedex 9
  - **LSR**, Logiciels Systèmes Réseaux, directeur Paul JACQUET, UMR 5526, b.p. 53, 38041 Grenoble Cedex 9
  - **TIMC**, Techniques de l'Imagerie, de la Modélisation et de la Cognition, directeur Jacques DEMONGEOT, UMR 5525, IAB, Faculté de Médecine, Domaine de la Merci, 38700 La Tronche
  - **VERIMAG**, spécification, conception, validation, de systèmes parallèles et temps réel, UMR 9939, directeur Joseph SIFAKIS, Centre Equation, 2, avenue de Vignate, 38610 Gières

1.2 les principaux thèmes de recherche

Les domaines de recherche de l'IMAG concernent l'informatique et les Mathématiques Appliquées. L'évolution du secteur sciences et technologies de l'information, les avancées technologiques récentes, l'ouverture vers d'autres disciplines et vers le secteur aval, la banalisation des usages de l'informatique, ont conduit l'IMAG à identifier sept axes stratégiques pour conduire sa politique de recherche :

Modélisation et calcul: calcul formel, équations aux dérivées partielles, géométrie algorithmique, informatique du parallélisme et calcul scientifique, modélisation stochastique.

Logiciel, systèmes, réseaux: développement de méthodes et outils pour l'ingénierie du logiciel et des systèmes critiques, la recherche d'informations complexes et réparties, les applications réseaux. Complexité des logiciels et systèmes, rapprochement informatique et télécommunications, grands volumes de données multimédias, qualité et fiabilité.

Communication langagière et interaction personne-système: communication entre individus et systèmes informatiques, communication médiatisée entre personnes. Recherche et expérimentation complémentaires en langage naturel, parole, dialogue. Systèmes d'interaction et systèmes multimédia

Image robotique vision: outils de modélisation et de construction intégrant des capacités de perception, localisation, reconnaissance et planification, dans le cadre d'applications en robotique, bases de données d'images et interaction homme-machine. Maquettes numériques 3D, simulations et réalisation de systèmes de réalité augmentée.

Ingénierie et informatique médicale: outils mathématiques, informatiques, physiques et biologiques en liaison avec la médecine clinique et la chirurgie. Gestes médico-chirurgicaux assistés par ordinateur, imagerie multidimensionnelle, modélisation de systèmes biologiques, exploitation clinimétrique de bases de données médicales.

Mathématiques et logiques pour l'informatique: logiques classique et non classiques, mécanisation de l'inférence, mathématiques discrètes, combinatoire, graphes, optimisation, recherche opérationnelle, problèmes multi-critères.

Systèmes cognitifs: étude, modélisation théorique et mise en oeuvre informatique d'activités cognitives : connaissances, raisonnement, apprentissage, langage, perception et action.

1.3 Les activités d'enseignement

Les scientifiques de l'Institut IMAG dispensent des enseignements à 1000 étudiants dans deux établissements de formation supérieure (l'ENSIMAG, École Nationale Supérieure d'Informatique et de Mathématiques Appliquées de Grenoble (INPG), et l'UFR IMA, Unité de Formation et de Recherche en Informatique et Mathématiques Appliquées (UJF)) et quatre formations doctorales regroupées au sein des écoles doctorales " Mathématique et Informatique " et " Génie Biologique et Médical ".

Environ 300 boursiers ou allocataires de recherche sont accueillis dans les unités de recherche de l'IMAG pour préparer une thèse de doctorat de l'INPG ou de l'Université Joseph Fourier.

1.4 Les partenariats

L'Institut IMAG développe des partenariats avec d'autres organismes (INRIA, CEA, CNET, GEMAGREF, INSERM...) et avec le secteur industriel. L'objectif est d'établir des relations de coopération pluriannuelles pour mener des actions de recherche stratégiques et des actions de valorisation de la recherche avec des industriels (par exemple, Verilog, Dassault Systèmes, Texas Instruments, Praxim, ...).

La collaboration avec l'INRIA se définit autour de projets communs de recherche (APACHE, IDOPT, iMAGIS, MOVI, SHARP, SPECTRE) et d'actions d'expérimentations technologiques avancées.

2. La Médiathèque IMAG

2.1 Rôle de la Médiathèque

La Médiathèque est une réponse aux besoins d'information d'une communauté scientifique dont l'éventail des recherches s'étend aux Mathématiques Pures et Appliquées, jusqu'à l'Informatique et à ses applications.

La Médiathèque a pour premier public les membres de l'Institut IMAG.

La Médiathèque, bibliothèque de recherche, se doit de fournir l'ensemble de l'information nécessaire à une communauté diversifiée.

2.2 Valoriser les collections de la médiathèque

Les collections traditionnelles constituent un noyau de haute tenue qu'il est important de valoriser :

*** Des collections dont l'origine remontent à la naissance de l'ordinateur**

Les collections de la Médiathèque remontent aux années cinquante, à la naissance même des sciences de l'ordinateur en France ; à côté de leur intérêt historique majeur, elles constituent un atout essentiel pour la recherche puisque dès l'origine, elles se caractérisent par l'ampleur des thèmes représentés ; elles s'étendent aux mathématiques pures et aux mathématiques appliquées, à l'informatique théorique, à l'automatique théorique, la programmation, les domaines de l'équipement, des systèmes, de l'intelligence artificielle, des applications de l'informatique (par exemple biologie, santé, mécanique).

Comme en témoignent les rapports d'activité, des données quantitatives de ces collections permettent d'en vérifier la bonne répartition tandis que l'internationalité des documents et la densité des échanges sont une garantie de leur qualité.

Aujourd'hui la Médiathèque est une des grandes bibliothèques en France dans les disciplines des sciences et technologies de l'information.

*** Une politique scientifique élaborée par les chercheurs**

L'objectif est d'anticiper les besoins d'une communauté dont les thèmes scientifiques s'élargissent très rapidement. Des structures et des outils particuliers permettent l'élaboration et l'application de cette politique.

<u>La Commission bibliothèque</u>

Comme il est d'usage dans les bibliothèques, pour connaître les besoins du public et pour les sensibiliser aux problèmes documentaires, une commission d'utilisateurs se crée vers 1980. La partie scientifique de sélection des acquisitions est réalisée par le Président de la Commission qui s'appuie sur la collecte des informations adressées par les spécialistes.

<u>Les expositions scientifiques</u>

Pour valoriser le patrimoine scientifique et souvent, en dyptique des manifestations scientifiques organisées à l'Institut IMAG, une ou deux fois par an des expositions thématiques qui peuvent atteindre une grande ampleur mettent en valeur des collections[1].

<u>Les collaborations : RNBM & INRIA notamment</u>

La Médiathèque a collaboré depuis toujours avec les bibliothèques de mêmes spécialités, lorsque ces collaborations se sont organisées et structurées en réseau, elles en est devenue tout naturellement un noeud important. La Médiathèque fait partie du réseau documentaire INRIA et du Réseau National des Bibliothèques Mathématiques[2].

=> Il s'agit donc de constituer la mémoire commune de l'Institut en profitant des compétences et des outils en place dans les communautés parentes.

*** Une tradition en informatique documentaire**

1973 : automatisation des catalogues (N. Gastinel)
1983 : système réparti de gestion (INRIA) (Claude Delobel)
1993 : serveur W3 et diffusion électronique des publications IMAG (fichiers PostSript)
1995 : Projets Callimaque et Calliope (IMAG - INRIA - XEROX)

Ces actions, novatrices en leur temps, n'ont pas toutes été poursuivies, par exemple la création d'index automatisés permettant d'accéder aux documents ou le système de gestion réparti de bibliothèques entre les bibliothèques de l'INRIA Rocquencourt, de l'IRISA à Rennes, de l'INRIA Sophia Antipolis et de l'IMAG.

On note cependant la volonté de la Médiathèque d'utiliser les mêmes outils (l'ordinateur et le réseau) que les usagers et ce dès les années 70.

*** Une communauté répartie sur 5 sites dans l'agglomération grenobloise**

A partir de la seconde moitié des années 80, les chercheurs de l'IMAG se répartissent sur cinq sites académiques dans l'agglomération grenobloise. La Médiathèque avait été conduite, non sans difficultés, à la création d'une " Antenne bibliothèque " au centre ville. Le problème du partage des collections, au travers de quelques essais provoque toujours l'insatisfaction générale. Quel qu'en soit le site, les fonds sont jugés insuffisants par les usagers, qui, afin d'en terminer avec les méprises fréquentes de localisation, préfèrent la réunion des collections.

Dès lors, la Médiathèque se tourne résolument vers les outils de communication pour signaler ses collections et offrir des documents en texte intégral.

*** Conclusion**

Les missions de la Médiathèque consistent essentiellement dans la mise en oeuvre de services de proximité, tout en contribuant au rayonnement scientifique de l'IMAG sur le plan national et international:

a) gérer des collections scientifiques recouvrant les grands thèmes de la recherche locale,

b) participer au rayonnement de l'Institut IMAG en affichant la mémoire commune et les publications des chercheurs (thèses et rapports);

c) assurer ces services au moyen des outils de communication qu'utilise la communauté elle-même : l'ordinateur et le réseau.

Se pose alors, l'ensemble des questions qui sont liées à l'adaptation au virtuel et à la gestion d'un environnement transitoire et hétérogène.

3. L'Adaptation au virtuel

3.1 La bibliothèque virtuelle

La Médiathèque de l'IMAG assurant trois services majeurs : la gestion des collections, des activités de diffusion et des services de documentation, une bibliothèque virtuelle IMAG doit rendre accessible les mêmes services à partir de la station de travail de chacun.

La bibliothèque virtuelle prendrait appui sur les faits que :

a) La situation scientifique et géographique de l'IMAG est éminente dans la région Rhône-Alpes, l'IMAG, à la fois par ses compétences de recherche en Informatique et en Mathématiques Appliquées, la richesse de ses collections et son savoir-faire technique. La médiathèque IMAG peut être un site privilégié d'un support de diffusion électronique d'information.

b) Les collections de la Médiathèque qui sont celles d'une grande bibliothèque spécialisée en Informatique et en Mathématiques Appliquées pourraient constituer le point de départ des activités de diffusion.

c) Une expérience d'une quinzaine d'années dans le déploiement et l'usage des réseaux au sein de la communauté l'IMAG.

3.2 Projet d'un CDEIMAG (Centre de Diffusion Electronique de l'Information en Informatique et en Mathématiques Appliquées de Grenoble)

3.2.1 Objectifs

Diffuser ou rediffuser des revues électroniques (tables des matières, résumés ou texte intégral) et d'autres documents électroniques (publications non commercialisées ou publications dont l'Institut bénéficierait de la propriété intellectuelle) dans le cadre d'un CDEIMAG, (Centre de diffusion électronique en Informatique et en Mathématiques Appliquées de Grenoble).

3.2.2 Politique documentaire

* <u>Au niveau des outils</u>

Dans le cadre d'un service public, le but est d'assurer l'accès aux utilisateurs de la Médiathèque à des documents de forme nouvelle (scannérisés ou mémorisés) ou à d'autres documents électroniques (revues, autres centres).

*** Agir au niveau du champ social de la recherche**

- Intégrer la politique documentaire dans la stratégie de la recherche
- Valoriser l'Institut auprès des tutelles finançant les recherches menées,

- Insister sur leur utilité sociale ;
- Renforcer la notoriété de l'Institut par une diffusion internationale en affirmant les compétences scientifiques de l'IMAG.

3.2.3 Points d'ancrage de la politique de l'information scientifique

Les activités de diffusion ou de rediffusion de revues électroniques (résumés ou texte intégral) et d'autres documents concerneraient :

* Les revues commerciales en abonnement à la Médiathèque

Les revues constituent un des enjeux de la recherche. Dans les domaines des mathématiques et des sciences de l'ordinateur la majorité des revues commercialisées sont sous format électronique. Les revues électroniques commerciales doivent être rendues accessibles en considération de leurs usages par les chercheurs grenoblois.

* Les éditions électroniques IMAG

Plusieurs types de publications concernant la vie scientifique à l'IMAG pouraient être promues.

* Propriété intellectuelle

La diffusion électronique doit se faire dans le respect du Code de la Propriété intellectuelle.

* Echanges

Il serait intéressant au moyen des revues et publications électroniques de l'IMAG de structurer des échanges pour obtenir des publications qui, si actuellement sont libres d'accès, semblent vouloir orienter leur diffusion future vers un mode de consultation payant.

3.3.4 Prises de décisions techniques

* Aspects serveurs et réseaux

Les aspects techniques relatifs aux serveurs, aux réseaux, à l'archivage pourraient profiter du savoir-faire du service des " Réseaux et moyens informatiques " de l'IMAG.

* Négociations commerciales

Les revues électroniques commerciales doivent être rendues accessibles en considération des conditions offertes par les éditeurs, notamment celles concernant les structures en consortium.

3.4 Conclusion

Le contexte électronique change radicalement l'environnement des bibliothèques, un CDEIMAG en tant que structure forte permettrait de discuter avec les parties prenantes (auteurs, éditeurs, publics points de diffusion).

4. Bilan sur 3 ans

La bibliothèque virtuelle n'a pas encore été réalisée. Des aspects partiels permettent d'entrevoir ce que pourrait être la future bibliothèque virtuelle de l'IMAG.

4.1 Les aspects partiels développés

*** La page Web de la Médiathèque[3]**

C'est à partir de la page Web de la Médiathèque que l'on peut dresser le bilan de l'activité de diffusion électronique. L'usager y trouve des renseignements sur la Médiathèque elle-même et les conditions pour y accéder. L'usager peut préparer sa venue à la Médiathèque en consultant le catalogue ou la carte de la Médiathèque. L'usager peut utiliser différents services, comme celui assuré par Calliope, base de données de sommaires de revues d'articles à partir de laquelle il peut appliquer des outils de recherche d'information ou de veille documentaire.

*** Les catalogues[4]**

Ils permettent d'accéder à 60 000 références qui concernent des livres, des thèses, des rapports de recherche et des documents video.

*** Le serveur Web du projet Callimaque[5 et l'histoire de l'IMAG]**

Le projet Callimaque propose d'ouvrir sur Internet de larges accès à des collections composées de 3000 documents montrant l'évolution des Mathématiques Appliquées et de l'Informatique depuis 40 ans. Callimaque est un projet de gestion électronique de documents. Il intègre le traitement, la production de documents et la recherche d'information. Callimaque est basé sur un produit de Xerox appelé XDOD (Xerox Document On Demand) qui permet la scanérisation, le stockage et l'indexation des documents. Des outils de recherche d'information qui prennent en compte la syntaxe et des outils d'aide à la traduction français<->anglais permettent :

a) d'interroger la base en français ou en anglais.

b) d'obtenir une traduction contextuelle sur certains textes comme le résumé des thèses[8].

Aujourd'hui, dans un but de valorisation, il paraît intéressant de clore rapidement ce projet (corrections des documents et réglements des questions de droit du document) afin de le rapprocher du projet ARCOLE9 de la BNF (les collections numérisées de la BNF : 85 000 documents numérisés, dont certains documents concernent les mathématiques).]

*** Le serveur Web du projet Calliope[8]**

Le projet Calliope est un autre projet, mené en collaboration avec l'INRIA Rhône-Alpes et le laboratoire de recherche Rank Xerox de Grenoble :

a) Calliope permet d'accéder via le Web aux sommaires[9 d'une sélection de revues scientifiques reçues à la Médiathèque de l'IMAG et au centre de documentation du Laboratoire de recherche Rank Xerox de Grenoble, (le serveur de la Médiathèque s'alimente sur le serveur de notre agence d'abonnements pour les mises à jour hebdommadaires),

b) le projet Calliope est une expérimentation en recherche d'information. La fourniture du document électronique qui devait, à l'origine, constituer un volet de ce projet, n'a pu encore être résolue et appliquée à l'IMAG.

*** L'Interface d'accès aux revues électroniques commercialisées[10]**

Depuis mai 1997, les usagers accédent au format électronique de revues en abonnement à la Médiathèque via le serveur Web de la Médiathèque. Plus de 300 abonnements commerciaux sont actuellement accessibles ; 150 abonnements sont en test :

Academic Press	test (période limitée de 3 mois)
Springer	abonnement
Kluwer	abonnement
SIAM	abonnement

Des négociations sont en cours avec d'autres éditeurs.

*** L'édition électronique et la diffusion**

Un consensus pour valoriser les recherches et mettre en oeuvre des outils de rayonnement de l'IMAG, permet l'émergence de plusieurs moyens nouveaux.

Les Annales de l'IMAG
Une équipe de chercheurs, en collaboration avec la Médiathèque travaille sur un projet de création d'une revue scientifique électronique couvrant les domaines de la recherche à l'IMAG, avec l'objectif de pérenniser le rayonnement scientifique grenoblois dans la tradition des pères fondateurs.

Au niveau technique, il a été décidé que cette revue multimédia comporterait un résumé en français d'une page et demi, d'un résumé de 8 pages en anglais et des annexes éventuellement amovibles. L'objectif serait d'arriver à une revue de haut niveau afin qu'elle soient référencée dans les grandes bases de données mondiales de recherche et d'évaluation.

Les Prépublications
Parallèlement à cette revue, une collection des meilleures thèses et des meilleurs rapports de l'IMAG est en cours de lancement.

La diffusion des actes marquants de la vie scientifique
La Médiathèque essaie de collecter des données relatives aux différents séminaires scientifiques et aux autres manifestations scientifiques internes à l'IMAG afin de concrétiser la vie scientifique commune.

4.2 L'impact des réseaux sur la politique documentaire

D'autres actions se sont développées ailleurs qui auraient pu faire partie intégrante du CDEIMAG.

4.2.1 La diffusion des rapports de recherche en Mathématique et en Informatique

Thesauria[11]

Thesauria, action INRIA, qui consiste en la mise en ouvre d'un serveur d'information concernant l'ensemble des publications françaises en informatique et en automatique.

Le serveur des prépublications de MathDoc

En partant du fait que les mathématiques sont, avec l'informatique, une des disciplines les plus en avance en ce qui concerne la présence des prépublications scientifiques sur le réseau (31 sites de prépublications mathématiques en France) et que la recherche d'une prépublication par navigation dans les serveurs Web de ces différents sites est fastidieuse pour l'utilisateur, la Cellule MathDoc a entrepris la constitution d'un index interrogeable regroupant l'ensemble de ces publications. Actuellement l'index est construit par le système Harvest, un "robot" qui parcourt l'ensemble des sites, et construit un index "full text " à partir des fichiers trouvés, quel que soit leur format (html, postscript, dvi, etc). La consultation de cet index plein texte est certes utile pour l'utilisateur désirant localiser une prépublication, mais la nature de l'indexation ne permet pas une recherche précise, et génère obligatoirement du "bruit". Le projet de la Cellule MathDoc est en train de constituer un index basé sur des données bibliographiques classiques telles que le(s) nom(s) d'auteur, mots du titre, classification MSC, date, mots-clés, etc...

4.2.2 BiblioWeb

Projet à l'initiative de chercheurs grenoblois pour mettre à la disposition des laboratoires grenoblois les abonnements aux Currents Contents[12 au moyen de plusieurs sites miroirs dans l'agglomération grenobloise. Ce projet a l'objectif de s'étendre à un grand nombre d'abonnements.]

5. Quelques perspectives?

La structure forte projetée (CDEIMAG), viserait à éviter la décentralisation de la Médiathèque et à sa pulvérisation au moment où l'information n'a plus besoin de support centralisé ; elle permettrait aussi d'améliorer la visibilité de l'activité scientifique de l'institut.

Il n'est pas trop tard pour structurer un CDEIMAG dont les activités se redéploieraient essentiellement sur :

5.1 Une fonction éditoriale pour la médiathèque?

Les connaissances sont élaborées dans les laboratoires, et sélectionnées par des scientifiques,

Les supports de formation sont créés et évoluent grâce aux enseignants chercheurs.

Dans le cadre de l'évoution vers l'électronique, la médiathèque élargit ses fonctions aux activités éditoriales.

5.2 la protection des droits des laboratoires : l'enjeu de l'archivage

Le réseau en ouvrant potentiellement l'accès au document développe de formidables enjeux autour de l'archivage électronique, de là l'importance de protéger les droits des chercheurs et les droits des laboratoires.

5.3 Bibliothèque et consortium

En ce qui concerne l'accès aux documents commercialisés, les groupements par consortium paraissent dessiner des solutions intéressantes pour les bibliothèques, en gérant un site miroir, un CDEIMAG pourrait y avoir un rôle majeur.

Notes termes techniques et leur traduction

- bibliothèque virtuelle - digital library
- numérisation - digitalization
- diffusion - dissemination
- revue de grande portée - first rate journal
- exposition scientifique - scientific exhibition
- IMAG : Informatique et Mathématiques Appliquées de Grenoble
- noyau - core
- bibliothèque physique - printed document library
- texte integral - full text

1. http://www-mediatheque.imag.fr/Mediatheque.IMAG/inter/expositions.html
2. En 1986, l'IMAG organisait à Grenoble, un des premiers colloques RNBM.
3. http://www-mediatheque.imag.fr/Mediatheque.IMAG
4. http://www-mediatheque.imag.fr/Mediatheque.IMAG/divers/catalogues.html
5. http://callimaque.imag.fr/
6. http://callimaque.imag.fr/htbin/docsearch
7. http://www.liv.ac.uk/www/french/19/arcole.htm
8. http://sSs.imag.fr/sSs/
9. En anglaise : sommaires s'abrège TOC (tables of contents)
10. http://www-mediatheque.imag.fr/cgi-bin/Mediatheque.IMAG/revues-electroniques
11. http://luberon.inria.fr:8000/Publications/THESAURIAPS
12. Les bases bibliographiques comporteront les résumés

Directeur de l'Institut IMAG,
Professeur à l'Université Joseph Fourier Grenoble-1, France
E-mail: Jacques.Voiron(at)imag.fr

Directeur Médiathèque IMAG
E-mail: Francoise.Renzetti(at)imag.fr

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SGML PUBLISHING AS A JOINT EFFORT

Tuija Sonkkila

It may take quite a while for a new standard to gain acceptance. In this respect, SGML (Standard Generalized Mark-up Language) has been no exception. SGML was given the status of an ISO standard in 1986. Before and after that, the principal usage of SGML has taken place in the field of technical documentation, where the benefits of getting different end-products for different clientele from the same, structured SGML database have been obvious. It is only now, in the age of multiple new and evolving electronic publishing platforms like the Internet, when SGML is getting foothold in academic circles as well. Indeed the future of SGML looks very promising. This is partly due the fact that the focus is shifting from publishing documents to publishing information.

DOCUMENTS ARE CONCEPT OF THE PRINT ERA

In the age of WYSIWYG desktop editors we are mentally locked to the idea of putting documents together by merely choosing the right fonts and margins. Styles are there for us to get the familiar look and feel of the document. This is only natural, because this is the way the WYSIWYG editors are meant to work. Their aim is to produce individual paper documents. The layout is unseparable from the content which means that the transfer of the document to another software or hardware platform poses a risk, resulting to some loss of properties at best. At worst the document has to be rewritten altogether.

In contrast, if it is the intellectual content of the document we liked to turn our attention to, if we wanted to make sure that whatever the medium in any given time, the message has to be easily transferrable to other formats, then we need a whole different editing approach. This means a separation between the content and the layout; a common understanding that without a proper distinction between the different structural elements of the content there is no life beyond the next generation of publication platforms; a set of tools and policies to accomplish this. In an organisation with a variety of traditional ways of doing things, the change in thinking may take a long time to get through, perhaps never fully. Still, it is worth all the trying.

PREDICTABLE STRUCTURE LEADS TO INFORMATION

In terms of academic publishing, Helsinki University of Technology (HUT) is a major producer in Finland. Annually, it publishes well over 400 titles of research publications in roughly 200 different series, ranging from laboratory notes to Ph.D. thesis. The lifespan of the publications varies considerably, but three things are in common. Firstly, the publishing process is decentralized to the degree that quite often it is the individual researcher herself who takes care of the whole publishing process, from tapping the keyboard to shelving the print run. Secondly, the only standard that publications are expected to follow concerns layout. Thirdly, the University Library gets a set of copies of every publication.

From the Library's - and ultimately from the end-users - point of view, quality of metadata is the top one concern. Metadata is that part of the publication that identifies it from another, giving a compact, predictable, standardized representation of the origin, content and format of the publication, essential for archival and retrieval purposes. It is no surprise really that HUT publications are quite challenging in this respect, because widely accepted local guidelines of how metadata should be formulated are missing.

There seems to be a relationship between information needs and the structure of information. Research in the field of digital libraries is bringing up evidence that academic users are interested in distinct parts of a scientific document rather than the whole document. As an example, some claim that

figures reveal what the authors have really done, as opposed to what they wished they had done. 1

Given the document is in structured, electronic format like SGML, and given the structure is following a semantically meaningful pattern, SQL-type languages could be used for this kind of sophisticated information retrieval.

In spring 1996, the Library took the initiative of seeking funding from the Ministry of Education in Finland for a four-year project of HUT electronic publishing. An amount of FIM 180K (30KECU) was granted by the Ministry from its special Information Society Fund. After that, a subsequent FIM 130K (25KECU) has been recieved.

The main goal of the project is to establish a set of procedures for electronic production of HUT serial publication series. Another important goal is to increase local understanding and knowledge about the importance of standards in academic publishing in general, and the benefits of SGML. In-house project partners include the Department of Automation and Systems Technology, the Department of Computer Science and Engineering, and the Computing Centre.

Q:TOP-DOWN OR BOTTOM-UP? A:BOTTOM-UP.

Implementing SGML in the publishing process is a tremendous task, a change in publishing paradigm really. Therefore, it is usually thought that for an SGML project to succeed, the involvement and commitment of the whole organisation is needed, from the day one. This might be true in communities with clearly formulated common goals, like companies. But one might argue whether it is foolish to even dream that something like that could ever be achieved in an heterogenous academic community where, quite understandably of course, individualism is a virtue and departments are traditionally very independent. Other strategies might come more handy. One of them might be called “Request For University Comments”, after the well-known procedure of how new Internet standards have to go through an open evaluation process before they are accepted. This is roughly the strategy chosen by the HUT SGML project.

What we need is two or three workable solutions on how to publish successfully using SGML as the underlying concept. By a solution we mean a publishing procedure consisting of the following steps: editing, layout description, creation of metadata, database storage, information retrieval, network delivery, and printing on-demand. Depending on tools and methods used we get a number of different solutions. Regardless of the solution, every part of it has to be truly operable. Otherwise it fails to get attention and approval. Without approval there will be no followers.

At the time of writing this the first prototype done in the HUT SGML project is approaching its completion.

THE FIRST PROTOTYPE

The prototype is based on the assumption that some of the writers might be interested in experimenting with a native SGML editor like FrameMaker+SGML, whereas some others, not being ready to give up their familiar Word desktop editor, would volunteer to act as a fore-runner and use a given template file for later SGML conversion purposes. In that case, the conversion would be done with FrameMaker+SGML, which most probably will be replaced later on by a true SGML conversion tool like Balise. Dublin Core Metadata Element Set, was chosen for metadata. Finally, instead of network delivery in pure SGML format, conversion to HTML was thought to be more appropiate at this stage. Jade, DSSSL engine by James Clark, will be used as the HTML conversion tool. The question of database management is still under discussion.

For those familiar with the issue of whether or not to use an industry-standard document type definition (DTD), it might be mentioned that document analysis resulted in the choice of constructing an own DTD. Future work with subsequent real-life examples will show if this was a wise move or not. SGML analysts tend to emphasize the benefits of industry-standard DTDs (or subsets of them), particularly in network delivery, where stylesheet construction and maintenance may otherwise become a substantial burden.

WORKSHOP - STEP TOWARDS REAL LIFE

A prototype is only a prototype, no matter how technically workable as such. It has to be tested against other types of publications for hints about shortcomings of the DTD. The tools have to be tested by writers for getting feedback. The model of workflow has to be evaluated to find out if it is feasible to put forward at all. This asks for a close cooperation between project workforce and HUT researchers.

Short-term plans of the project include a start-up of a workshop where a small number of HUT researchers are invited to participate. The aim of the group is to bring forward researchers' experience in publishing, and to lay ground for closer cooperation. At the same time, evaluation of the prototype will take place as another sub-project.

COOPERATION MAY BE JUST AN EMPTY WORD, BUT IT ONLY NEEDS FILLING

Cooperation at university level is never a trivial task, partly because of the amount of time and effort it takes, often without any immediate results. Differences in work culture may be hard obstacles, clashes of interest between organisational units likewise. Nevertheless, cooperation do counts, particularly in publishing, and especially now.

Academic publishing will face fundamental changes in five or ten years to come. Signs are there already. Commercial publishers of scientific journals are losing market, quietly but steadily. At the same time, universities are gradually taking back their former role as academic publishers. To name just few examples, Stanford University's HighWire Press, based at the University's Cecil H. Green Library, announced recently2 about its work with scolarly publishers in publishing electronic versions of traditional print journals, Lindköping University Electronic Press3 in Sweden has done innovative work in establishing publishing guidelines, and University of Montreal in Canada will shortly establish an Electronic Press with SGML as the underlying publishing concept4. There is still time to learn from their examples. Why not start today?

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(3) http://www.ep.liu.se/

(4) Jean-Claude Guedon in the semi-formal discussion session at the ICCC/IFIP Conference on Electronic Publishing `97, 14-16 April 1997, University of Kent at Canterbury, England

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Helsinki University of Technology Library,
Finland
E-mail: sonkkila(at)cc.hut.fi

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Vilnius University Library Automated System - Change to the new technology

Daiva Keraite

1. Introduction

Vilnius University Library automated system is based on an integrated library system BIBLIO, developed in Vilnius University Computer Center. It was started in 1992 and since then it has grown from small library system containing only two modules to the integrated library system with 60 working places, accessibility from Internet and the central database which contains 85 thousand bibliographic records not only from Vilnius University Library but also from several Lithuanian academic libraries. The last big improvement in the development of library system was the change of hardware and database platform from initial old-fashioned ND/Sintran/Sibas environment to the modern Unix/Oracle environment. At current time library system is moving to the client/server technology. This paper is an overview of the system development in general and particularly its last big change -- the project of porting to the modern platform. Revealing future perspectives connected with this change are discussed shortly too.

2. Development of library system

Technical background for creation of library system was delivery in 1992 to Vilnius University and other Lithuanian universities of several ND (Norsk Data, Norway) minicomputers as a technical help for initiation of Norway-Lithuania computerization project. Vilnius University computer network and Lithuanian Academic Network (LITNET) started from these computers too. ND computers were taken out of production in Norway in that time, so for library system development it was very important to choose appropriate tools which will guarantee possibility to port in the future to another database system and another computer hardware platform not only data accumulated in the database but also software applications of library system. Unique software development tools (Unique Concept, production of Unique, Norway) were chosen for this purpose. Unique Concept tools consisted of high level programming language, automated software development tools and support to several the most popular database systems (SIBAS, Oracle, Informix, etc.).

After choice of development tools the first modules of library system were designed. Library system was designed as integrated from the very beginning, but only two modules (acquisitions and cataloguing) were created. It was sufficient to have only these modules to start accumulate data about new incoming publications into database. Input of bibliographic records into the database started in the beginning of 1993. Modern software development tools allowed to build application programs rather quickly, so the new modules were added to the library system in a short time. In 1994 on-line catalogue module was added and as the library system computer was connected to the Vilnius University computer network that had connection to the Internet at that time already, at the same time library system became accessible from the Internet. Later, periodicals, information services, reports, and import/export modules were added to library system. It is planned to add circulation module when more records will be stored in the database.

Library system was designed to run on the central computer with the terminals in working places. At the beginning only central building of the library was equipped with terminals, but after development of Vilnius University computer network the working places were equipped in several branch libraries in the University.

3. Short description of library system modules functioning at current time

Acquisitions module enables to register necessary information about acquired books, supports file with information about each supplier and allows to make reports for analysis of library activity.

Cataloguing module include applied programs for bibliographic description of acquired publications, keeping and accumulating that information in database. It allows to describe monographs, periodicals, and create analytical bibliographic records. System uses UNIMARC format as internal for this purpose (UNIMARC is recommended by IFLA and adopted by Lithuanian National Library).

Information services module supports periodical retrieval of lists of bibliographic records and representation in printed or file form for publication purposes. Alphabetical order or grouping by a UDC is supported.

Import/export module supports bibliographic data exchange from and to library system. All data exchanges support UNIMARC bibliographic standard. Two Unimarc formats - ISO-2709 - IFLA recommended magnetic tape format - and our own designed textual human readable UNIMARC file format are used. Also this module includes converting software for handling of different character coding tables in UNIMARC files.

4. OPAC interfaces

OPAC module is the most important module of library system. It was added to library system after successful realization of acquisitions and cataloguing modules. OPAC supports possibility to search and retrieve information about bibliographic records. Search is based on keyword search method. Words from different fields of bibliographic record can be combined together with Boolean operators AND, OR and NOT.

There are several user interfaces to OPAC, and they show how library system was growing. The first OPAC interface was built for Tandberg terminals, operation with OPAC was based on function keys (user must press special key to perform a search, to move with arrows within the screen, to press another special key to show search results, etc.).

When library system was connected to the Internet, it was realized that there are a lot of different types of terminals all over the world and that the only one way to make it possible to all of them to use remote OPAC in terminal mode is to create user interface which would operate not with keys but with commands. Standard command language (CCL, Common Command Language for information search and retrieval, ISO 8777) was chosen for this purpose, and now all OPAC users, which connect to the library system with telnet, access database through this interface.

The last interface is WWW interface, and it became possible to develop this interface only this summer after successful completion of porting of library system database to Unix computer and to Oracle server (this process will be overviewd later). Oracle Web server supports this interface. The current version of OPAC WWW interface allows to search database by author, title, ISBN/ISSN number, UDC code, subject headings, series. The filters for language and year of publication can be used. Search results are represented in catalogue card format. Several search fields can be filled, and logical AND operation is performed with terms in the fields. Only 50 records satisfying the search request are retrieved from database in order to reduce system and network overload.

5. Change to the new hardware platform. Joint catalogue project.

Successful implementation of OPAC in Vilnius University library raised an interest of several other Lithuanian academic libraries to create a joint catalogue in Vilnius University library system basis. This idea looked especially attractive for smaller libraries, which have no possibilities to create their own systems accessible on WAN. Libraries, participating in joint catalogue project would prepare their own information locally on PC's and this information would be transferred and imported into a common database in VU. Technical parameters of existing computer system were too week even for VU at that time, so it was necessary to move the system to more powerful computer on Unix platform. Possibilities to create the Union catalogue of 6 Lithuanian academic libraries and other tasks such as training of library staff to use Internet and other modern technologies were thoroughly discussed and involved into special TEMPUS application as Joint European Project. Partners from EC - Denmark, Netherlands and Sweden were involved to support realization of it.

The grant for this project called “Integration of Lithuanian Academic Libraries” was received in 1995. The main goal of the project was to port Vilnius University Library system to modern hardware and database platform and to give opportunity for libraries participating in the project to acquire appropriate hardware in order to install BIBLIO library system in their libraries. Before porting process and installation was complete, libraries-participants would prepare their own bibliographic records with other tools and import them into Vilnius University Library system database. Testing and improvement of import/export module of BIBLIO were also a part of the project.

The main and the most complex task of the project was porting of the library system. Library system was initially designed with the future intention to port it to another hardware and database platform. Application software was built with Unique 4GL programming tools, and the first hardware platform was Norsk Data (Norway) minicomputers with not-Unix-compatible operating system SINTRAN. Unique software development tools consist of Unique 4GL -- high level programming language, tools for quick software development and database porting tool. At the project start time Unique Concept supported several the most popular operating systems and environments (SINTRAN, Unix, Windows 3.11/95/NT, etc.), several the most popular databases (Sibas, Oracle, Informix, Sybase etc.). It supported terminal mode in Unix, but in Windows environment it supported Windows GUI as well.

The Sun Ultra server and Oracle database management system were chosen as the next platform for VU library system.

The porting of library system was planned in two phases. As the existing computer system was working in terminal mode, the first phase of porting was considered to port database to Oracle server and to port library system applications to Unix for operation in terminal mode. This phase was planned to finish in autumn 1996 but because of delay in delivery of computers and reduce of staff in programming working group, this phase was completed only in the beginning of 1997. The work considering platform change was bigger and required more reprogramming than it was expected but in spite of all it required less human resources than to create new system or purchase and adapt other library system.

As the new Unique Concept version supports Windows environment and client/server technology, the second phase was to port library system applications to Windows environment to operate in client/server mode. After completion of this phase BIBLIO library system would be able to operate in terminal mode, client/server mode and on individual PC computer. It would be possible to change working places from terminals to PC's gradually. The second phase is completed successfully in current time as well, and the first 20 computers are installed in Vilnius University library. The new software is being tested in working places. So today system is functioning in mixed terminal and client mode. In the nearest future it will be working in such a way, until all the terminals will be replaced with PC's.

The BIBLIO library system has gotten a new life after porting it to another platform. It can be used in other libraries and the final phase of Joint catalogue project foresees installation of BIBLIO in other academic libraries. The current technical requirements for computer system are Oracle server and PC's in working places in order to work in client/server mode. Possibility to use cheaper database systems (Informix, MS SQL server, etc.) exists as well, but such a project needs some investigation and testing. BIBLIO also could be used in a stand alone computer in the smaller libraries for the initial phase of library system development.

6. Future perspectives

After changing of hardware platform the new possibilities are evolving in development of Vilnius University library system. These possibilities could be divided into three directions.

The first: integration of library system with modern Internet technology. WWW interface to OPAC is the first step in this direction, and another step could be usage of WWW tools to exchange bibliographic records with other library systems or other bibliographic databases. Integrated Windows working environment makes this work easier: for instance you can use Netscape in one window to find information and to paste or import information into library system in another window.

The second: to use Oracle server as the basis for integration of library system with other information systems in the University. After acquisition of Oracle server the library system was the first information system in the University being ported to Oracle server. But it became possible to plan reconstruction and porting to Oracle server of other information systems in the University. The same database platform would make it easier to exchange data among these information systems. Information systems under the closest interest for library system are Student database and database of scientific publications of University workers.

And the third: increasing of system modularity. Client/server technology and open database architecture enable not only easily build new modules but also add modules of other producers to existing library system. For instance, circulation module may be purchased from well-known library system vendor and integrated with BIBLIO. Of course closer investigations in this field are necessary.

Senior programmer of Library System Group,
Vilnius University Computer Center,
Sauletekio al. 9, Vilnius 2054, Lithuania
E-mail: daiva.keraite(at)sc.vu.lt

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Information Services - the convergence agenda

M.J. Clark

An Introduction

Salford University recently celebrated its centenary, which included its existence as a former College of Advanced Technology. The University was, until 1996, one of the UK's smaller institutions but has more than doubled in size following what is probably going to become a common UK phenomenon, merger with an associated college. Merger, the national agenda towards convergence, and an opportune vacancy arising for a new Director of Service allowed the University to consider major restructuring. I was appointed with these issues as my agenda on arrival at Salford early in 1995.

The current restructuring in merger, is the continuation of a process started earlier in the University's history. The financial jeopardy experienced by the Institution in 1981, and subsequent re-structuring, led the Vice Chancellor to propose a convergence of computing and library services under a common management structure. The services were finally converged in a single location, an extended library building, with the title Academic Information Services (AIS).

The University post merger has 20,000 students, in a wide range of disciplines, and is situated approximately 1 mile from the centre of Manchester. The merger resulted in change in AIS from a single-sited `somewhat converged' campus service, to a seven-sited `fully converged' post merger service.

The Pre-Merger Environment

In 1988, following lengthy consultation, the Librarian was appointed Director [1], responsible for both Library and Computing Services with a Deputy Director directly responsible for each of these areas was . The reality of the situation was that there was some shared infrastructure, i.e. a common building and hence common work space and customer space; however, the services developed as less converged than in some totally independent service Universities. The AIS building had been extended to house the computing service on its transfer, with little if any thought being given to converged service delivery. The additional space provided open-access facilities, accessible from the former Library, with its own computing help-desk and advisor service.

The former College operated independent services and locations, on each of their sites. There was no common model for service provision and little relationship between the staff. Generally the College staff were on lower salary scales than their University counterparts and the service provision for Computing was lacking investment, strategic planning, or direction.

Convergence - a viewpoint

Converged delivery of services is appropriate if it enable better support for the customer and hence a better service. There are many models for converged services; most claiming convergence within the UK have managerial convergence without attempting to undertake the necessary restructuring and re-training.

Clearly there has been convergence between the Library and Computing Service activities in support of their users needs. The desktop computer is more commonly used for information access or processing than for mathematical computation purpose. Similarly, the library serves its customer through networked services including the OPAC, CD-ROMs and World-Wide-Web. In many disciplines the network has become the first and sometimes sole route to timely information access. Equally, the traditional material will continue to be a significant resource for the foreseable future.

The customer wants a single point of entry to service support and often is unable to discriminate a problem to the service provider. The complexities of infrastructure or service mechanisms are of little importance to them. The need is for instantaneous support, without excuse for inability to provide that support. The scale of support required has grown dramatically as the customer base grows with little or no increase in staff resource to support this growth. Thus, measures must be adopted to reduce the need for support by simplifying the interface, and by providing alternative measures to expensive staff resource.

Information is at the heart of learning. Neither the Librarian nor Computing Specialist has an exclusive right to its control or access. There is no right model for convergence other than partnership to support the customer's requirement. The pressure of reducing financial resources for staffing requires effective partnerships to be formed where the service delivery is customer focussed. Thus the impending merger provide a route to re-shaping the service at Salford. Although complete convergence was not a short-term achievable, it was not to be an issue sidestepped in the haste of merger. It has thus been put at the centre of AIS's operational agenda.

Merger - An Opportunity

Merger discussions had been underway for several years prior to my arrival at the Institution. The College Principal and University Vice-Chancellor had this as their personal objectives. I was appointed from outside as the Designate Head of the planned merged and converged service that would result Merger of the institutions was resisted in many quarters, and was by no means a certainty until fairly close to the final date, although realistically most felt the process was inevitable.

The University was persuaded that service should be equable across all sites, and agreed to invest major capital funding in refurbishment of the former College Library premises to support both merger and converged service delivery. Major investment in the network and telephone infrastructures was undertaken, essential for facilitating both merger, and converged service delivery.

Merger- the process

Merger, for areas of the University and College that were replicated by both, would be undertaken by an assimilation process. Individuals would have to compete for posts, created in the new structures, derived for the post merger institution. (There was little replication in the academic departments, as the merger was a very good match of disparate subject areas). The appropriate senior person, (often following an internal competition between former heads in the two institutions), created the structures and application for the posts in the structure would proceed tier by tier enabling staff with relevant previous experience and grading to apply, with appeal processes in place.

A blank sheet of paper is a great place to start a service; however, the agreement existed that all existing staff should nominally be accommodated in the structure, and that the combination of the old and new should nominally produce a 10% saving in the cost model. The former grades, service conditions and custom and practice relating to terms and conditions would require to be tackled. There was opportunity for staff to take early retirement under a generous merger related package.

Complete restructuring is a very threatening process for the staff involved, I would not wish to understate the difficulties through the process and beyond. The new AIS staff structure attempted to provide a common framework for former computing and library staff by recognising the individual professional and non-professional experience of the staff concerned. There was an attempt to provide a path for the non-professional to professional status by providing a suitable intermediary `para-professional' tier in the structure. Re-skilling was seen as essential and budget was earmarked. The new structure focussed on the need for information professionals and attempted to expunge the concept of library and computing terminology. However, the users recognise the physical as a Library, despite the other services integrated into the facility. We now naturally talk about AIS services being in the Libraries.

The structure recognised two categories of AIS staff. Firstly, those who were customer and service focussed and who had a major role in providing the public service. Secondly, those who provide private services essential for the public service but who were by the nature of their role actually invisible to the customer at the point of access. There were of course many that ranged in their duties from the private to the public or spent time in different roles. It was desirable that as many staff as possible should at least serve in the public service on occasion, to ensure awareness of purpose.

The first management `away-day' of merger set a context where there would need to be an internal re-focus; it was to be forcefully stated that `AIS is a customer of AIS'. The failure of the public service was often in the hands of the private service that had failed to deliver to the needs of AIS colleagues. It was my stated view that the private side felt that they served the needs of the external customer first and AIS staff second. Thus systems to support the public AIS operation were given a lower priority. Associated with this was a major lack of communication within the service between functional areas and inconsistent views of priority and purpose.

Assimilation and Re-structuring

Many would envy the opportunity offered by assimilation. The service could be planned from scratch, with a structure necessary for an Institution whose size had more than doubled, and would now be operating across several major campus locations. The overall structure was loosely defined with generic job descriptions, consultation was then was undertaken with staff and Trade Unions. The new structures were required to demonstrate efficiency or effectiveness gains in merger; the associated assimilation rules allowed people who could claim posts in the new structure contained significant elements of their previous role would have automatic right to apply for that post. Staff had their former salary protected in the event of assimilation at a lower grade. There was a merger early retirement and severance scheme available for staff who wanted an opportunity to leave. There were to be no compulsory redundancies.

The assimilation process was lengthy since as each tier was assimilated, the appointees would join the process of re-defining the job descriptions in the subsequent tiers, and being involved in the appointment process. Where new roles were created, both internal and external candidates competed through open competition. Effectively every former member of staff had to apply for a post in the structure unless the new role was a replication of a former role. The attempt at total fairness, with a visible process, with many stages for appeal, was naturally lengthy. It was clearly understood that AIS assimilation would be the most difficult anywhere in the University and would create the largest assimilated structure.

`Generic' job descriptions, emphasising information services, was an attempt to make posts available to staff from either a Library or Computer background. Convergence was at the heart of the structure with clarity that the new operating model for AIS would be through team based management. Re-skilling is essential, the public function of AIS has a majority of relatively junior graded staff providing support to AIS customers.

AIS today

The opportunity may appear to be every Director's dream, i.e. to re-structure. However, the process itself is very threatening for staff. Clearly there have been winners and losers. However, the initial perceived benefits hide the difficulties. All change is threatening; during assimilation morale fell to a low level, with all the associated attributes such as high sickness and stress-related absences. During assimilation staff found they were both moving into their new role, whilst not fully released from former responsibilities. The process continuing whilst trying to deliver a full service.

Sickness, vacancies, and the overhead of the process itself all resulted in difficulty in achieving significant staff development. Assimilation and filling of vacancies arising took almost a year. During this period, staff had to support other massive changes resulting from service requirements arising from integrating the two very different environments. Major networking developments of around [[sterling]]2 million, a programme of re-development of AIS library locations at [[sterling]]3 million, and high investment in services infrastructure, were all undertaken. These investments kept staff from reflecting on the perceived threat as they could see AIS was to be at the heart of the University's future mission.

AIS - the near future

AIS continues to modify structure as staff are offered opportunities of Voluntary Early Retirement and Severance arising from projected budget deficit without institutional attention to overall staff cost issues. A tier of senior management will effectively be lost. The managers of service areas and service locations will be further empowered. The senior management of AIS will become light, an appropriate model, as a more predictable period of change follows. Team structures are developing but at unequal rates and hence require further senior management support and monitoring.

We have or are putting in place mechanisms to review the costs and costing of all our operations, and looking for measures which will improve efficiency or effectiveness. The Institution continues to support AIS closely, allowing continued re-structuring, to provide fitness for purpose.

AIS - the next three years

There are tremendous opportunities within G. Manchester. The four Universities have a special relationship, which is largely based on the close relationship that exists between Senior Management of the Institutions. Salford is the only institution of the four, that has adopted convergence strategies; however, this has no way impeded the special relationship. The institution Libraries have developed a special relationship and founded CALIM [2], which will be the framework for future developments in information delivery. CALIM is preparing strategy and business plans for a hybrid library service operating in some form of commonwealth model. It is likely that CALIM will found a company to provide service to the institutions, providing benefits of shared resource and efficiency, possible when scaling to support approximately 100,000 students. The Computing relationship has enabled the development of a MAN, which serves the institutions providing 155 Mbs connectivity to all major and satellite sites of the institutions. Similarly, a model for joint service provision, shared resources, and economies of scale are all attainable. The anticipated Deering agenda for regionalisation positions Manchester in an excellent position for the future. The four institutions are well positioned to be an exemplar for collaboration in the UK higher education sector.

Salford has founded a project called GEMISIS [3] that has a major Cable & Wireless Communications and the City as its partners. This 10 million pounds project has laid the infrastructure to support the GEMISIS mission. We have launched the BITN [4], which is rapidly connecting business across G. Manchester and will permit the University to deliver remote learning, technology transfer, and collaboration in many areas. We will be using connectivity planned for local schools and Further Education to facilitate Salford drive towards being the Institution of Enabling Technologies. We wish to use our new Video-on-Demand server to support the remote learner and to this end we are developing content applicable for the BITN, the remote learner, and the local student.

Conclusion

Salford has undertaken massive change in its model for service delivery now and into the next decade. Change is threatening, but it will not go away or slow down. Staff must accommodate change as a continuous process of opportunity. AIS at Salford is better positioned, than similar services elsewhere, for the changes ahead. The role of AIS is as a front-line customer support unit, for both local and remote customers. The cost of both infrastructure and services are decreasing whilst the need for customer support grows. The astute will observe the continued de-skilling by technological development, and accept the thrust towards customer focussed support in a rich information environment.

[1] Academic Information Services at the university of Salford - C. Harris, British Journal of Academic Librarianship, pp147-152, Vol 3, Number 3, 1988, ISSN 0269-0497

[2]CALIM Consortium of Academic Libraries in Manchester

[3] GEMISIS is an umbrella for projects which demonstrate the viability of the Information Super Highway

[4]Business Information Transfer Network

Director of Academic Information Services,
University of Salford, M5 4WT, UK
E-mail: M.J.Clark(at)ais.salford.ac.uk

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Computer based functions for advanced student services

[1]Soren Berglund, [2]Einar Lauritzen

1. Introduction

One of the major goals of the educational reforms that began in the early 1990's has been to accelerate the decentralisation of leadership of Swedish universities and colleges. The process has continued across a wide front of organisational and administrative arrangements. The new legislation ties financial grants directly to contracts each university is expected to negotiate periodically with the government, spelling out detailed targets for student enrolment and graduation. Such tangible incentives obviously raise the competitive interest in institutional research. Less obvious was the persuasive power of the benefits that would accrue from collaboration in establishing a self-governing consortium that can collect, analyse, and establish standards for reporting student and institutional performance.

The Ladok consortium now includes practically all degree-granting institutions in the nation. The large majority of its work is performed at member universities, supervised by university faculty and technical experts. Ladok governance is in the hands of senior university officers; day-to-day management is exercised by a central staff of experts selected from university ranks; performance is audited regularly by government officials and experts from other organisations.

This paper outlines the organisational arrangements that safeguard independence, accuracy, and security; provide incentives for continuing innovation and technical leadership; and remain responsive to the needs of member institutions, students, and the general public. The paper describes the student data and related services routinely delivered and the experience with the continuing stream of innovations to keep pace with changing needs and technology.

The paper also outlines several new projects now being developed and deployed, including some instructive examples of cooperation with industry and government agencies.

2. Computer-based student services

For any educational institution, the reliability and safety of its student records are of great importance. The design of the Ladok system recognises this central fact, and incorporates stringent safeguards to protect against tampering as well as accidents. It monitors performance and supports the administrative and academic staff in their professional services to a clientele that includes universities, students, and government agencies.

The primary functions of a student records system are to keep track of individual students with transcripts of academic performance, and to furnish the raw material for institutional research about students. Ladok has expanded from this core by adding such related services as an admission system and very soon a service to keep track of alumni. In many countries -- though not yet in Sweden -- the student record system also delivers other data, such as student fees, financial aid, housing, and related services.

An important part of a student records system are the aggregated reports that summarise the performance of departments, faculties, and the university as a whole. These reports contain important performance indicators for institutional research that help guide university governance and allocation of resources. They are also of interest to government agencies and foundations that help support the university financially.

The Ladok system can also furnish key data about applicants for admission, and thus can assist the admission staff of any university that wishes to apply its own algorithms for screening applicants. The screening can focus on special interests of individual departments or set of disciplines. Admission systems often work with competition algorithms that aim to fill classes with applicants that best match the standards set by faculties in specific fields, such as physical sciences or fine arts.

Exchanges of students with foreign universities are becoming increasingly popular. Ladok has grown to collect and report student information in a standardised format that facilitates communication among participating universities, including implementation of the European Credit Transfer System, ECTS. This encourages cooperative arrangements between sister institutions, and the dissemination of relevant information to students and their faculty advisors.

Protecting privacy and security in a student records system is vital for its users, clients and funding agencies. The development of advanced security software and devices is a continuing effort, in which close cooperation among member universities and with industry has been especially fruitful. An example of recent efforts is the adaptation of the so-called Smart Card, which gives individual students an identification device the size of a credit card that contains a machine-readable chip with individual information about credit status, etc.; the chip also permits bringing user data up to date after each transaction, such as adjusting the account balance after each purchase or deposit.

Just as individual records are of long-lasting importance to each student, reports on the aggregate results are important measures of departmental and institutional effectiveness. One direct application is the use of the summary reports by the government in allocating appropriations to individual institutions and special projects.

3. Development of new standards and advanced functions for students

Further development of advanced functions are driven by opportunities for cost-savings and the competitive advantages offered by additional information. Ladok seeks to keep its services abreast with developments in industry and commerce. This is consistent with the natural expectation of faculty and the general public that universities should be in the forefront in technology and functional design.

In this section we describe some current activities in the Ladok portfolio of projects.

3.1 Delivery of written material via computer and hybrid channels

Printing of admission certificates, student course certificates, certificates of study etc. are high-volume tasks in student systems. Such printing used to be performed at considerable cost by individual university computer centres.

During the past year these large-scale printing runs have been moved to the National Post. This has been the result of extensive negotiations by Ladok. The shift takes advantage of the postal service's investment in a system of regional printing centres that accept computer output from Ladok directly to a central node. Reports are sorted by postal code of the addressee and then transmitted to the regional print center nearest to the receiver before being printed on paper.Thus, hard copy reports are generated only just before delivery to the ultimate addressee. The new procedure minimises physical transportation and maintains control by a service that has a well-established reputation for safeguarding the privacy of the mails.

The advantages for the consortium are substantial. The cost has been reduced by half, compared to printing at computer centres. Investment costs for special printing equipment are absorbed in a much larger whole, and printing quality and distribution speed has improved. This agreement between the consortium and the National Post will be further developed in the near future with functions for special enclosures, including applications for housing, letter from the rector, etc. Work is also under way on special handling for enclosures with high intrinsic value, such as airline tickets, and identity cards that are usable as credit cards in university book stores and cafeterias, and for other university goods and services.

For the more distant future, we are exploring options for servicing some other institutional printing by departments and at desktop.

Today, we write our documents in a word processing program in a personal computer, instruct the computer to make a printout, walk to the printer, search for an envelope, write the receiver address on the envelope, insert the document in the envelope, seal the envelope, add special instructions for air mail or registered mail, and put the envelope in the box for outgoing mail. The internal post service weighs the envelope and calculates the appropriate postage and finally handles the mail to the Postal service for distribution.

Soon, we expect to instruct the computer to make a virtual printout and choose in the print manager window to send the document to the printing service. We expect to achieve next-day delivery to the addressee, without internal handling of documents and distribution. This differs from e-mail and fax by the way the final distribution is done by ordinary mail delivery by the Postal service. Not everybody has access to fax and e-mail yet. The distributed content can include official documents and supplements that are most efficiently delivered by ordinary mail.

3.2 Special concerns about security and privacy

The system for reporting and safeguarding the academic transcripts of individual students is naturally of great importance to each student. Lapses in accuracy or privacy can cause considerable embarrassment, and perhaps expense, even after the student has graduated.

In Sweden and in some other countries, the reports of aggregate results from the system are an important factor in determining the allocation of government appropriations for education, a primary source of institutional support. There is no hard data on the use of institutional summaries by private foundations and other sources of financial support in assessing the merits of applicants for grants and research contracts, but the prospects are clear. With this in mind, accuracy and security of records are of great value to students, to the universities, and to agencies that depend on accurate and impartial records for allocating their support of education. The Ladok consortium addresses this problem by applying several security methods:

- internal control mechanisms with electronic certificates
- log files
- strong logon password and other security schemes
- encapsulation of clients, communication, server modules and database and servers
- periodic security reviews by external reviewers with wide experience

The latest approach in this area is the application of Smart Card technologies, allowing even stronger encryption and authentication methods. Our current project includes commercial vendors that service banks for the development of a national identity card with photo and a chip imbedded in the plastic card.

The identity of the card holder is guaranteed by the National Post, which is the official agency to issue the national identity cards for Swedish citizens. The high degree of public confidence in that system has encouraged us to use the new card for a variety of applications that demand reliability and security.

3.3 Hot technology development strategies (client/server, Internet, JAVA, WWW, etc.)

Many traditional student systems were originally mainframe-based, acting as legacy systems. They are difficult to keep up to date and demand large investments for deployment and maintenance. User interfaces are frequently not attractive to modern users and they are difficult to adapt to the continuing flow of demand for new services and safeguards. These difficulties are especially awkward in systems that experience a constant turn-over of users.

Student systems, especially, continue to change and grow. Therefore, it is important to accept change as a given in planning for the maintenance and development of the system. For this, we need access to the latest techniques and modern methods in development. The Ladok consortium are currently reengineering its old COBOL-based system to a modern client-server system, running on PCs and Macintosh clients. The wide use of computer-generated and machine-readable forms in industry and commerce has raised the general level of demand for user-friendly appearance and function. University faculty and students expect us to keep pace with improvements they see elsewhere. We are re-designing printouts to be more attractive and easier to use. Graphical user interfaces are easier and quicker to use than traditional text instructions.

Increasingly, our users are faculty and managers who expect professional service. Analysts are replacing clerks as primary contacts, and we have a constant influx of new users.

The client-base of universities continues to expand in size and diversity. Descriptive material, course catalogues, and application forms need to be accessible to prospective students (not to mention parents, advisors, potential employers, foundations, research agencies, government agencies, and sources of research and consulting contracts).

In an increasingly competitive field, universities have found that many of their high-potential prospects turn to computer-based information sources. This trend has been encouraged by the rapid growth of PC's and PC-based tools of substantial power. Java systems are now within reach of modest budgets, allowing users to work with their web-browsers. The cost of applications continues to drop relative to traditional, paper-based alternatives for reaching a mass market.

The obvious problem in this rapid expansion in technical improvements is the maintenance of safeguards against unauthorised access and against mis-use. Those problems are high on the agenda of Ladok staff and contractors.

4. Incentives for Continuing Evolution

The academic world is - to say the least - extremely dynamic. University officers, faculty, students, and staff are notorious for their appetite for "the latest, at the lowest price". Ladok has a lot of pressure on what can be delivered to Swedish universities in the area of computer-based services, with due attention to reliability and cost. A very important dimension in this continuing drive is Ladok's success in matching internal development work with cooperative ventures with commercial and not-for-profit suppliers of high-quality software and equipment. In this, Ladok has had the active encouragement of its member universities and of the government agencies responsible for higher education in Sweden.

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[1]Project Manager, University of Umea, Sweden
E-mail: sonbed(at)adm.umu.se
[2]Academic Registrar, University of Uppsala, Sweden

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SYSTEM DEVELOPMENT FOR HIGHER EDUCATION AND RESEARCH ASSESSORS SELECTION

Irmantas Aleliunas

Introduction

The assessment of higher education and research is quite a new thing in Lithuania. In order to avoid the subjective assessment, it is necessary to create the system of assessors selection. The computerisation of the system of assessors selection is highly appreciated. In this case it would help not only selection of assessors, but also management of peer reviews.

Keywords

The assessment of higher education and research, the system of assessors selection, management of peer reviews, the database of reserve of assessors.

Management of higher education and research assessors

In order to reach the best accuracy and reliability of the quality assessment in higher education and research, it is necessary: to direct aims; to distinguish conditions where aims should be reached; to make action plans; to take necessary measures for carrying out the action plans; to regulate actions according to variable conditions.

These requirements could be realised in the stages of management process. The process of management is divided into management functions, according to those stages. Results of higher education and research peer reviews depend on performance of management functions. In order to increase the efficiency of assessors management it is necessary to create a computerised system of assessors management.

Forming of assessors reserve

Assessors are recommended into reserve by science and higher education councils, Lithuania Science Council, Lithuanian of Science, councils or administration boards of trade unions, chiefs of ministries or other institutions.

Data about a candidate are offered in a special form. This form should be signed by a candidate and an offering institution.

An assessor can be eliminated from the reserve if he does not correspond to requirements made.

Problems

However, several problems exist. It is important to choose right criterions of selection. The system of selection of assessors may decrease subjectivity but subjectivity depends not only on personal opinion of assessors. Lithuania is a small country and it is difficult to find assessors without any relations to the institution to be assessed. High requirements for receiving efficient decisions put great demands for the effective using of information resources. One of the reasons to make the right solution is to perfect the collection of information and creating of information security tools. It is important to create the right selection techniques as well. Serious problem is that results of peer reviews are verified only after a long time period.

Requirements to the reserve of higher education and research assessors

Peer reviews are carried out by groups of assessors. The group of assessors contains from three to five persons. One of them is the head of the group. It is possible to invite assessors from abroad too. The reserve of assessors is divided into two parts. The first part includes active researchers; the second one includes some politicians, businessmen, artists etc.

Main requirements to assessors selection system are these:

- Assessor can not be an employer of the institution to be assessed;
- At least one assessor from the active group of assessors reserve should be included into the branch of science to be assessed;
- The group of assessors should contain some assessors from different branches of science;
- One person active in social work and a person from the second part of assessors reserve should participate in the activities of institution or scientific collective peer review;
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- Assessor have to know a foreign language if scientific work to be assessed is created in a foreign language;
- Assessor should have a scientific degree if he assesses scientific activities;
- In case activity of scientific area of subject or a study program is assessed, at least one assessor have to be from this area of subject and a half or more than a half of assessors have to be active in the same scientific or study field;
- One assessor of the group has to be active in social work if general scientific or higher education institutions assessment is performed;
- At least one assessor have to know requirements of professional qualification if he assesses a study program, providing professional qualifications.
- Only one assessor could be selected not from science or higher education institution.

Additional requirements to assessors are these:

- Number of assessors with higher qualification should be limited in groups (max. or min);
- Number of assessors from different regions should be limited (max. or min);
- Number of assessors from different scientific branches and reserve parts should be limited;
- Number of assessors from higher education and research institutions should be limited.

Desirable requirements to assessors are these:

- Frequency of using assessors should be even;
- Assessors whose assessment is better evaluated should be used more frequently.

Solution (a group of assessors) made by system can be omitted or filled up according to customer's wish. The group of assessors can be filed up according to desire of group or the head of the group. The group of assessors can invite an expert to solve specific problems.

Techniques of assessors selection

During selection it is important to conform the demands and the interests of an assessor and a customer. It depends on flexibility of the mechanism of an assessors selection. This mechanism should be a system which allows to evaluate:

- business skills;
- personal skills;

Business skills can be defined by commission according to system of points. However, this method needs a lot of experienced and competent people, which is expensive and in this case it is impossible to avoid subjectivity.

Method evaluating business skills according to specially prepared tests is also a very tedious work. This way of definition needs a lot of time to prepare and process results of tests, therefore, this way is better for sociological inquest. However it does not solve personnel management problems.

The selection and evaluating of assessors could be improved using professional-demographic methods, which allows to apply computers. This model would allow to describe and assess the experts themselves. The professional-demographic model (PDM) is a complex of indices such as personal indices (communication skills, reliability etc.) and business indices (scientific activities, pedagogical activities etc.) ones.

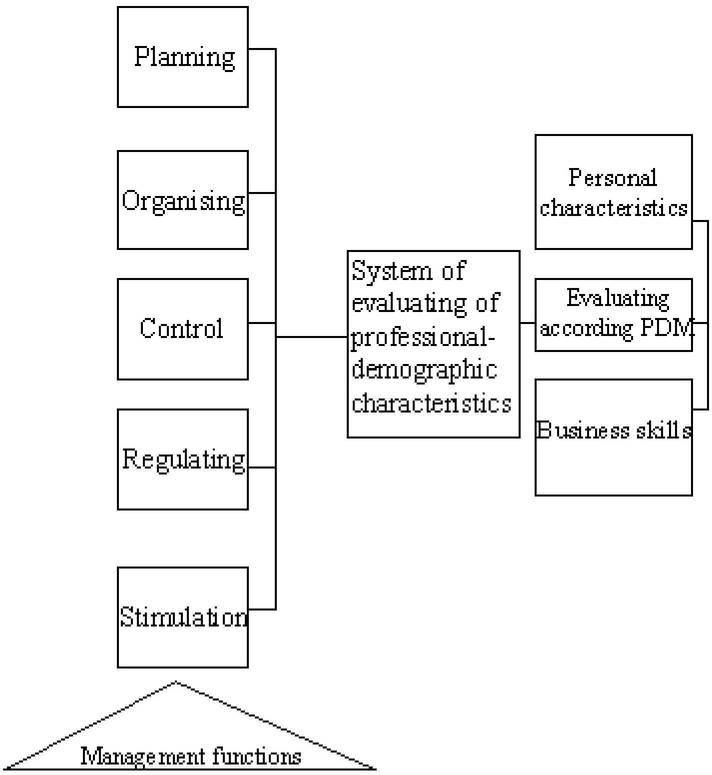

Figure 1. PDM in relation with management functions

Relations between the professional-demographic model and management functions could be examined in Figure 1.

Different characteristics of assessors are divided into two blocks which are business (professional) skills and personal characteristics.

Detailing the characteristics of assessors

The reserve of assessors is divided into parts. Assessors from different parts should have different business skills. Persons (scientists) from the first part of reserve should have the following business skills:

- Scientific activity (theoretical, experimental, organisational) should be active;
- Scientific activity (theoretical, experimental, organisational) should be resultative;
- Scientific activity (theoretical, experimental, organisational) should be irreproachable from the point of view of ethic of science.

Persons (public persons) from the second part of reserve should have the following business skills:

- Persons should be active in politics, culture, business, industry;
- Persons have to take an active interest to science and higher education;
- Persons should take an active interest in production of science and higher education;
- Persons should be acquainted with the foreign experience (was worked abroad, have relationships with foreign firms and organisations).

It is a pity that the model (including PDM) does not exist in practice which would allow perfectly evaluate personal characteristics. It is an especially big problem to evaluate personal characteristics of a new assessor. However, it is possible to define.

The most important personal characteristics of assessors are the following:

1. Intellect:
   - ability to observe, summarise, select and analyse facts;
   - logical thinking;
   - ability to generalise information.
2. Association and partnership:
   - respect for different opinions, ability to hear out, patience;

- ability to make contacts easily;
- ability to win confidence and respect;
- politeness and good manners;
- oral and written communication skills;
- ability to motivate people and to create atmosphere of benevolence.

3. Intellectual and emotional maturity:

- stability of actions and behaviour;
- ability to resist from pressing and influences of other people;
- ability to make independent conclusions.

4. Personal initiative:

- self-confidence;
- creativity;
- initiativity.

5. Ethics and conscientiousness:

- desire to help people;
- exceptional conscientiousness;
- knowing his own competence limits;
- recognition of own mistakes.

Person, having all these skills could become an absolutely ideal assessor, but as ideal people do not exist in reality. These skills are preferable for aspiration. Evaluation of these characteristics is a big problem. It is possible evaluate them testing people, but this method is not as good as it is described above in text. Besides that, a freshman assessor can be without some of these characteristics, because part of these characteristics can be cultivated only in practice when working.

Characteristics can be evaluated according the objective indices, therefore PDM is not completely perfect for entirely ideal employers, because it is difficult to estimate all the indices. The creation of selection systems lasts very long, therefore, indices may be accreted by the approaching method. Part of the characteristics are evaluated by scale system. However, different characteristics have different points of importance. It is necessary to multiply points by coefficients of importance.

On the other hand, using PDM we can realise additional requirements, because it is possible to evaluate the level of assessors activity. Three levels of assessors activity could be defined:

1) not active enough (null points),

2) active (one point),

3) very active (two points).

Besides, it is possible to evaluate quality of the assessors work. We can define the quality level of made peer review

in the following way:

1) unsatisfactory (null points),

2) satisfactory (one point),

3) good (two points),

4) excellent (three points).

It is possible to definite qualification of assessors according to these points. The system stimulating to do work of better quality, therefore, it is necessary to introduce assessors with this system. The system also makes management of peer reviews more effective.

Input data to the database of reserve of assessors

After the estimation of all earlier discussed things it is necessary to input the following data to the database of the reserve of assessors:

1) data about identification and education of persons,

2) data about their work experience,

3) data about their scientific activities during the last five years for the first part of the reserve of assessors and data about their interests in science and higher education for the second part of the reserve of assessors,

4) data about their activity as assessor,

5) data about the quality of peer reviews.

Once in two years assessors have to make corrections in personal data.

Benefit prognosis

The system of assessors selection allows to create assessors groups or to select single assessors, because the computerised program fulfils realise all requirements for composing the group of assessors. This system allows to use the reserve of assessors the most favourably. In this case subjectivity decreases, because selection is performed according to objective indices and mainly automatically. Data about the assessors is stored in the database, therefore, it is possible to receive full and concentrated information about assessors any time. This system allows us to manage peer reviews in more efficient way because PDM is used.

Implementation and maintenance

The system of assessors selection is a part of information system for assessment of higher education and research institutions. This system is under implementation in the Lithuanian Centre for Quality Assessment in Higher Education. The administration of the database of the reserve of assessors is performed by the group of the systematisation and information.

Conclusions

It is obvious that finding a perfect model and techniques for the selection of the assessors is a hard task. However, PDM could serve as good model for creation of the computerised system of assessors selection. The main part of the system is a database, containing data about the assessors. The Lithuanian Centre for Quality Assessment in Higher Education implements this system in its work when selecting assessors for assessment of higher education and research institutions.

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SKVC
Suvalku g. 1
LT-2600 Vilnius
Lithuania
E-mail: irmant(at)skvc.ktl.mii.lt

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i3vreg. - education. An approach for an integrated university information system

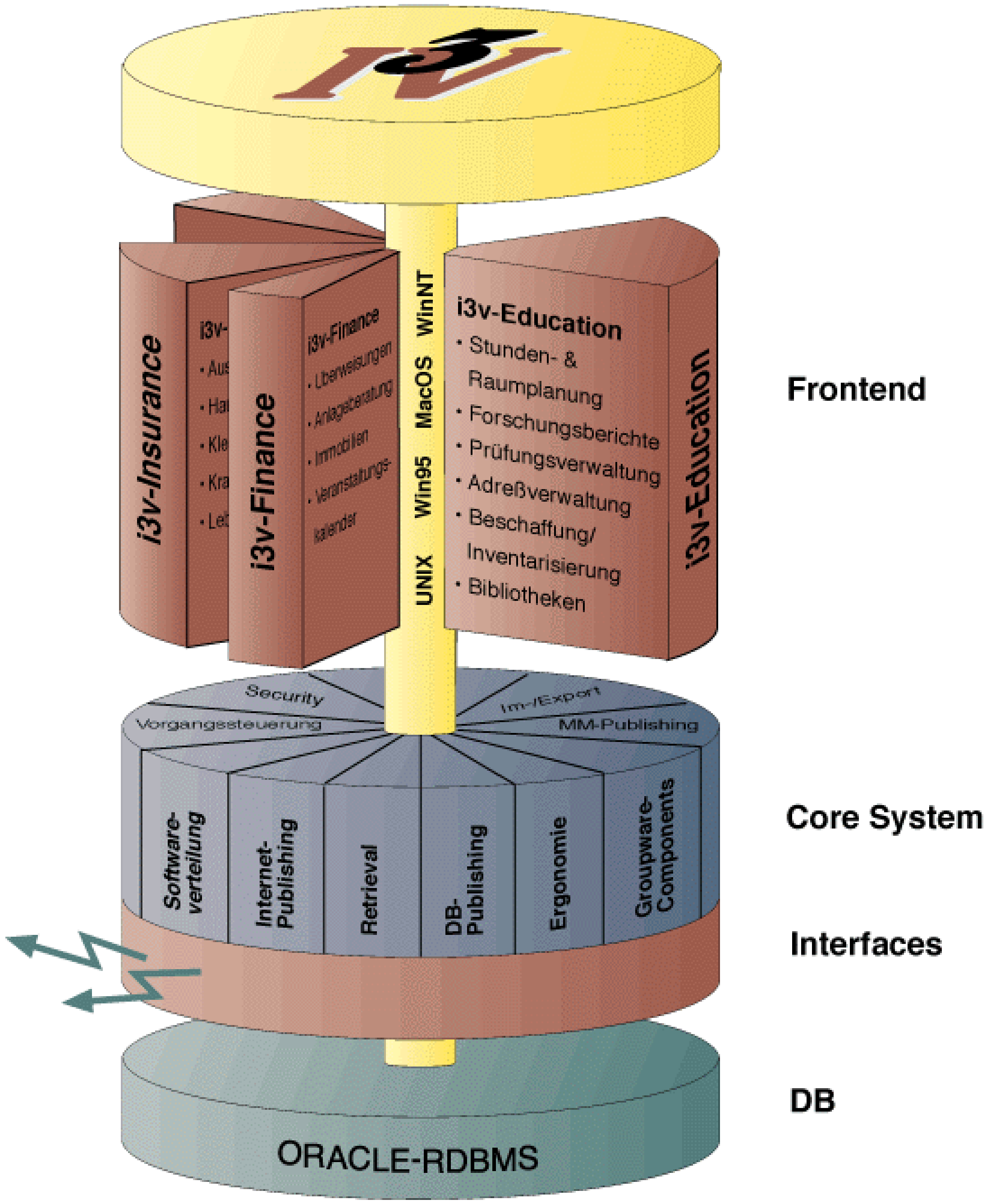
Ulrich Kammerer

1. i3vreg. and its features

i3vreg. stands as an abbreviation for ,,Integrierte Institutionelle Informations Verarbeitung". It is an architecture for designing and implementing highly efficient administrative information systems. Its basis was developed at the University of Karlsruhe in the years 1989 to 1993 and became a commercially available product when i3vreg.-technology was transferred to the GINIT GmbH in 1994.

2. i3vreg.'s architecture

i3vreg.'s architecture features three layers: the database-layer, the coresystem-layer and the application-layer. It is available for all relevant hardware- and OS-platforms, e.g. all the Windows derivates, MacOS 7.x, OS/2 in WinMode and several UNIX-derivates. On all platforms, the user interface is exactly the same, so training, initial period and user support are minimized and the integration of new applications or changes in hardware equipment are nearly transparent to the customer.



2.1 Database-layer

In the i3vreg.-database-layer all informations are stored within an integrated, totally interlinked data-model. The data stored in this extremely complex model is of very high quality. One of the main reasons for this quality is that all the data is stored absolutely redundancy free. This means, that each entry is stored only at one dedicated location within the database. All business processes are able to use it in their own contexts. Contextsecuring constraints ensure that data is stored and combined consistently, depending on the needs of the different applications. Of course security is provided on database-level and interacts tightly with the following layers.

2.2 Coresystem-layer

The coresystem-layer includes all the functions which are common to all i3vreg.-applications. Some of the most important functions are the following:

2.2.1 Automatic database-connectivity

Automatic database-connectivity means that all database-specific functions are hidden not only from the user but also from the administrator. All database activities, beginning with the insertion of new users, granting of privileges, construction of queries etc. are formulated transparently within the graphical i3vreg.-user-interface. As a result it is not neccessary for any i3vreg.-user to work with database manipulation languages like SQL at any time.

2.2.2 Highly flexible retrieval-routines

For all its applications i3vreg. provides a set of well suited retrieval-mechanisms focusing on different aspects. Those are "query by example", attribute-independant full-text retrieval, date of change dependant retrieval, logically-extended retrieval using arbitrary complex expressions and the i3vreg.-hypertext-retrieval which yields all entries similar to a selected aspect of an object.

2.2.3 Contextsensitive interlinking of all the data stored within i3vreg.

Based on the fully integrated and highly normalized i3vreg.-database, the user can browse through all the data stored within i3vreg. very easily because links are provided and maintained automatically, interconnecting data on a high level of quality throughout the whole system. This feature is especially helpful when retrieving information with unsharp requirements out of large databases.

2.2.4 Software-distribution

As a main point when running a large software-system for a broad variety of users it is absolutely necessary that software-distribution is realized in a manner which does not bind much of the anyway restricted manpower dedicated to system administration.

For these purposes i3vreg. provides the software-distribution-technology i3vreg.-UpdateOnDemand, which ensures that all the applications respectively their different modules are updated transparently to the user when he makes use of them.

In spite of this highly complex task, the system administrator only has to give consent on different granularity levels to the "publishing" of new releases and i3vreg.-UpdateOnDemand will realize all further steps fully automatically for him, regardless of the number of connected clients or platforms involved.

2.2.5 Platform-independency

One of the most critical factors for the success of a university information system is that it has to support all the platforms which are used by the staff. This is because of the fact that many of the users involved in the different processes order their one and only machine mainly for their daily research and teaching but not for administrative purposes.

Besides the different Windows-derivates, the UNIX platform for scientific faculties and the Macintosh platform, which is mainly used for areas like architecture, design and graphics, have to be supported. As everyone must have the chance to be involved in business processes concerning him, a successful long term approach can only be platform-independent.

2.2.6 Database- and internet-publishing

Another important aspect are the publishing capabilities of i3vreg.. Because of the diminishing public fundings, more and more universities are forced to implement improved activities for marketing and public relations. This results in the need for all kinds of more or less complex reports. On the one hand, these are high-quality print-reports which present the activities of the university as a whole, specialized reports based on different themes which show the overall competence of the university in a specific field and on the other hand the need for a clearly structured and easy to use representation of the university's activities in the WWW.

For all these purposes, the i3vreg.-coresystem provides publishers which are automating those tasks for the whole university. The i3vreg.-database-publisher delivers individual reports as input for the final editorial work of print-products. Supplementing this the i3vreg.-internet-publisher presents all or arbitrary selections of the highly interconnected data stored in i3vreg. in an individualized layout within the WWW.

2.2.7 Self-service concepts

Because of different new emerging technologies like chipcards self-service concepts become more an more relevant for university administration. Chipcard-technology enable new concepts of business processes in universities to be realized. Examples are the payment of all kinds of fees by electronic cash (in libraries, cafeteria, enrollments, etc.), the definition of legally binding actions using digital signatures (registration for tests and possible cancellation of it, official journey accounting, signature for test results) and many more.

In 1994 GINIT firstly prepared i3vreg. for the use of chipcard-technology and in the years 1995 to 1997 GINIT was one of the active members of the UniversCard-consortium, involving higher education, industry and politics, which defined the requirements to a chipcard to be used as a standard in universities.

Because of these long-term-activities i3vreg. is well suited for the use of chipcards within its applications and combines the benefits of the chipcard-use with the benefits of a fully integrated information system to the university.

2.2.8 Groupware- and workflow-integration

For different applications groupware- and workflow-aspects have to be integrated.

Groupware is called this way because it is mainly designed for sharing information among members of a group. In this logic i3vreg. structures its users into groups which are working together on the same business processes and data. Further every group has the possibility to contact non-groupmembers via integrated e-mail, in which the collected information necessary for the nonmember can be sent directly out of i3vreg..

In other cases, there is a need for workflow-computing as there are many persons involved in a specific process. For those cases i3vreg. provides dedicated workflows for such applications to support all involved users in an appropriate manner.

2.2.9 Security and administration of user-rights

It is absolutely clear, that an integrated university information system has to provide high security-standards. On the side of secure communication i3vreg. provides the possibility to encrypt the nettraffic and to use digital signatures for providing authentic data for legally binding actions. On the side of access-security i3vreg. provides mechanisms for defining user-access in a truly fine granularity. These access-mechanisms guarantee that unauthorized access is impossible and every user can only search and update the part of data for which he is authorized by the system administration.

2.2.10 Interfaces to others

The coresystem contains an additional layer in which interfaces to systems produced by others or the university itself can be built in. This provides the possibility to combine different products into one integrated solution for the whole university.

2.3 Application-layer

The application-layer contains all the i3vreg.-applications of the product line(s) chosen by the customer. All those applications are strictly designed in a modular fashion, so that they can work together in nearly every combination.

Based on this overall architecture several productlines for different branches exist. The largest of these is the one presented here, i3vreg.-education, an integrated solution for almost all the administrative business processes of an university.

The following chapters illustrate the applications available within i3vreg.-education today.

2.3.1 University model

This model allows to define and successfully integrate any organizational structure of an university. According to this organizational model all i3vreg.-applications are automatically structured and fit exactly to the specific needs of the university. Based on the common organizational model generic user-privileges are defined so that system administration becomes quite easy and almost effortless.

2.3.2 Curriculum-planning and room-reservation

This i3vreg.-application provides a fully decentralized approach for curriculum-planning and roomreservation. Because of its architecture a nearly 100% automation of this process can be achieved. Additionally this application successfully prevents collisions of roomreservations and events for every single student.

Furthermore this application offers a vast amount of possible printouts. Those reach from printing of the curriculum catalogue, room-reservation-plans, timetables for students and lecturers up to maintenance and configuration information for the cleaning staff and the housekeeper to prepare every room optimally for an event. In addition it is possible to control houseelectrics accordingly.

2.3.3 Announcement, administration and surveilance of the course of studies

With this application it is possible to handle the announcement, the administration and the surveilance of diploma theses, seminars, tests, examinations etc. It gives full support for the complete workflow for all persons involved in this business process. Those are the researchers, the students, the examining board and all the involved secretaries and administrators in the universities organization.

Of course the neccessary output in paper is provided as an integral part. Supplementing this application a student's registration for tests, practical studies and seminars can be realized using cryptoprocessor-chipcards.

In the near future an application for the administration of examination regulations for the decentralized parts of an university will be available. It will effectively support all the involved parties including, of course, the student himself.

Naturally this application will support interfaces to existing systems so that an integration of existing software solutions will be possible.

2.3.4 Libraries

i3vreg.-Library supports the management and day-to-day-work of university libraries by endorsing the whole integrated business process. Starting out with the order, purchase process, inventory and catalogueing of the monographies it also organizes all steps in the field of lending, provides powerful decentralized literature- and magazin inquiry topped with reservation capabilites from every i3vreg.-Client.

Further on, i3vreg.-Library support decentralized libraries with abitrary many sublibraries. It is possible to define user-groups with individual lending-time-models, admonitory models, etc.

The integration with national-library-based catalogues assures that the local library-staff can simply download the catalogue-entry into the local database rather than retyping it.

2.3.5 Addressmanagement

As another relevant application i3vreg. provides its addressmanagement. With this application it is possible to organize all the addresses which are needed in the university in private and public address-books. It is possible to define as many distribution lists as are needed. Every address can simultaneously be part in any of those lists.

Furthermore the formatting of the addresses is absolutely flexible and supported by individual auto-formatting capabilities.

2.3.6 Automation of the ordering, acquisition and inventory process

The i3vreg.-applications in this field provide an, in large parts, automatized ordering and acquisition process. Depending on the process-model of the single university it is possible to support decentralized, centralized or mixed acquisition policies. In all cases the bookkeeping activities can be initiated when the goods are delivered and mostly all the activities which have to be done for the inventory management are done in an automatism.

An overview over all the selling-partners, the inventory, etc. is supported as well as the automated printing of orders etc.

2.3.7 Administration of research projects and technology transfer

This i3vreg.-application provides full support on the administration of research projects and their attractive representation in an uniform WWW-presentation. All research projects can be arranged according to different criterias like content, methods, involved researchers, etc. The administration of papers and their integration into collective publications such as yearbooks is assisted by wizard technology to guarantee for bibliographical correct citations.

This package makes it much easier to get in contact with sponsors and to support technology transfer from university into the industry which both become extremly relevant for universities competing with each other more and more in the future.

2.3.8 Accounting for computing centers

With i3vreg.-accounting it is possible for a computing center to define arbitrary complex tariff models for its services. Based on these tariff models the consumption can be individually accounted to each customer.

It is possible to define interfaces to different resource-use-log-files on which the tariff model bases its calculations.

The invoices can be transferred automatically to the bookkeeping-software used in the specific university so that the whole accounting process can be automated further on.

A trouble-ticketing-system will be fully integrated into the accounting system in the near future so that the helpdesk/hotline of a computing center can deliver the best support to its customers.

3. Cooperations and further development

Several universities and institutes cooperate with us to incorporate new components into i3vreg.-education. Some of those projects are mentioned below.

- Cost- and Efficiency-Controlling for universities with the University of Mannheim
- Realization of a complete system for administration of examination regulations for the decentralized parts of an university with Prof. Stucky, chairman of the German Society for Informatics GI, and his AIFB
- Integration of library-catalogues and CD-ROM-archives with the library of the University of Karlsruhe

As i3vreg. is a complete solution to higher education customers, it is consequently open for partners developping solutions for additional higher-education-specific domains in form of further cooperations.

Last but not least all the new and emerging technologies are continuously integrated into i3vreg.-technology if they bring advantages to the i3vreg.-community. This ensures that all users are equipped with an always state-of-the-art software-infrastructure.

GINIT GmbH,
Vincenz-Priessnitz-Str. 1,
76131 Karlsruhe, Germany
URL: http://www.ginit.de
Email: info(at)ginit.de

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Ping: an electronic interface for the Swedish universities

Peter Lundberg, Staffan Gustafsson

In this document we describe the "Ping"-system, a public interface to the Swedish University admittance system using WWW-technology and smart cards, enabling us to perform various services both to our regular users, current students and applicants. Examples of current services are an ability to check ones results, changing addresses in the system and ordering certificates of merits. The system is being developed in three stages, currently the first stage is under installation. This, of course, is a very brief description.

Originally the name Ping was derived from the UNIX-command "ping" which is used to check if a host on a network is available for communication or not.

The purpose of the Ping-project:

Starting out from an initial, experimental system, at the Royal Institute of technology (KTH), the LADOK-group is currently developing a general-purpose transaction handler. The transaction handler will be able to "pass along" transactions to its peers at other LADOK-installations. With this ability we will be able to implicitly "join" together all the databases at the different universities in Sweden, thereby simplifying local admission, improving the support for administrators and students, and providing information for applicants.

Short description of LADOK:

LADOK is a computer based student admission and documentation system for a university or university college. It focuses on administration of undergraduate and graduate students. The system is locally deployed and managed by the institutions

The LADOK system has a mutual core, identical for all LADOK system installations in Sweden. The core consists of a structure of database tables, computer programs and terminal screen routines. Every institution decides what parts of the core to be used at the institution and it is also possible to use locally developed addendum's. The LADOK-system can therefore be viewed upon as a large "smorgasbord" where the institution can choose which parts to use.

The LADOK-system consists of two major parts, the admission system and the documentation system. They are integrated and share data, e.g. name, address and other facts about applicants and students. A third part, handling documentation of graduate students, is newly added to the LADOK system core. Undergraduate studies are handled within two major concepts, courses and study programs. The first has its focus on students and single courses and the second of students following a specified study program, normally 3- 4 years study.

The system files contain information for student identification, general eligibility for university studies, admission to courses and study programs, registration on courses per semester, course data, credit points from courses, awarded degrees and international studies.

The LADOK system mainly focuses on student admission and documentation, planning and follow-up. The system is designed to be used by all Swedish state financed institutions of higher education and has its focus on the departmental level. Users of the LADOK system at an institution can be found at all levels:

- university board and administration
- faculty or school heads
- departments
- students

Data from LADOK are exported to the ministry of education and other agencies for follow-up purposes. An important objective of LADOK is to prepare the annual invoice to the government for studies on the undergraduate level at an institution.

The LADOK system is owned by a consortium of 49 institutions in higher education in Sweden. Software maintenance for the LADOK system core is conducted by a maintenance group at the University of Umeå. Local system usage is the responsibility of the institution, who pays for servers, networking, terminal equipment and local support.

The system is currently facing a major revision that aims for easier user interface and new functionality including a strong focus on security issues. Today, the system is used by approx. 2.000 simultaneously on-line users but it has to be prepared for a large growth in number of users inside institutions and, of course, there are more than 300.000 students waiting for better service with WWW, touch-tone telephone systems and explicit student applications.

The IDOL-project:

The IDOL-project (Swedish for ID-Oriented solutions) is an ongoing project where several Swedish organizations gathered around a common specification of a smart card which is to be used as a means of identification in Sweden. Some of these are:

- The national telephone company (Telia)
- The national mail company (Posten) who issues the smart cards.
- The national railway company (SJ)

The card consists of both a chip and a picture, which means that it can be used as both an electronic and a visual means of identification.

On behalf of The Royal institute of technology in Stockholm the LADOK-group was asked to design and construct one part of an application enabling student access for approximately 6000 students.

The application consisted of three parts;

One part handling the direct interface to the student and his/her smart card (Telia's responsibility
One part handling the catalogue services for the identification process (Posten's responsibility)
One part handling the transactions between the student and the database (our responsibility)

The services currently provided to the students are;

1. checking registrations to courses
2. checking results
3. checking and changing ones addresses
4. ordering certificates.

The system has been in action for nearly seven months and has been the source of much knowledge. During this period we have had approximately 45000 database accesses. The "slow" periods during weekends and Christmas makes an average of 300 accesses per weekday.

In summary:

The most popular service is the possibility to check registrations, and we feel that we have evidence to say that the students have a strong interest to check their status in the system and use the services provided. It is still to early to say in which extent they will use the system to obtain certificates since the system has not been working across the summer.

The project provided us with a possibility to build a transaction-handler that operates with a secure protocol. The security in the system is high enough for us to let the students make changes on their own data. We therefore feel that we can use the model to evolve the system into a more general mechanism where students can take part in a large administrative system both for retrieving their own data and feeding the system with changes and (for example) applications.

Advantages of an electronic interface:

The advantages of an electronic interface to the admittance-system are not as obvious as they might seem.

Possible advantages might be expressed in the following terms;

Savings: The possible economical savings that the system can result in are at present marginal at best. The organization must keep the same kind of record of their students no matter if the system exists or not, and must be ready to provide the same kind of service. If we were able to develop the system to handle more student input the savings would probably be large, mostly because the time from application to acceptance / rejection could be shortened and the cost of personnel could be reduced.

Public-relations / service: As the system works today the only service that is completely new to the organization is the possibility to change addresses, I think that we can see an increased openness in the admittance- system as beneficial in terms of public-relations but measuring the benefit in good service against a possible cost in bad student service is difficult at best. One service that we think would be greatly appreciated is a possibility for applicants to feed the systems with high-school grades to find out weather the are qualified for taking a certain course/courses or not.

Record-keeping: From the technician's point of view, using the system should result in a more correct database since students will be able to check and in some extent change the data describing them.

Problems with an electronic interface:

Technically we have had few problems in designing and constructing the application. There are, however some indisputable problems concerning the installing of a system like the one in KTH in a larger scale. This has to do with the general infrastructure situation.

The cost per student in a system like this is at present very much to high to make it realistic to escalate the system to extend the entire nation. At present the cost per student is approximately $150.

My estimation is that it will take three to five years before we have an infrastructure within the Swedish Universities that is so developed that we can use it to develop services that will force the students to use smart cards. Of course "Stand alone" solutions will be developed just like in KTH bot not in a national perspective. However, until then we still have to provide service to the students and must find secure ways to authenticate users across the Internet.

Principal changes evolving from IDOL to PING:

Working within IDOL we learned that the system can handle input to the database in a secure way and that this is where the real benefits of an electronic interface are. A request that arose during the development was that the system should be able to forward questions to its peers. Therefore we have these main issues that will be addressed in the Ping-system.

The system shall;

- Be able to use several ways to authenticate users.
- Provide the same services as the system being used at KTH.
- Develop services focused on student input.
- Provide services to high-school students by testing their grades.
- Provide a seamless interface between different universities by being able to retrieve information from several LADOK-installations.

The last item on the list is by far the most important. An example on this is the typical scenario of a student administrator asking LADOK for the results of a student. With the help of the Ping-system the same kind of question could be put to all LADOK-installations thereby providing the administrator with a complete picture of a students situation. In Sweden it is not uncommon for students to change university within their education and so we expect this function to be of great value.

Some strategic design-decisions

The first and most important design decision we had to make was that if information is to be retrieved from various locations later to be used in decisions we have to be able to save the data locally together with an electronic seal describing where they came from and when they were retrieved. This is done by creating duplicate tables for certain data expanded with the information described above. The idea is that if we have a table "courses" which describes the local results of a student we also have a table "Xcourses" which describes Xternal results at a certain point in time. At present this concerns six tables in LADOK, and yes, the association to the X-files are obvious.

The second important design d is that we must take responsibility for all the three parts of the application except from the basic catalogue-services, which we hope, will be provided by several companies in Sweden. This is necessary since we want to be able to use several schemas to authenticate users.

This decision has meant that we must develop our own ID-server, as well as our own client-application. The ID-server is currently (may 31) in a stage of rapid development. The target platform is Windows NT.

For the client-application the obvious user interface today is WWW / JAVA. This is not because JAVA is the "hip" language of today, but because it gives us three certain obvious advantages.

1. The awesome problem of distributing software to 300 000 students is almost eliminated if we can use a JAVA applet.
2. Handling the problem of different versions is also more or less solved since there will not be any old software installed anywhere.
3. There are some problems with JAVA running in different browsers on different platforms. Using JAVA does not solve the problems, but they are minimized.
4. Internet gives us the widest possible exposure of the system, providing us with the possibility to use the system towards high-school graduates.

Technical premises:

It is beyond the scope of this document to give a precise technical specification of the system, some basic issues however are these:

- The system is prepared to authenticate users through smart cards, a tacacs functionality (userid / password) and internal LADOK-id's / passwords.
- Information will be passed between client and server using DES- encryption.
- A University authenticating itself to another installation will use a public/secret key pair.
- A student authenticating itself to an installation will receive a RSA-generated key to pass an encrypted session key between client and server.
- The client will not contain any secrets, if anyone would go through the problems of writing an own client so be it, the protocol will be public.
- The time for a single transaction is approximately 0.5 seconds and we aim to be able to scan all installations within 30 seconds.
- The local ID-server will have functionality to exclude specific transactions, for example those that means that changes will be done to the database.

The development process:

The system will be developed / launched in three stages:

Stage 1: The first stage will contain basic functionality to facilitate the admission of students. We intend to focus on the possibility to exchange high-school grades, and previous university merits. This will be performed as batch operations with a very low level of interaction. This service is more a step in preparing the applications before the final admission can be performed.

This stage is currently under final testing

Stage 2: The second stage will focus upon improving the support to the student administrators. We intend to provide the student administrators with functionality to check and confirm merits between different universities thereby giving a more complete picture of a student's current status.

This stage will go into a testing phase at the end of the summer.

Stage 3: The third stage will focus upon student services, the services that will be provided will first of all be the same that are being used at KTH and later extend to more Input-oriented functions.

In which extent student services can be of the same "inter-university" kind as those of the administrator's remains to be seen, this has to do with how the security problems are solved.

This basic student functionality will be tested at the University of Umeå during the autumn of -97.

During the autumn we will also develop a public service which will provide high-school students the possibility of testing their grades for general and specific qualification. We also aim to provide a service that will answer the question, "would these grade have qualified me for a specific course last year?" These two services are perhaps the most exciting of all, still we are only at the beginning of what we can achieve with a general-purpose transaction handler like Ping.

LADOK-gruppen,
University of Umeå
901 87 Umeå, Sweden
E-mail: peter.lundberg(at)ladok.umu.se
staffan.gustavsson(at)ladok.umu.se

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Vers un management assisté par réseau

Robert Marty, Jean Xech

Nous choisissons d'introduire notre problématique en citant Daniel Parrochia dans son ouvrage "Philosophie des réseaux". En effet, les quelques lignes ci-dessous introduisent d'emblée une dimension dramatique qui, nous semble-t'il, est attaché à tout changement profond dans les pratiques sociales. Les évolutions technologiques rapides voire brutales que nous connaissons sont à l'évidence de ce type.

"Fonctionnellement, écrit Parrochia, chaque fois, la mise en réseau réalise une économie. Une telle constatation fait loi : la liaison n'est pas le malheur : ont gagne à s'unir, c'est-à-dire à se déposséder. Allègement de masse, diminution des charges, minimisation des distances, gains de surface, puissance ou compréhension, etc... Contrairement à ce qu'on croit, c'est le local - la "racine" - qui, très largement, aliène. C'est l'isolement et la réclusion qui tuent" .

D'un certain point de vue donc l'administrateur de réseau et avec lui le service informatique peuvent être perçus comme celui ou ceux par lesquels le malheur arrive. Vecteur d'un progrès technologique plus ou moins accepté, plus ou moins redouté -car il va bouleverser les pratiques quotidiennes et les rapports sociaux-, le service informatique va devoir assumer d'importantes tensions. Agent du changement technologique il est concerné au premier chef par les transformations des rapports sociaux qu'il induit et il se trouve de ce fait projeté au centre de la sphère des relations politiques et sociales de l'institution dont il est aussi un acteur. D'agent impliqué à distance il devient l'un des acteurs principaux du changement institutionnel. De sa capacité à résoudre des questions cruciales auxquelles il n'est pas nécessairement préparé vont dépendre la réussite ou l'échec des adaptations nécessaires de notre institution aux défis toujours renouvelés de la modernité .

Notre propos sera donc de tenter de saisir très d'un même mouvement de pensée changement technologique et changement institutionnel car ils ne peuvent être pensés séparément sous peine de diverger jusqu'à séparation complète génératrice de paralysies et de conflits.

Notre thèse c'est que l'arrivée ou la généralisation d'un réseau dans une institution relativement fermée comme la notre contraint l'ensemble des agents et des acteurs du chargement à assumer collectivement le passage de la gestion au management. Il s'agit bien d'un saut qualitatif sur fond de bouleversement des habitudes acquises, de remises en question, de redéfinition des statuts et des rôles.

Notre présence ici en binôme traduit dans le fait la reconnaissance de la nécessité à priori de recoller la compétence technologique de l'ingénieur et les capacités analytiques, régulatrices et d'aide à la décision disponibles dans les sciences humaines. En d'autres termes, l'enjeu principal est le passage d'un réseau de machines ou d'adresses IP à un réseau d'agents d'une institution , c'est-à-dire un réseau de personnes dont les statuts et les rôles sont déjà distribués.

La sociologie des organisations a pour coutume de distinguer l'organigramme - la dévolution instituée des pouvoirs dans une structure hiérarchique - et le sociogramme -le jeu des relations réelles de pouvoir entre personnes groupes formels ou informels qui déterminent réellement les prises de décision et leur mise en oeuvre. Le réseau, par sa capacité à mettre en relation les personnes tout en ignorant l'organigramme s'inscrit d'emblée dans le sociogramme qu'il dope littéralement face à un organigramme rigide et peu préparé. Il crée de ce fait une tension institutionnelle qui fera nécessairement problème à un moment ou à un autre. Il convient donc de mettre en place les moyens intellectuels et les procédures pour faire face de façon positive à ce type de situation. A la traditionnelle " informatique de gestion" on devra dont se préparer à substituer une "informatique de management" dont le réseau, avec ses fonctionnalités multiples (courrier électronique, serveur Web, serveur de listes et de documents, de logiciels, de didacticiels multimédia, etc....) sera la figure emblématique

Pour aborder ce passage obligé il est nécessaire, comme dans toute démarche rationnelle, de fonder son intervention sur une bonne conceptualisation de l'existant capable d'accueillir, en la maîtrisant, la perturbation amenée par l'arrivée ou la montée en puissance du réseau. La bonne approche, nous semble t'il, consiste à expliciter la réticularité de l'institution telle qu'elle s'est établie dans le temps en distinguant une réticularité institutionnalisée (les relations administratives hiérarchiques explicites de l'organigramme) et une réticularité instituée (relations établies implicitement, sous- jacentes, à base d'alliances et de rejets de divers groupes plus ou moins constitués et de relations interpersonnelles). A ces deux réticularités on opposera dans un premier temps la réticularité du réseau comme réticularité instituante. Elle est instituante dans le sens suivant emprunté à la socianalyse (analyse institutionnelle en situation d'intervention) : le réseau informatique, en permettant la communication instantanée de point a point, donc de personne à personne court-circuite les flux d'information déjà-la; il procure des accès immédiats à des informations jusque là difficiles à obtenir ou dont la vitesse de circulation était si faible que l'information était obsolète à son arrivée (par exemple, les comptes-rendus des instances de décision) ; il permet des réactions quasi instantanées et massives à tout événement important; il facilite la communication entre groupes formels ou informels qui retrouvent de la vigueur en s'organisant mieux, etc.... Nouveaux chemins, courts-circuits, instantanéité, accélération : le graphe des relations individu - individu, individu - groupe, groupe - groupe, groupe - institution est radicalement modifié. Nouvelles conduites et nouveaux rapports induisent un déséquilibre qui enclenche une dynamique : l'institution est concernée dans les fondements mêmes de son mode de fonctionnement. Que le nouvel équilibre soit plus favorable à l'exécution des missions d'enseignement et de recherche qui sont la finalité ultime de nos établissements n'est pas une évidence à priori même si certains peuvent penser que le réseau par ses vertus propres pourra résoudre magiquement tous les problèmes. Les acteurs de ces changements produisent alors une sociologie empirique spontanée ; les comportements qu'elle détermine peuvent aboutir à créer une situation chaotique, cause d'un rejet d'autant plus massif du réseau que, pour beaucoup, elle sera le cadre d'une première expérience. En exportant dans ce champ les concepts de la socianalyse nous nous efforcerons d'anticiper et de situer le débat au plus prés de nos vécus quotidiens.

1. L'institutionnalisé de la réticularité : organigramme et hiérarchie.

La science administrative, cette branche de la sociologie des organisations qui applique à l'administration publique les méthodes forgées à l'origine dans les grandes entreprises a depuis longtemps intégré le fait que le fonctionnement d'une organisation quelle qu'elle soit ne peut être compris si l'on ne prend en compte que les lois et règlements explicites qui la gouvernent. Certes, ces derniers sont opérationnels mais les niveaux d'analyse qu'ils autorisent doivent être complétés, voire corrigés par une analyse des relations informelles que l'on peut décrypter dans les motivations personnelles, les comportements, les stratégies des acteurs et des groupes en présence. On sait bien que leurs intérêts et leurs objectifs ne coïncident pas nécessairement avec les buts affichés de l'organisation. Michel Crozier a bien montré comment les caractéristiques essentielles du fonctionnement de l'administration française - impersonnalité des règles, centralisation des décisions, isolement des catégories hiérarchiques - favorisaient le développement de pouvoirs parallèles et produisaient l'émergence d'un "cercle vicieux bureaucratique". Il a ainsi mis en lumière une certaine incapacité à s'adapter aux changements autrement que par crises successives.

1.1 Les comportements individuels des agents.

Ils sont bien identifiés et peuvent être considérés comme des produits du système. En général, les agents considèrent qu'ils ne sont que des rouages d'une hiérarchie dont ils ne perçoivent pas les motivations réelles. La multiplication des niveaux intermédiaires, la dilution des responsabilités au fur et à mesure qu'on s'éloigne des centres de décisions induisent beaucoup d'entre eux à "ouvrir le parapluie" en toutes circonstances. La personne se police elle-même pour apparaître seulement comme un agent. La prise de risque est l'exception, l'initiative cherche à se couvrir de toutes les garanties possibles avant de se mettre en oeuvre. La délégation de pouvoirs est rarement effective : difficile à donner, difficile à recevoir. Les communications sont limitées à l'horizon de chaque entité administrative ; l'arrivée de l'ordinateur conduit simplement à envisager la réalisation des tâches quotidiennes d'une autre façon, en conservant les mêmes principes.

1.2 Les conduites de groupe : facultés, départements, laboratoires, services .

Les conduites de groupe sont caractérisées, par analogie avec l'esprit de corps, par ce qu'on peut appeler l'esprit de catégorie. Chaque groupe cherche à "bétonner" ses positions, ce qui interdit toute initiative transversale et conduit à la multiplication des stratégies de prise de position à tous les niveaux de la structure administrative (notamment à l'occasion des élections) et à une forte crispation sur les acquis. L'ajustement des personnels en fonction des changements survenus dans les filières, l'ajustement des moyens (locaux et crédits) sont autant d'occasions de guerroyer. La collaboration avec d'autres groupes perçus comme des concurrents potentiels est écartée à priori; le blocage peut devenir la règle. Les groupes communiquent très peu entre eux et l'ordinateur est pour l'essentiel consacré à la gestion des affaires courantes du groupe. La rigidité de l'ensemble s'inscrit dans la hiérarchie : université - faculté - département - laboratoire reconnu - équipe d'université.

1.3 Les organes de direction : conseils et commissions

Le rôle des organes de direction est particulièrement difficile. D'une part ils doivent exécuter une politique définie au niveau national qui se manifeste sous forme de décrets, circulaires, dotations de fonctionnement, attributions de postes, etc.... D'autre part ils sont confrontés à la pression de la base qui fait remonter exigences et besoins. La pratique des plans quadriennaux a malgré tout pacifié les rapports ; le sentiment du contrat à remplir et la concentration des affrontements sur la période de la négociation du contrat on considérablement réduit les tensions en moyenne. Cependant la structure pyramidale contraint à faire cascader les décisions et l'information ; sauter un niveau intermédiaire même non concerné peut ouvrir un conflit. Les organes de direction communiquent généralement par circulaires, comptes-rendus, bulletins d'information, tous moyens grevés par l'inertie de la filière de duplication et de diffusion interne. L'ordinateur et le réseau y sont généralement perçus au mieux comme devant procurer des gains de productivité sur les tâches habituelles (et donc réduire les tensions sur les demandes de poste de IATOSS principalement) au pire comme une couche supplémentaire à gérer.

Il apparaît donc que la place assignée à l'informatique dans ce moment de la réticularité de l'institution correspond à la classique informatique de gestion. Les relations inter-instances sont matérialisées dans des connexions caractéristiques de l' informatique centralisée dont on sait que, de toute façon elle subsistera.

2. L'institué de la réticularité : groupes de pression et syndicats d'intérêts communs.

Il est clair que si le fonctionnement de notre institution était uniquement déterminé par le réseau et le type de relations que nous venons de décrire le blocage serait quasi-permanent et remplir nos mission serait une gageure. On sait bien que s'il n'en est pas ainsi c'est parce que l'organigramme est doublé d'un sociogramme qui se prête par ailleurs à une lecture nettement moins aisée.

2.1 Les attitudes individuelles.

La personne ne se réduit par, fort heureusement, à l'agent et, si l'agent fonctionne, la personne vit. Selon ses motivations, son histoire, les hasards de l'existence aussi, chacun est partie prenante dans l'institution d'un réseau de relations interpersonnelles assez stables qui se prolonge au-delà des simples relations de travail. Ces rapports extra - professionnels souvent conviviaux constituent un réseau par lequel circulent quantité d'informations inexprimables dans des relations de type administratif. Ces flux d'information se concentrent dans des noeuds qui correspondent à des personnes (souvent identifiées comme des "leaders d'opinion") qui occupent des positions privilégiées dans le sociogramme (des positions d'autorité, à distinguer des positions de pouvoir, sans que l'une exclue l'autre).

2.2 Les groupes informels.

Ils sont pour la plupart l'expression de la transversalité de l'institution : syndicats, associations de toute nature, lobbys, groupes de pression circonstanciels (par exemple réunions éphémères de catégories pour obtenir des avantages contre d'autres catégories).Ils communiquent difficilement car ils sont éclatés sur les campus et ils doivent trouver des plages de réunion quand ce n'est pas des lieux de réunion,... Ils communiquent traditionnellement par le courrier intérieur ou grâce au dévouement de "chevilles ouvrières" (de plus en plus rares, sauf en cas de crise avec mobilisation intense). Ils concourent fortement à la mise en place des groupes dirigeants et participent souvent à la direction informelle de l'institution.

2.3 Le fonctionnement réel du pouvoir : réunions non statutaires et apartés.

Les organismes officiels (Conseil d'administration, conseil scientifique, conseil des études et de la vie universitaire, commissions de spécialistes, etc....) réunissent du fait des règles de représentation plus ou moins proportionnelles des personnes qui participent à des groupes informels aux intérêts divergents. Ces groupes ne peuvent y apparaître au grand jour. L'élaboration de leurs stratégies nécessite des procédures d'information mutuelle. Quelquefois le téléphone suffit mais ce moyen est trés en deça des possibilités offertes par l'e-mail et, bientôt, par la téléconférence dont on peut se demander si, lorsqu'elle sera généralisée, elle ne deviendra pas le mode privilégié de communication informelle.

En définitive, la réticularité institutionnalisée et son complément indispensable la réticularité instituée décrivent le déjà-la, la situation qui préexiste à l'arrivée du réseau. Avec ce dernier nous passons nécessairement dans l'instituant, en précisant bien que ce terme ne doit pas d'emblée être pris avec une connotation positive.

3. Le réseau comme analyseur.

3.1 Les conduites adaptatives des agents/personnes

Relevons l'ensemble des attitudes psychologiques que l'on observe généralement lorsqu'une institution est confrontée au fait technologique. On peut les classer en trois catégories caractérisées par :

- la frilosité voire la méfiance qui conduit à pratique de la gestion dans laquelle le support informatique n'est qu'une couche supplémentaire tolérée et maintenue à distance;
- le transfert : les gestionnaires utilisent le support informatique en relève ou en substitution des supports traditionnels (par exemple, la circulaire électronique prend la place de la circulaire papier, la gestion de l'occupation des salles de cours se fait en temps réel, etc...)
- l'anticipation réaliste : elle recherche dans les nouvelles possibilités technologiques l'occasion de dépasser les pratiques existantes, elle guette et favorise les pratiques émergentes positives afin de concourir pour le mieux aux missions traditionnelles de l'établissement.

Il est clair à priori que les attitudes réelles balanceront suivant les moments et les premier résultats observés entre ces trois pôles. Il est clair aussi que l'un des enjeux principaux au seul souci de la justification des investissements réalisés, est notre capacité à imaginer et à mettre en oeuvre les dispositifs institutionnels, qui peuvent favoriser l'émergence des changements positifs que l'on peut raisonnablement espérer.

3.2 Les groupes formels et informels face au réseau.

Les groupes institutionnels trouveront certainement des avantages dans l'utilisation du réseau : meilleure communication (en qualité et en quantité), moins de réunions contraignantes par l'utilisation du groupware et de la visioconférence, plus grande facilité pour gérer à distance. Cependant ce sont les groupes informels qui devraient être les plus importants bénéficiaires, car le réseau lève presque toutes les contraintes qui limitent aujourd'hui leur puissance d'intervention. Par exemple, la moindre information, la plus petite rumeur même peuvent être communiquées instantanément par multi- adressage à l'ensemble du groupe qui peut réagir dans l'instant et la diffuser aussitôt à d'autres groupes ou à tous. Une diffusion qui nécessitait de huit à quinze jours pour produire ses effets dans l'informel se fait en 24 heures, peut-être moins. Les circuits classiques qui dépendaient du hasard des rencontres sur le campus, dans les couloirs ou dans les réunions officielles sont remplacées par des circuits presque instantanés et de plus, les cibles sont atteintes avec une précision et une exhaustivité maximales.

À l'égard de ses groupes le réseau produit un déséquilibre qui accroît la tension par exacerbation de l'activité communicante; en gros, on peut dire que les montées en tension seront considérablement plus fortes.

3.3 L'institution : que faire avec le réseau?

Les organes de direction sont donc confrontés à une nouvelle donne informationnelle qui par nature échappe à tout contrôle et se prête peu à une analyse réfléchie étant donné la fluidité, l'instantanété et l'étendue des modifications. La temporalité de la communication n'est plus du tout la même. Certes les directions peuvent bénéficier et même de façon privilégiée de l'instrument, mais encore faut-il s'adapter rapidement sinon les avantages des personnes et des groupes "branchés" risquent de devenir exorbitants. Elles peuvent se trouver dans la situation désagréable de courir aprés l'événement, d'être les dernieres informées, d'autant plus que les liaisons vers l'extérieur subissent aussi les mêmes transformations (l'interconnexion physique des réseaux est aussi l'interconnexion des réseaux informels).

En somme la nouvelle donne c'est que la réticularité instituée prend le pas sur la réticularité institutionnalisée; il faudra donc que les directions se donnent les moyens de maîtriser les configurations émergentes de pouvoir et surtout d'autorité.

4. La solution Intranet .

De quels outils - en plus des capacités individuelles et collectives d'analyse- disposent les directions pour gérer la nouvelle donne

? Il est exclu de réduire les formidables possibilités d'évolution apportées par le réseau en bridant les fonctionnalités de façon réglementaire. Certains seront peut-être tentés, cela serait dommage. La réponse est à la fois technologique et pragmatique : c'est selon nous la mise en place progressive et pilotée politiquement d'un Intranet/Extranet qui permettra non seulement de réduire les tension institutionnelles mes surtout de les utiliser pour améliorer singulièrement la réussite collective.

En effet, l'Intranet permet de souder dans le même concept l'institutionnalisé et l'institué : le premier peut accroître sa visibilité institutionnelle, fluidifier l'information, expliquer ses décisions en évitant les malentendus, couper les ailes aux rumeurs dans l'instant ; le second peut s'y projeter - car c'est sont intérêt- dans la mesure où tout groupe ayant des visées sur le pouvoir à vocation à convaincre l'ensemble des acteurs du bien fondé de ses objectifs. L'Intranet et son complément l'Extranet, en permettant à chacun de participer à tout instant à la vie de l'établissement (même les "turbo-profs"seront intégrés) peuvent devenir de merveilleux outils de gestion intégrée et dynamique du dit et du non-dit,du manifeste et du caché.

5. Conclusion : du cryptisme à l'agorisme.

Avec le réseau se repose le vieux débat sur les formes de l'exercice du pouvoir et/ou de l'autorité. Chacun de nous, chaque groupe formel ou informel doit choisir entre rester entre-soi, se calfeutrer dans les certitudes partagées par un petit cercle (cryptisme) ou s'ouvrir, communiquer à tout vent, prendre des risques, s'exposer à la critique (agorisme). Le réseau, nous semble t'il, pousse vers l'agorisme de façon inéluctable ; il permet de capter l'énergie de l'informel pour régénérer les parties ossifiées de structures un peu trop pérennes ; à travers l'Intranet il permet d'afficher en permanence l'état et l'évolution de nos établissements ; enfin et peut-être surtout, il est un moyen privilégié d'instaurer cette transparence et cette démocratie dans la gestion tant de fois évoquées dans les professions de foi.

Université de Perpignan, 52, Avenue de Villeneuve, 66 860 Perpignan Cedex, France
E-mail: marty(at)univ-perp.fr, Jean.Xech(at)univ-perp.fr

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Preservation of the Electronic Assets of a University

T Alex Reid

Oxford University is a highly devolved institution, with nearly 100 departments, 40+ colleges and many other academic and administrative units. Its form of governance allows considerable autonomy to these various entities (indeed, the colleges are separate legal and financial organisations). Furthermore, the University is housed in numerous buildings distributed throughout the city.

This environment has always presented special challenges to the orderly and effective development, acceptance and implementation of IT strategy. For instance, the University has invested in a substantial FDDI backbone network which now reaches all these units, connecting over 200 Ethernets, and with about 15,000 computers attached. Computing facilities are thus highly distributed, and also highly diverse. All major brands of Unix workstation are represented, and personal computers include DOS, Windows3.1, Windows95, WindowsNT, OS/2 and MacOS. As befits such an environment, IT support is also well-distributed. Central support, meanwhile, is responsible for supporting core services like the network and providing backup to the distributed support staff.

The IT Strategy of the University (accessible at http://info.ox.ac.uk/it/strategy) seeks to ensure that this diversity works harmoniously, that there is central provision of services of strategic importance and where it makes sound economic sense to do so, and that sensible standards are promoted throughout the University. The result at Oxford is a rich computing environment, but which avoids the excesses of anarchy and duplication.

2. The Problem of Electronic Assets

Against the setting described above, the University, in common with all others, is faced with a staggering increase in the quantity and variety of electronic information. Some of this is ephemeral, so its storage, management and preservation is of no great concern. A very substantial proportion of it is, however, of immense value, not just to its creator/owner, nor just to those local or international colleagues involved in related work, but often to posterity.

The problem of making important university information accessible to others, in time and space, has been solved in the past by a combination of formal publications (meeting minutes, research reports, proceedings, journals, books, etc), and formal storage arrangements (departmental and central filing systems, libraries, archives, etc). This system itself is straining under the load of the exploding amount of information being produced and published, especially in the scientific world.

To this we are now adding, at an enormous rate, information in electronic form. In many cases, this is duplicating the conventional printed or visual form, and in others it is substituting for it. In other cases again, however, it is information not only in a new form, but sometimes of a totally new kind.

Not only do we have few paradigms for managing this electronic information (since we are able to carry so few across from our experience with conventional media - which themselves took centuries to develop), but we have been slow to recognise the existence, importance and vulnerability of some of this information.

There are several dimensions to the storage of this information. There is its durability; its appeal (how widespread is the interest in it?); its size; its vulnerability; its popularity (the frequency with which it is accessed); and its rarity.

These dimensions create a vast array of situations and policies which must be implemented, including ensuring an effective backup regime is operating; preservation of electronic information beyond the current media and our lifetimes; building suitable metadata files; and dealing with the vexing question of formats which will survive current software and hardware platforms.

Among the many types of electronic data we need to safeguard are scientific research results which are often extremely expensive, sometimes impossible, to recreate; electronic images of rare and sensitive documents; even the Web pages we are creating, into which much intellectual effort is being poured.

3. Elements of the Solution

The solution to at least some of these problems at Oxford was perceived to be a very large central file store to which all users had access across the network. Issues of economics dictated that this must be a hierarchical store, ie one with a hierarchy of media. Given the environment at Oxford, it was also clear that this must be a client-server system, and capable of supporting thousands of clients, from a wide range of vendors. It also had to provide a range of functions, including backup, archive, ftp storage, and file migration.

Designing an effective backup regime is not as simple as it sounds. We define backup to be the process of making a duplicate copy of a file for storage in a different place, so that in the event of damage to the original, it is possible to revert to the backup copy. One needs to recognise that some files undergo constant revision, so it may be necessary to keep copies of a multiplicity of revisions. It is not cost-effective to keep copies of all revisions for ever, and some arrangement must be made to delete backup copies when the original really is no longer required. The system therefore needs to have the capability of setting appropriate parameters to cope with different regimens (eg numbers of versions to keep, amount of time to keep them after the original dies, etc).

An archived file is distinguished from a backup by the fact that its retention is totally independent of the original. Indeed, the operation of archiving is more like a "move" than a copy, and the whole point of making an archived copy is that it should be retained indefinitely (ie regardless of the fate of the original).

File migration is the process whereby local file stores "overflow" onto a much larger file store. Migrated files would not stay on the local system, but would remain in the local directory so that they could still be found. Ideally, migration should occur only when space on the local system reaches a critical threshold, and normally the least-used and/or largest files should be migrated. Recovery should be transparent (apart from a tolerable delay). Once again, it must be possible to implement a variety of policies through options and parameter settings.

Ftp storage is a manually-operated case of file migration, in which the process is handled by direct action of the user. The lack of automation gives greater control over file location, but does require extra effort. It also requires direct user access to the server.

A further option which can be considered is NFS-mounting of files. We decided not to seek this capability in its present form, since without (say) a Kerberos environment it could be quite insecure, and file space management at the central store could be difficult, and unless due care is taken use of files held in this way could put a heavy load on the network.

Other very important factors required of the system are performance, reliability, availability and data integrity. The server needs to have adequate performance to cope with substantial numbers of clients, to transfer data to and from the server without delay, and to locate and deliver files from its hierarchy of media in a rapid fashion. Reliability of course is an important requirement, as is availability, in such a populous and diverse environment. Data integrity is, of course, the most vital requirement of all, with provision for ensuring data is free from attack, is moved and stored without error, and safe from a catastrophic failure of the whole system.

It goes without saying that capacity, ease of use, expansibility, conformance with standards, etc were also important considerations.

Funds were allocated in early 1995, and a 2-stage tendering process initiated. The first stage used a Request for Information as a means of testing the feasibility (in functional and in economic terms) of the project, and of informing vendors of our needs, and in turn of shaping the requirements according to what was reasonable. Formal tenders were then called, in line with European Procurement Guidelines.

4. The System in Practice

A system from IBM was chosen, and delivered during 1995. Itfirst went into productive use in mid-1995. It is based on dual RS/6000 computers, and employs an integrated suite of software, known as Adstar Data Storage Management (ADSM), and has a large automated tape silo. One unit acts as the storage manager, providing backup, archive and ftp services direct to clients. The other acts as a file server, migrating files between media as needed.

Overall, we have been very pleased with the system, which has now been in production for two years, especially its functionality. It has been especially gratifying how well the system has appeared and functioned to end users on a wide range of platforms. We have to say, however, that the solution did not work out as we had anticipated, in a number of ways.

Our first priority had been to provide some form of "unlimited disk space" service. In ADSM this would be implemented through file migration; however, we found that the migration software was not available at the time of installation, and in any case implementing such a scheme would have presented us with a number of difficult policy decisions. Archiving, like migration, also needed careful consideration, preferably based upon some non-operational experience. On the other hand, the backup facilities of ADSM very attractive - they were fully-integrated into the system, and clients were available for all major platforms in use at Oxford. The ftp service was also perfectly satisfactory. Accordingly, we decided to introduce the backup service and the ftp service first.

Secondly, we quickly found that the load placed on the system by so many backup clients was so great that the system could barely cope. Typically, personal systems are backed up weekly, to a set schedule, and on an incremental basis, while departmental servers are backed up more frequently. Traffic volumes now exceed 250 GBytes/week. Only constant attention, administrative effort, pressure upon IBM, and additional resources has enabled the system to keep pace with this demand.

Thirdly, we had expected a turn-key solution, which would function with very little attention, apart from some ongoing tuning and once options had been selected and initial parameters set. However, we have also found, possibly because we have been pushing the technology to its limits, that a high level of system errors has been encountered (most in software, but we have also encountered a surprising number of tape drive faults). This has put considerable pressure on the 2.5 staff responsible for caring for the HFS, and has meant delays in rolling out new services because of the preoccupation at times with keeping it operational.

The fewest difficulties have been encountered with the ftp service, which has consistently provided satisfactory service, though the relatively small number of users has meant that we could anticipate and control demand to some extent, and adjust accordingly.

We are now able to offer an archive service. At this stage we have only accommodated projects of importance to the whole University. And we are now also gradually rolling out the migration service.

We have been very conscious of the limitations of previous archiving arrangements in use at Oxford (and probably at most universities), whereby users could offload files from their local systems with no limit on time and space. Our current "archive" holdings are therefore likely to be very largely of zero value, but we must faithfully preserve them. Accordingly, we have redefined the term "archive" to reflect more accurately its use by archivists, and established a university committee to develop suitable policies about who can archive material, how much they can archive, and for how long (see http://info.ox.ac.uk/oucs/services/archiving/archive-policy.html). For people who wish to store material which has been deemed to be not of general interest, we will charge for the privilege of retaining it in perpetuity at the rate of about £20/GByte pa (covering regeneration of the data and replacement of the system when required), and we also provide a CD-ROM writing service.

5. Future Developments and Requirements

We are hopeful that both the level of system errors and performance deficiencies will be eliminated before long, and some progress is being made on that front. Regardless of the impact of these expected performance improvements, it is clear that we will not be able to roll out the backup service to all 15,000 clients using only the existing system. In reality, this was never likely to have been possible. Instead, ADSM is intended to support a hierarchy of collaborating servers. "Regional" or departmental ADSM servers will provide first-line file services, which will then pass on their data, in consolidated fashion, to the main system.

Arrangements have just been put into place to make a third copy of the data held in the system which will be stored in fire-proof safes at a location some 10 miles away. A reciprocal agreement is also in place (informal at this stage) to have access to a similar system installed at De Montfort University, should any disaster result in the whole system becoming inoperable.

Of course, the current system will only have a limited lifetime, but we expect to migrate to future developments of the system as they emerge and as the existing system needs replacing or upgrading (whether from the same supplier or another), and the University is expected formally to commit to that shortly. The ramifications of being able to make meaningful use of this data in the very long term which are being considered by the Computer Archive Group, including metadata, data format and hardware and software obsolescence. Clearly, current standards, like SGML and JPEG, should be employed wherever possible, and a regimen for updating the data held in these formats when they are upgraded will need to be developed.

We have made little progress on implementing a system to provide metadata, and have been disappointed at the lack of offerings from suppliers in this area. However, we are aware of national and international efforts to explore this area, which are being pursued in connection with major digitisation projects being conducted within the UK as part of the eLib project, as well in the USA, Australia and elsewhere. Indeed, we are collaborating with the University Library and external partners in several small projects in this area.

We are also exploring further implications and implementation strategies of additional "migration" services, believing that this is a service which may well only be offered to departmental servers.

In the longer term, we envisage (rather, we hope!) that an environment will gradually emerge in which there would be a uniform view of files right across the University, with a range of storage and access options, and which will support all the functions and more that we are seeking in this present system. Perhaps DFS/DCE will bring this, and we await such developments with interest.

IT at Oxford University,
Oxford University Computing Services,
13 Banbury Road, Oxford OX2 6NN, United Kingdom
E-mail: alex.reid(at)oucs.ox.ac.uk

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Data Warehouses and Executive Information Systems - Ignoring the Hype

Doreen Stevenson

What is a Data Warehouse?

A data warehouse is a repository of information specifically designed to make the extraction and analysis of data simple and efficient. Traditional production systems, such as a Student Information System, are designed to optimise transactional processing. The features which increase the efficiency of these systems are generally those which also make it difficult to extract data simply and without major impact on production databases. For example, in order to optimise update operations in a production system data redundancy is minimised. This makes extracting data complex because it is necessary to access and link a number of tables to retrieve the required data. This linking also creates a severe load on the production databases.

Data warehouses enable information to be collected from a number of sources and stored in a central area effectively integrating systems which may be quite disparate in nature. They are designed to optimise the extraction rather than the input of data. They are generally read-only and may be updated less frequently than operational systems. In order to boost performance and increase ease of access there may be significant data replication.

Why Develop a Data Warehouse?

A high proportion of data warehouses fail. Often this is because they have been developed for the wrong reasons. A data warehouse is not simply an interesting IT challenge - it is not even mainly that. The most important principle in data warehousing is that the project should be driven by a need to produce results for the end user and not by a desire to create a sophisticated IT system.

At the University of Queensland the Management Information Section (MIS) which is part of the Planning Secretariat began developing a data warehouse at the end of 1995.

The Section, then known as the Statistical Information Section, was not an IT section. It was a user rather than a developer of systems. The decision to develop a data warehouse arose from an urgent need to access data easily and efficiently. When a fairly simple query caused the payroll run to collapse it became clear that some action was necessary. The decision that the MIS should undertake the development was based on the Section's understanding of the outcomes required.

The project has been challenging but it has also been exciting and most of all, it has been fun. Not because of the IT aspects, although these have been interesting, but because of the interaction with users and their positive responses. User excitement and gratitude can be extremely seductive. The higher education environment often produces operational systems which are not particularly well regarded by users. Much of this is to do with lack of resources either for the systems themselves or for IT staff development. A data warehouse can stand outside this and avoid many of the constraints of the operational systems. It also provides an ideal environment for IT staff to focus on the business needs of the university and to gain a wider understanding of its activities and goals.

Ignoring the Hype

Many organisations have valid concerns about the potential costs of developing a data warehouse. It is common to read articles where managers justify not undertaking such development for financial reasons. There is a lot of hype in the IT industry generated mainly by software and hardware developers. Reactions to this hype tend to fall at two ends of the spectrum. Some managers get confused and become overwhelmed. They simply walk away. It all looks too difficult and certainly too expensive both in terms of staff and of hardware and software resources. Others become excited - at last, something interesting to add to the IT strategic plan. They either throw resources at it or spend a long time evaluating expensive software tools for data extraction, data validation, meta data storage etc. They prepare lengthy business plans and needs analyses for the organisation. In the meantime users' real needs are unmet and they remain disempowered.

Ignore the hype! Data warehousing is an area where the limited resources in the higher education environment can actually work in our favour. Most universities in Australia and Europe cannot afford to expend large sums on `non-essential' IT systems unless they are sure that they are going to bring real benefits to the organisation. It compels us to focus upon outcomes and upon user needs.

The Wooden Bridge Approach

Shortly after we began to `roll-out' the first release of our student data collection on the data warehouse MIS staff attended a seminar on data warehousing run by Digital Computing. The speaker, David Brisbane, has been involved in data warehousing consultancy for a number of years. David dealt with a range of issues but particularly stressed what he called `the wooden bridge approach'. As he put it `there is no point in building the Sydney Harbour Bridge if users do not like the view when they get to the other side'.

I would like to use the wooden bridge theme to explain what I believe to be some of the critical success factors in the development of a data warehouse.

***Design**

It may appear paradoxical but the best way to satisfy user needs is not to undertake an extensive user needs analysis before commencing development of a data warehouse. Such analyses tend to be lengthy and may raise unrealistic expectations. It is more productive to develop a prototype and get user reaction before the first release. Although it is important to keep integration issues in mind do not attempt to develop an organisation-wide data warehouse from the outset. Choose an area in which there is a real business need.

Since the MIS was both a major user as well as a developer of the data collections within the data warehouse the Section had a reasonably good understanding of user needs. We started with the student data collection because we knew that this was an important area for Faculties and Departments and it was one with which we were familiar. Only when we had developed a prototype did we invite comment from users. It was easier to get productive feedback when we were able to demonstrate how the system would work.

***Construction**

In order to keep the process as simple as possible and to provide value to the user within an acceptable timeframe it is better initially to use software and database systems with which you are familiar. One of the most important features of a successful data warehouse is an efficient method of data transfer from the production systems. This is particularly important for those data collections which are updated frequently. If you use the same operating system and database on the data warehouse as are currently used on your other major systems you have the benefit of a simpler transfer process as well as available skills in database administration and other areas. If your systems have software that is disparate or not suitable for a data warehouse then you may need to introduce a new database or operating system but it is better to avoid this in the initial development where possible. Similarly it is not necessary to purchase an expensive extraction tool.

***Support**

Strong support is one of the most critical success factors in data warehousing. There are a number of areas from which this support is important:

Senior Executives

It is vital to have a `sponsor' from the Senior Executive, preferably someone with funding responsibility. In our case since MIS is part of the Planning Secretariat and reports directly to the Secretary and Registrar we are able to keep him up-to-date with progress. Where it has been necessary to get support for an initiative that has funding or policy implications it has been possible to do this quickly. The Planning Secretariat also works closely with the Vice-Chancellor's senior executive staff. This means that the MIS is informed of the policy directions of the University and related information requirements which can be fed directly into the data warehouse development.

Owners of the Data

Developing a data warehouse must be handled with care and sensitivity. Owners of the data are likely to have concerns about confidentiality and security issues. It is important to involve them as much as possible in the development process. They can provide valuable advice on data availability and on user needs. At the University of Queensland the IT support for the operational systems has been devolved to the appropriate administrative area (for example the student systems support group is part of Student Administration). MIS has involved the owners in different ways according to the resources available. With the development of our research data collection we provided the IT resources to extract and manipulate the data from a fairly old Rbase system while the Office of Research Services put a lot of effort into replacing missing data and revising their procedures to accommodate better the extraction of data at unit record level. With staff data the Director of Personnel Services provided IT resources to work with us on the development of this collection. This has proved successful both from a system and staff development point of view. Both Offices feel some ownership of the data collections.

Central IT or Planning Area

While I believe that the user/developer model has the best chance of success many universities administrative structures may not lend themselves to this approach.

If the data warehouse development is to be undertaken by a central IT area it must be user driven. This will involve a close working relationship with the planning area or other appropriate group. In the reverse case, as in our situation, it is important for the planning area not to work in isolation from other IT groups. In addition to keeping aware of developments likely to impact upon the data warehouse we receive advice and support on issues such as database administration and capacity planning.

Users

While a data warehouse has the potential to bring great benefit to an organisation it is a non-essential system. If users do not see value in it they will not support it. It is important that they feel a sense of ownership.

Rather than have a formal release of the system we had a number of informal demonstrations. We contacted individual Faculties and invited representatives from each of their departments to a demonstration with an upper limit of 12 on the attendees at each session. At these sessions we explained briefly what a data warehouse was and showed them what it could do. The message that we tried to convey was that this was a system designed by users for users. Their input was essential. The sessions were as interactive as possible. We had six of these sessions and many visits from Heads, Deans and other staff where we would sit and discuss their requirements over a cup of coffee. Users constantly ring or e-mail us with feedback or to seek advice. User groups have also been established.

***Easy Access**

If it is not easy to access information on the data warehouse users will either ignore it or, more likely, will ring up expecting you to provide the answers for them. The interface to the data warehouse should be intuitive and user-friendly for a wide range of non-IT staff. It should also be flexible and accommodate ad-hoc queries.

We chose Business Objectsô, an ad-hoc query and reporting tool, as our interface because of its user-friendly nature and functionality.

Much of this advice is not new: the importance of prototyping and reiteration, the need for the data warehouse to be user rather than IT driven, and to have support from the top as well as from the owners of the data. But perhaps, as we did initially, you may dismiss it as obvious and search for some other more complicated and more expensive formula. If you concentrate on the fundamentals you will find that the project gains its own momentum and you will have at least the early stages of a successful data warehouse enabling you to make an informed judgement on whether additional resources are necessary and how they should be spent.

What is an Executive Information System?

An Executive Information System (EIS) allows senior management and other staff to access a wide range of summarised data electronically. It is generally a stand-alone system but may use data automatically extracted from a data warehouse. Its most important design features are ease of use and visual impact. It should be intuitive so that managers can use it with little or no training. Many of these systems will have drill-down and slice and dice capabilities similar to more comprehensive decision support systems (DSS) designed for planning and other administrative staff. While a DSS may trade-off some ease of use for increased functionality it is important that this is not the case with an EIS. An EIS has to be extremely easy to use and will probably have to be tailor-made for the purpose.

Why Develop an Executive Information System?

Most senior executives want `value-added' reports provided either in hard copy or electronically. They need and expect advice on data and trends. This can be provided much more simply than by designing an EIS for the purpose. A Planning Officer can use an On-line Analytical Processing (OLAP) or other tool to extract and manipulate data and then incorporate this into a report. Reports can be set up using a tool like Business Objectsô and e-mailed regularly or posted to a Web-site.

If you develop an EIS you face the challenge of designing a system which is suitable for use by executives but which must provide sufficient additional benefit to the organisation to justify the cost of development and of ongoing maintenance.

The University of Queensland EIS has been developed using Microsoft Accessô with a Visual Basicô interface. The screens are attractive but not elaborate. The Home Page which has the University crest surrounded by an arch of six individual arches is appealing for its visual impact as well as its simplicity. One senior executive likes it so much that he keeps it on his screen as a background. Maps showing students' permanent domicile and country of birth have been added. Data access is easy and flexible with an on-line help facility and a glossary of definitions.

I could spend some time discussing executive information systems in greater detail. Unfortunately space is limited so I have chosen to focus on data warehouses. While a successful data warehouse can give an organisation a competitive edge an EIS is the icing on the cake. If resources are limited forget about developing a system for executives. They and the university will benefit much more from a well-designed data warehouse with supporting commercial reporting tools. Above all, whatever you develop, focus on outcomes and ignore the hype.

Secretary and Registrar's Office
The University of Queensland
Queensland 4074, Australia
E-mail:d. stevenson(at)mailbox.uq.edu.au

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Managing Information For Managers

John Townsend

1. Executive Summary

In Autumn 1996 Edge Hill embarked on a pilot project to use GroupWare and Intranet technologies to manage preparation and provision of access to documentation and corporate data for the Senior Management Group (SMG) and some School Board meetings, and the subsequent publication of such information to the wider College community.

Justification for the project was based on: existing 3 year corporate objectives to move to an electronic information base and continue to embed IT as a tool to support learning, teaching, research, management, administration and operation; the

need to provide easier and earlier access to documents for SMG; a desire to reduce the volume of printing required for SMG meetings; provision of a single source and repository for all documents required by SMG; a desire to provide better

access to SMG documents for all staff and students.

The following describes the information management process that Senior Managers followed during the pilot, with brief reference to the technology, and outlines the benefits obtained, the main issues that have arisen during implementation, and the lessons that will inform future planned roll-out across the organisation. It will highlight: the persistence of paper and associated ways of working; the critical role of staff development in relation to unforeseen areas; the message that the technology must be kept simple, but is peripheral to the real change; the way that changes in the process lead to questioning of the value of everything involved in the process, from information to the role of meetings and management structures themselves; the key lesson that the benefits arise not from the application of the technology but from the changes in working practices that it enables.

2. Background

The Information Management Pilot was set up in Autumn 1996 in order to contribute towards meeting two Objectives from the Strategic Plan for 1996/7- 1999/2000;

5.1 `Pilot an Application of Document Processing'

3.3 `Introduce and monitor internal communications strategy'

The specific aims of the Pilot were to:

- Review how information was currently circulated and stored within Edge Hill
- Propose ways in which current practice could be improved through a more effective use of IT systems
- Review current IT systems regarding access and usage and identify any skills training required.
- Identify possible performance indicators for use within any new Information Management System proposed.

As part of the Pilot two committees agreed to participate in collating, circulating and storing their papers in an electronic rather than paper form; School Board of Management and Social Sciences and SMG.

The Pilot was based on the use of software and hardware already available within Edge Hill, consisting primarily of the Microsoft Office Suite for the production of original documents, Novell GroupWise 4 for submission, collation and distribution, and standard DOS/Windows directory structures for storage. Latterly as phase 2 is developing Netscape is being used as the front end to all facilities, using various viewers to access documents, and moving towards full indexing and search facilities.

Some additional IT training has been provided to SMG members and their Personal Assistants by Computer Services and Guidelines were produced by the Quality Unit and Computer Services and circulated to those staff submitting and receiving SMG documents.

3. Operation

The School Board of the School of Management and Social Sciences held three meetings during 1996/7 which all used electronic means for the submission, storage and circulation of documents (wherever possible). SMG held 13 meeting between January and June 1997 which used electronic means for the submission, circulation and storage of documents (wherever possible). SMG processed a total of 114 documents. Every School and Service area within the institution submitted at least one document to SMG using the electronic system. As a result a range of staff beyond SMG members and their PAs were involved in the pilot including Departmental Secretaries (who submitted Academic planning documents), School Administrative Officers and administrative staff from the Modular Programmes Office, Personnel, Marketing and Educational Liaison. All staff using the system were provided with Guidelines on request. Supplementary one-to-one guidance and advice was provided by the Quality Unit and MIS Help desk.

The two committees used a slightly different approach to information management;

School Board

- Internal documents were submitted via email to the secretar
- External documents or those not available as electronic documents were either scanned or circulated separately as hard copies
- The Secretary formulated the agenda, referenced the documents and collated them into one single Word document
- The Word document was then circulated to Boards members as a Groupwise attachment
- Board Members printed their own document

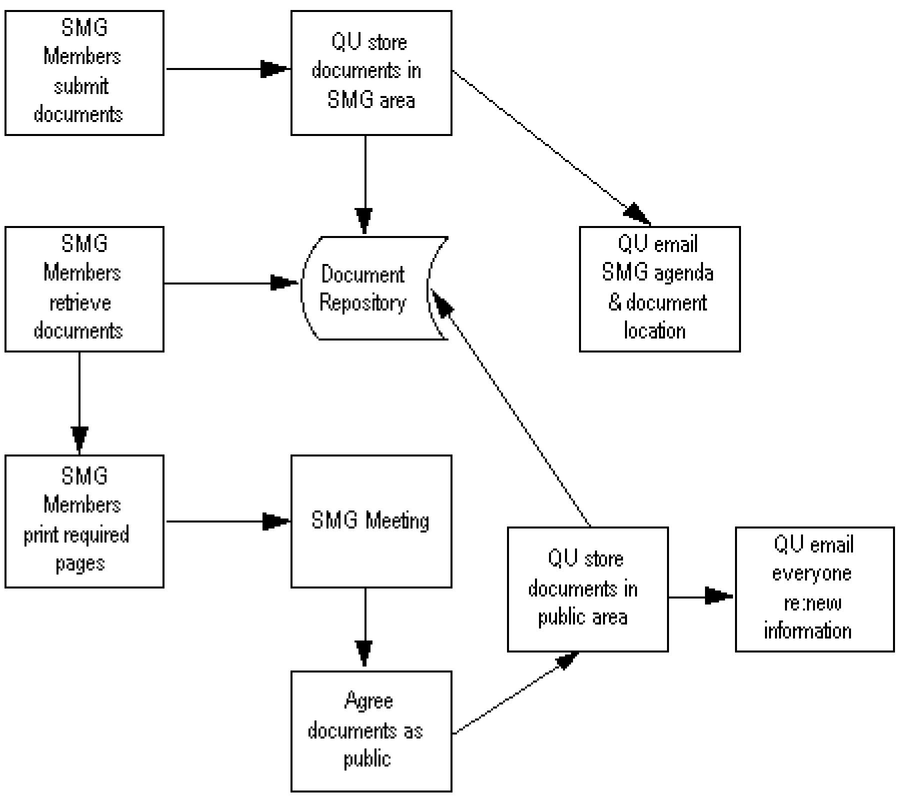
SMG

- Internal documents were submitted via email to the SMG Pilot Groupwise address
- External documents were submitted as hard copies and scanned centrally
- The Quality Unit formulated the agenda and referenced the documents
- The Agenda and documents were saved onto a Shared Directory on the network which is accessible to all SMG members and their PAs.
- The documents were available as either separate documents or within one single `meeting' file.
- The Quality Unit advised SMG members by email when documents were available for the next meeting, citing only the document locations.
- SMG members accessed all relevant documents for a meeting, and printed as necessary

Essentially in this model SMG used more of a pull approach to the technology, where more responsibility was placed on individuals to go and 'get' the documents, rather than in the School Board model where the documents were printed as attachments.

The following process model describes the approach adopted in relation to SMG.

SMG Document Management Pilot
Process Model 1/97



Key : QU = Quality Unit, the department responsible for managing the documentation.

SMG = Senior Management Group, the University College's senior management team

It should be noted that this model includes a recent revision, which is the storing of documents as agreed at SMG meetings in a public area accessible by all staff; agendas are also now accessible to all staff prior to meetings.

4. Benefits

- Improved speed of circulation of documents to members (where documents have been submitted within the deadline SMG members have normally had access to documents in the shared directory within 5 hours)
- Improvement of access and reliability in storing and circulating documents (the system now forms the basis for setting up and maintaining an up to date electronic bank of policy papers)
- Improved awareness of available IT capability in the Institution and therefore the possibilities for its use in other areas (Personnel are currently considering making information available on the network)
- Improved capacity to disseminate committee documents to non-committee members within the Institution through either Groupwise or Shared Directory (as a result confirmed SMG agendas and minutes are now available to all staff within a shared directory)

5. Issues

- The need to adopt a common format, header and layout for internal documents to make collating and storing documents more efficient.
- The need to address the shift in staff resources required in the Information Management process between Print Unit, School Offices and Quality Unit who collate and circulate and store documents and other staff who submit and print documents.
- Local' printing of documents by committee members - this has raised a variety of issues including the following; gaps in IT awareness/skills, difficulties in access to printers, awareness by members of need to print documents in advance of the meeting, concern regarding the cost of printing documents `locally' within Schools/Service Area and Subjects rather than centrally without related shift in printing budget.
- Limited use of the flexibility of the electronic format by some committee members who are not reading/scanning documents prior to printing and therefore not being selective in what they print.
- A general need for more training in IT skills for both teaching and non-teaching staff in Windows, Word, Excel and Groupwise
- The need for a more user-friendly interface for staff accessing documents

6. Lessons

The overall conclusion of the pilot project has been that the benefits that may accrue from the application of such technologies in managing information for managers arise not from the technology itself, but from the changes in working practices that application of the technology enables. Those managers who used the technology according to the principles of the pilot - accessing information prior to meetings, printing only what was required for meetings - gained the most benefits. Others who simply printed everything, achieved little but a change in the location of where the printing took place.

Particular areas to be taken on board in the next phase of development, rollout across the organisation, are as follows:

Push v. Pull. Traditionally, Edge Hill has deployed a push method of providing information both for meetings and in general. Typically, a pile of paper, of lesser or greater size, arrives on a member of staff's desk, and they then read it as and when. There is no onus on the individual to 'get' the information - in theory, if they need it, it will arrive; neither is there any particular expertise required on the part of the recipient, other than the ability to read and interpret. Under the new pull method, an individual is simply made aware that some information that may be relevant to them, either for a specific meeting or more generally, is now accessible on the network. The onus is then on the individual to access the information, evaluate its relevance, and print all, part or none of it as they see fit. This move from push to pull has a number of implications, some of which are addressed below.

Training in electronic as opposed to paper document preparation. Edge Hill has an extensive staff IT training programme, and most staff engaged in the pilot had participated in this at some time. However, what the pilot revealed was that staff had really only learnt to produce paper documents and had developed various strategies for doing this which involved drafting, redrafting, test printing and so forth. Now that they had to produce documents for circulation to others electronically, a number of gaps in skill and understanding emerged.

The Persistence of Paper. The attachment of individuals to paper should not be underestimated or demeaned, and there are a number of persistent behaviours that derive from it. Whether these behaviours result from the technology, or whether the technology is chosen to fit these behaviours, would require more extensive analysis. They can however be characterised as follows:

- **Haven't got time/taking it home/reading it over the weekend.** Typically here a set of documents, usually for a meeting, is printed in its entirety, the grounds for this being that the individual, usually a senior manager, doesn't have time to read them at work. This undermines the principle the project is trying to promote, which is the on-line scanning of documents prior to printing. Significantly, those individuals who have derived most benefit from the pilot have changed their working practices to include time for scanning prior to meetings, and have begun to print only short sections of documents as required. Various 'technical' solutions to this have been sought, including suggesting portable equipment and modems for all senior managers, and promoting the use of executive summaries for all documents to encourage the individual printing of these only, the theory being that a full set of documents can then be lodged with the secretary of the meeting for reference. It should be noted that these solutions require at least the scanning of documents prior to the meeting - which leads on to

- **Reading them during the meeting.** Some staff reported a major difficulty with printers as being that they were shared and everyone tried to use them just before the meeting. Assuming that papers for meetings are actually intended to be read, this suggests the meeting as the time for reading them. A cynic might suggest that this would at least provide the individuals with something to do; however making another assumption, that the purpose of meetings is to discuss pertinent issues and then arrive at some actions, or put another way, that at the end of a meeting there should at least be the potential for the world, or at least some small part of it, to be in some way different from how it was before, reading papers for a meeting at the meeting would not seem to be the best way of preparing for or contributing to the meeting. This leads to the next major implication of the project.

Application of the critical faculties - or, why do I need this junk? A further unanticipated result of the pilot, particularly amongst those who were guided by its principles, has been increased criticism of the value of documents, meetings and even management structures. Where the arrival of a pile of paper, to be scanned, read, binned or whatever as required prior to a meeting, is something with which all managers are familiar, the need to exercise some additional skill in accessing on-line documents, together with encouragement to read and reflect on them prior to meetings, encourages individuals to be more critical of the content of the documents, divorced as they are from the authority invested in the printed word. It is a short step from this to questioning: the need to attend meetings to discuss irrelevant documents; the need for managers who wish to produce and discuss irrelevant documents to attend anything at all; the way we do things around here. As stated above, the true benefits of application of technology to managing information for managers will only be realised when managers change the way they work for the benefit of the organisation. It will be interested to see if this occurs as the technology is further embedded during the next stage of the project.

7. Footnote

MIMEO - Managing Information for Managers - the Electronic Office

Following a successful application for government funding, the project, renamed as above, will be expanded over the next 18 months, both to build on progress to date, and also to incorporate workflow and access to corporate data, invest more resources in analysis of user requirements and user feedback, and investigate more fully similar applications of technology in other sectors, environments and countries.

Head of Computer Services
Edge Hill University College,
St Helens Road, Ormskirk,
Lancashire L39 4QP,UK
E-mail: townsend(at)admin.ehche.ac.uk

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Implementation of University Information Systems

Ivan Vrana

Concept of integrated university information system

It is no surprise that the need for an information support is felt in universities, similarly like in other enterprises. There exist many rational reasons, why management of universities wants to keep path with a technological development, wants to take advantage of the new communication facilities of computers and wants to take a strategic gain of being on the leading edge of this process.

High expectation of the university managers in a potential benefit offered by the information systems contradicts with a generally poor historical experience of using ?information systems" at universities. Understanding of the historical experience is an important factor for starting any new activities in this field.

Selection of some important notes (without any ambitions for completeness) will be listed here in order to mention reasons, why the problems in university management arise, to show possible solutions and to outline the way from the problem statement to its solution:

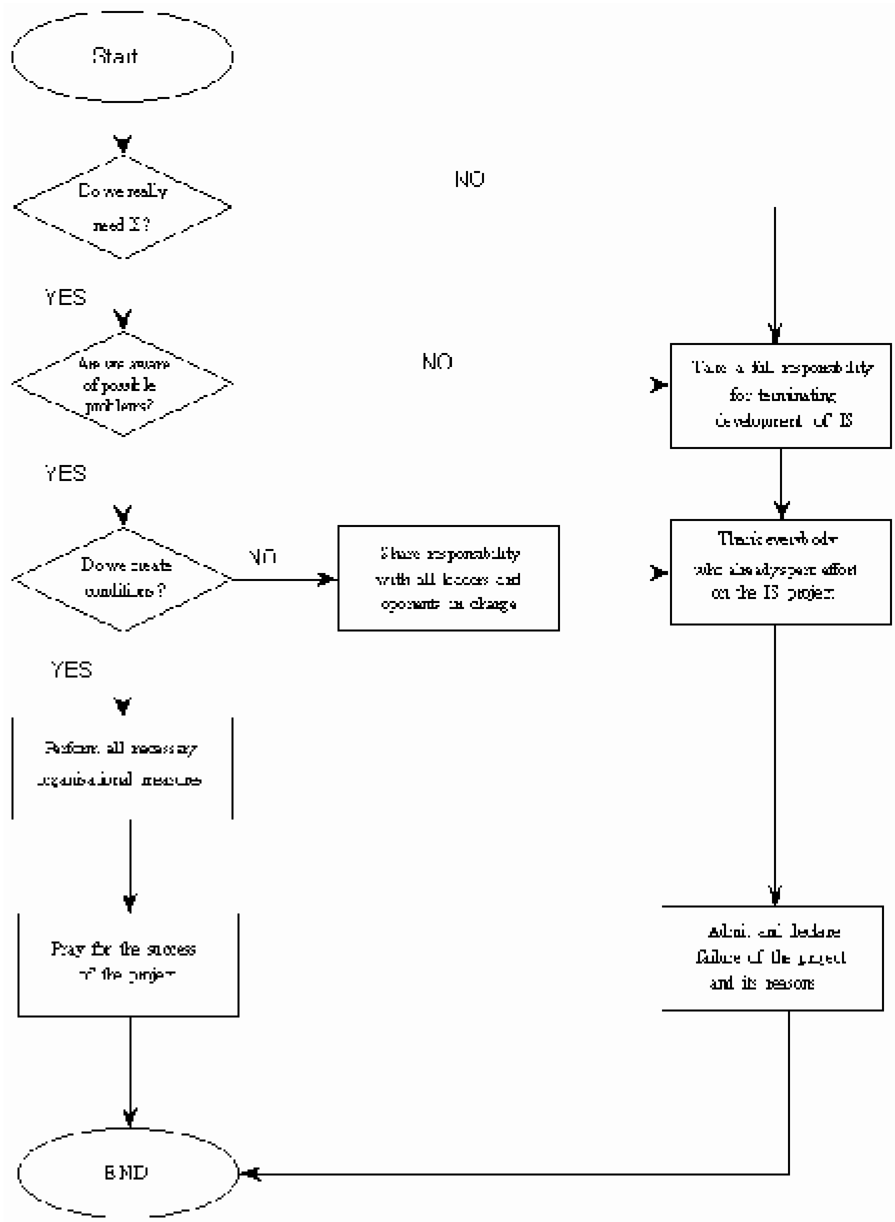
- Lack of relevant information concerning the mission critical activities of the university (e.g. education process, research, finances, etc.) is an obstacle of effective management in many universities. Because of this reason, effectiveness of the university management is not only reduced but it can be even disabled, in some cases.
- Relevant information is needed about global and detailed features of the managed unit should be available to managers for management regardless whether the university / faculty / department level.
- Availability The information delivered to managers of the should be up-to-date, accurate, reliable, etc., for an efficient management.
- Lack of the above mentioned information causes a reduced efficiency of the university management and may approach a collapse.
- A very important resource of management-suitable information can be gained from the administration of individual activities of the university mission: education , research, finances, public relations, library, etc.
- Properly designed information systems can enable an efficient administration which, in turn, makes an efficient management possible. Components of current information systems usually support individual isolated university activities, but these components should also communicate and co-operate to each other in order to assure a unique interpretation of data.
- The integrated university information system (IUIS) can only make this goal possible. It also makes the maintenance of the system and its further development easier. The data maintenance and update is easier, more reliable and cheaper, with the IUIS, too.
- Because of the same historical reasons, the situation in majority of universities can be characterised by these facts:
- There exist some isolated non-compatible modules of information systems supporting limited functionality of university activities.
- These modules arose spontaneously (not systematically), sometimes as a product of ?fans" who wanted to improve their small particular task.
- All these modules have just a limited scope from the point of view of the organisational, territorial and functional structure of the university.
- They don?t communicate to each-other,. tThere is little or no documentation to them which makes their maintenance and advancing difficult or impossible.
- Development was done without a basic professional knowledge in developing information systems and it reminds ? reinventing a wheel" very often.
- This is why many universities try to develop their IUIS in order to improve their management.
- Development and implementation of the IUIS should consider a set of rules and principles which influence a success or a failure. Many general conditions for success are often violated or simply neglected. Majority of these IUIS projects fail because of the lack of expertise in this branch. Besides financial losses and frustration of people such a failure also results in a considerably reduced effectiveness of management in a university, faculty and department level.

Everybody feels (except of the top managers, sometimes) that a more systematic and co-ordinated solution is needed. But how to get it? This is a topic of the present paper.

Where to start

Before starting any activities in building information system, the top managers should answer several questions. The following decision diagram contains the typical questions to be answered and their consequences:

The correct and honest answer to these questions (not telling lies into ones own pocket) is vital in order to avoid later disappointment and confusions.



From beginning, the university management should be aware that the project will be accompanied by problems: general & university specific. They should be also aware of risks of the project and of the high probability of the failure unless special measures are taken. That is why the questions

- do we really need an information system?
- are we aware of risks of such a project?
- are we willing to create adequate conditions for the project?

must be considered with a great attention.

Control of the project

An efficient control of the project can considerably reduce risks of the failure of the project. The following aspects form a vital part of control:

- Creating and (constant) defence of the concepts and principles. Project management should always expect plenty of attacks to the foundations of the project.
- Decisions about self development or external supplier of the system.
- Choice of a suitable life-cycle type: waterfall, iterative, prototyping,...
- Attention to early phases of the life-cycle (e.g. information strategy planning, analysis, etc.). Mistakes from these phases are very expensive later.

- Scheduling implementation of individual components according to priorities of the university.
- Co-ordination of suppliers with users.
- Organisation provisions (as deep as an operative control).
- Reliable system of checking and monitoring progress, problems and making corrections.

Many models exist, of how to accomplish control of the IUIS project in the certain university environment. The most typical models of control in the university environment are listed below:

A. Project management is neither a part of the top university management, nor the top faculty management. It only has a position of some service unit.
B. Project manager is a member of the top management of the university in the post of a vice-rector.
C. Project management consists of a vice-rector at the university level and is extended by vice-deans at the faculty level.
D. The new control structure is created in parallel to standard (understandable) organisational structures (as in C), creating non-typical organisational structure at the university.

The most critical aspects of success:

A lot of articles has been published concerning influence of individual aspects to the success of the IS projects. We shall mention those aspects which are typical for the university environment.

- Project management co-operates with well educated university managers and employees. This seems to imply a good understanding of general principles by managers, at least. But contrary, we must expect a bad understanding, resistance and little co-operation of managers and users in various posts. Introduction of a new system enforces introduction of an order to all activities concerned. It is necessary to clean the Augean stables before the system can serve. Generally, people don?t like order, regardless whether educated or not.
- Everybody should be aware that the magic system (supplier) doesn?t exist.
- A certain (high) priority must be assigned to implementation of IS within other university/faculty/department activities. University management must make everybody sure that building of IUIS is a short term priority though not being the long-term mission of the university.
- Some people play a key role for a success of the project in individual phases of the system life-cycle. It is a foolish mistake to expect serious results built only on enthusiasm of people. Motivation and responsibility of key persons is vital.
- Good planning and checking is important in order to make individual tasks co-ordinated and feasible.
- Selection of the suitable hardware, operating system, database management system and networking is vital from the point of view of security, reliability, robustness, etc.
- University as well as project management should expect problems - they will occur. Insist on a specific description of the problems; this is the only way for a quick recovery.
- Management must understand reasons for problems and resistance and try to foresee and avoid them.
- There exists many aspects which contribute to success or failure of the project of IUIS. Contribution of main individual aspects to success is given by a following Table 1:

Contribution %	Aspect
40	political decisions and support
25	organisation
20	quality of the system (functionality, performance, ...)
10	interface
5	others

Table 1

Feasibility of the project

The type of selected (or enforced) model of control has a direct influence on the feasibility of the entire project. Let us consider a simple linear feasibility model

$$A = \sum_{i=1}^{9} a_i \quad ; (1)$$

where

$$a_i = W_i \alpha_i / 100 \quad ; i=1,2,....,9 \ (2)$$

for the feasibility of the control type A and similarly also for B, C and D. We denoted weights of individual factors by W, contribution of the model to an accomplishment of the factor by a (or b ,g , d , respectively), total impact of the given factor in the model by a (or b, c, d, respectively) and the entire feasibility by A (or B, C, D). The feasibility expressed in this way is also proportional to the ability to control the project.

The following Table 2 shows how feasible the project is with respect to four typical alternatives of control. We can see that some models of control make the project more hazardous than feasible. We can see from this table, that ability of control is very sensitive on the way how control structures are penetrated to both: top management of the university as well as the top management of all faculties. Besides the fact that project managers should be a part of the top management of university and faculties, the form of this representation is also very important. The greater use of the standard control structures (vice-rector, vice-dean), the more legible such a control is for all academic environment and, as a result, the more influence and efficiency of control can be gained. At the other hand, any artificially created control structures prove themselves to be ineffective which reduces feasibility of the project and brings additional risks.

Conclusion

As soon as the university management decided to implement integrated university information system, this management carries a full responsibility for the success of the project. There are several aspects which can decide between its success or failure. Selection of the adequate type of the project control is one of these critical aspects. Failure in guaranteeing an efficient control makes the project unfeasible. Fortunately, there exist forms of control which can make the project feasible, as shown in the present article.

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"Using Information in Electronic Age", Manchester 16-17 December 1996.

			Type of model: A			B		C		D	
Factor	Weight %	Index	Weight	Contribu tion %	Total	Contribu tion %	Total	Contribu tion %	Total	Contribu tion %	Total
		i	W	a	a	d	d	b	b	g	c
Political willingness	40										
University management		1	0,16	10	0,016	30	0,048	50	0,08	70	0,112
Faculty management		2	0,2	5	0,01	5	0,01	10	0,02	70	0,14
Academic senatus		3	0,04	10	0,004	30	0,012	50	0,02	70	0,028
Organisat. aspects	25										
University		4	0,075	30	0,022	70	0,0525	90	0,0675	95	0,07125
Faculty		5	0,125	5	0,006	5	0,00625	20	0,025	95	0,11875
Network management		6	0,05	30	0,015	40	0,02	50	0,025	95	0,0475
System quality	20	7	0,2	80	0,16	80	0,16	80	0,16	80	0,16
Interface	10	8	0,1	70	0,07	70	0,07	70	0,07	70	0,07
Others	5	9	0,05	90	0,045	90	0,045	90	0,045	90	0,045
TOTAL			1		0,348		0,42375		0,5125		0,7925

Table 2: The project feasibility with respect to four typical alternatives of control

Czech University of Agriculture Prague, Czech Republic
E-mail: vrana@pef.czu.cz

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Construire les usages: Dynamique d'usage des applications télématiques dans les unités de recherche scientifiques

[1]Luc WILKIN, [2]Jacques MORIAU

INTRODUCTION

Les développements récents de la télématique conduisent à un appel de plus en plus pressant pour que soient mis en place des réseaux électroniques de support à la recherche scientifique. Si l'utilisation de tels moyens n'est pas neuve (les scientifiques utilisent depuis longtemps les ressources d'échange de données ou de consultation de banques de données), le recours à ceux-ci de manière plus structurée, plus systématique et plus massive est, en revanche, de plus en plus à l'ordre du jour.

L'argument qui sous-tend ce mouvement est familier : l'accroissement de l'accès à des ressources d'informations coûteuses et disséminées à l'échelle mondiale ne peut être que bénéfique tant du point de vue de l'efficience que de celui de l'efficacité du travail scientifique. Plus récemment, l'apparition de nouvelles technologies de communication comme la téléconférence, les systèmes de conférence électronique, les " collaborative systems ", les " group decision support systems " apportent la promesse de synergies entre équipes qui, autrement, n'auraient guère l'occasion ou les moyens de se rencontrer et de travailler ensemble.

Si nombre de scientifiques proclament que l'usage de la télématique a dès à présent augmenté leur efficacité et changé la nature de leur travail, peu d'études à notre connaissance ont cherché à analyser les conditions d'acceptation et d'utilisation de la télématique dans le travail des chercheurs1.

Dans les pages qui suivent, nous nous proposons de présenter succinctement un cadre théorique d'analyse de la dynamique des usages des technologies de réseaux dans les unités de recherche scientifique. Dans un deuxième temps, nous présentons quelques données issues d'une enquête menée au sein de plusieurs équipes de recherche tant dans le domaine des sciences exactes ou appliquées que dans celui des sciences humaines.

UN CADRE THEORIQUE D'ANALYSE

Poser la question des dynamiques d'usage des applications télématiques dans le cadre spécifique de la recherche universitaire impose, à notre sens, de répondre à quelques questions préalables. Parmi celles-ci, citons les plus importantes : quel modèle sociologique choisir pour étudier les relations entre le technique et le social et comment définir la pratique scientifique? Sans entrer ici dans le détail des réponses qui peuvent y être apportées, disons simplement que, dans notre approche, l'utilisateur final constitue une préoccupation principale. C'est la façon dont ce dernier va se comporter face à l'innovation technique qui nous semble déterminante. C'est dans des situations de travail concrètes que se posent les choix engageant des relations, définissant des pratiques qui mènent peu à peu à des irréversibilités. Il est donc de toute première importance de prendre en compte la façon dont la multiplicité des actions individuelles interagissent.

Par ailleurs, nous écartons les explications selon lesquelles des attributs particuliers (par quoi il faut entendre les variables socio-démographiques habituellement utilisées) de chaque individu constituent un facteur suffisant de compréhension des usages. Au contraire, nos analyses nous conduisent à privilégier la dimension collective des faits que nous observons dans les laboratoires et les équipes de recherche et donc à emprunter la voie proposée par les courants d'étude proche de l'interactionnisme.

Ce paradigme permet en effet de lier plusieurs processus qui nous semblent essentiels. L'interactionnisme met en avant l'idée que les unités d'étude appropriées se situent au niveau des interactions entre les acteurs sociaux. Le social naît des situations d'interaction que nouent les acteurs. Ainsi qu'un des pères fondateurs de ce courant l'exprime2 : " Society exists where a number of individuals enter into interaction. This interaction always arises on the basis of certain drives or for the sake of certain purposes. Erotic, religious, or merely associative impulses ; and purposes of defense, attack, play, gain, aid or instruction - these and countless others cause man to live with other men, to act for them, with them, against them, and thus to correlate his conditions with theirs. In brief, he influences and is influenced by them. ".

L'interaction naît donc de la confrontation de plusieurs intentionnalités. Il s'agit de prendre en compte les autres dans la réalisation de l'action. Ceci nous amène à un deuxième point de méthode : l'interaction se réalise dans l'action, dans les pratiques. C'est ici que la question de l'articulation des pratiques de l'acteur à celle de l'organisation nous semble importante car si l'on considère l'organisation à la fois comme acteur à part entière et, d'autre part, comme contexte de l'action, il convient de préciser quelques points.

La place du contexte doit être repensée : il ne s'agit pas ici d'un contexte extérieur aux acteurs qui jouerait le rôle de toile de fond ou même de réservoir de ressources, il s'agit d'un contexte organisé qui émerge en même temps que l'action prend forme3 . Dans notre perspective, action et contexte se constituent corrélativement. Ainsi, en ce qui concerne les outils télématiques, il s'agit de voir que ces derniers ne naissent pas ex abrupto, qu'ils n'arrivent pas in nihilo. Il doivent au contraire, petit à petit, s'imposer comme des possibles, forcer des inerties, s'insérer dans des structures existantes afin de s'y faire une place, si place il y a.

Ce que l'analyse sociologique peut apporter à la compréhension de ces mouvements dynamiques, c'est comment des investissements politiques, sociaux et techniques produisent une géographie et une économie des hommes, des institutions, des règles, des actions et des objets. Il existe dès lors une démarcation entre contenu et contexte de même que la composition de ces derniers n'est pas prédéterminée, ni par la forme spécifique de la technologie (déterminisme technique), ni par l'existence de groupes sociaux pré-constitué (déterminisme social). En d'autres termes encore, il faut garder à l'esprit que la frontière entre contenu et contexte, technique et organisationnel ne doit pas être tracée a priori par l'analyste mais doit advenir des négociations entre acteurs. Comme l'affirment Huff et Finholt : " Since we are familiar with the technical issues of electronic mail, it is easy to think that these are what will determine its success : faster transmission, better interfaces, more flexible standards, more reliable networks, etc., are what will really make electronic mail use take off. For some technologies, this may be true (...). But most computing technologies will fall in between. For this large majority of computing artifacts, then, it will be essential to understand both the technical issues and the social contexts before we can understand their success. "4.

Pour abonder dans ce sens, citons encore Friedberg qui résume mieux que nous ne pourrions le faire nous-mêmes, la dialectique à l'oeuvre : " Etudier la dimension organisationnelle de l'action sociale conduit à considérer la structuration de tout contexte d'action comme une solution chaque fois spécifique que des acteurs, relativement autonomes et agissant dans les contraintes générales d'une rationalité limitée, ont trouvée pour régler leur coopération conflictuelle et pour gérer leur interdépendance stratégique. Cette solution est contingente au sens radical du terme. Elle dépend des caractéristiques techniques, économiques, sociales et culturelles qui constituent en quelque sorte la pré-structuration du contexte en question... Aucune loi universelle, aucun déterminisme et aucun principe abstrait ne peuvent donc en expliquer la forme et la dynamique spécifique. Cette explication ne peut qu'être elle même locale, c'est-à-dire fondée sur la connaissance empirique des conduites réelles des acteurs et des conditions spécifiques de leur coopération prévalant dans ce contexte particulier "5.

L'enjeu est d'identifier ce contexte d'action et son processus de construction. De ce point de vue, l'étude des dynamiques d'usage des applications télématiques revient à mettre à jour des processus généraux de réorganisation des pratiques scientifiques.

A nos yeux, un réseau télématique comme objet technique, possède un haut niveau de flexibilité interprétative6. Il représente donc des choses différentes pour des acteurs ou des groupes différents, il s'intègre dans des pratiques différentes, il est qualifié différemment.

A présent, quels peuvent être les éléments susceptibles de constituer la structuration du champ permettant de différencier les usages des applications télématiques dans le contexte particulier de la recherche scientifique ?

DONNEES D'ENQUETE

Nos enquêtes de terrain nous conduisent à définir les facteurs qui suivent :

- la structuration de la discipline;
- l'organisation du travail de recherche;
- l'institutionnalisation des relations de travail;
- l'utilisateur final.

La structuration de la discipline fait référence à un certain nombre de traits distinctifs des disciplines scientifiques. Trop souvent, en effet, la question des usages est traitée comme si les disciplines scientifiques constituaient un ensemble homogène.

Les interviews7 nous conduisent à retenir comme élément important la nature de l'objet de la discipline. Deux pôles peuvent ici être plus particulièrement distingués : des disciplines ayant un objet " universel " et des disciplines ayant un objet " spécifique ". Par objet " universel ", nous entendons des objets dont la présence et les manifestations de cette présence se retrouvent de façon semblable dans l'univers connu. Ceci implique également des systèmes d'explication unifiés (des paradigmes), des théories et des méthodes partagées par tous les scientifiques travaillant sur ces objets. Il s'agit principalement des objets relevant des sciences dures, telle que la physique des particules. En revanche, la spécificité de l'objet se rapporte à des objets limités par nature dans leur présence et dans leurs manifestations. Cette limitation entraîne des systèmes d'explications particuliers ainsi que des théories et des méthodes spécifiques, comme c'est le cas, par exemple, dans des disciplines telle que l'histoire ou certaines branches de l'économie.

Un deuxième élément est relatif au niveau de centralisation / décentralisation géographique de l'activité. Ce trait se rapporte à la plus ou moins grande dispersion géographique des chercheurs travaillant sur le même objet. Il est lié au trait précédent dans la mesure ou nous constatons que les chercheurs travaillant sur des objets " universels " ont tendance à être plus dispersés.

Un troisième élément a trait aux rapports entretenus entre la discipline et le champ économique (financement de la recherche, partenariat, possibilité de prises de brevets, etc). Enfin, nos enquêtes font émerger un quatrième élément, à savoir l'évolution lente ou rapide de la discipline qui peut s'appréhender à travers, par exemple, le rythme des publications ou le nombre de revues.

L'organisation du travail de recherche se réfère à la prédominance du travail individuel par opposition au travail collectif, les modalités de coordination entre chercheurs, le type de relation et de communication qui prévaut dans la discipline entre pairs ou entre individus de statuts différents. Nos enquêtes montrent sur ce point de substantielles différences d'une discipline à l'autre.

Quant au niveau utilisateur, citons quelques éléments discriminants : position dans la trajectoire professionnelle, formation de base, légitimité du chercheur dans son domaine, etc.

La place manque pour mettre en évidence les " profils " d'usage qui résultent de tous ces éléments. Deux exemples permettront toutefois d'illustrer notre propos.

Si l'on aborde la question du recours au réseau sous l'angle du fonctionnement du champ scientifique et de la discipline, le chercheur que nous avons interviewé en PSYCHO8 n'éprouve pas le besoin d'un recours intensif au réseau dans son domaine privilégié de recherche : il connaît les quelques chercheurs légitimes et les sources autorisées. Il utilise par conséquent plus particulièrement le courrier électronique pour échanger avec ces chercheurs. Si, dans le cas présent, le réseau n'est pas envisagé comme source première d'informations, il reste cependant un moyen de communication important (E-Mail).

Un autre chercheur de DEMO HISTO9 est amené à réaliser un travail quantitatif (constitution de bases de données démographiques) et doit par conséquent recourir à l'outil informatique à des fins de traitements statistiques sur des masses de données importantes.

Il n'y a pas à proprement parler de problématique similaire en psychologie de la connaissance, domaine privilégié du chercheur PSYCHO : sans doute y a-t-il partage et échanges quant aux paradigmes d'expériences. Mais il n'y a pas de pratique de constitution de bases de données. Les résultats du travail scientifique de la discipline sont déjà le fruit d'un premier construit scientifique : constitution d'hypothèses, mise au point de test destinés à les éprouver et vérification par l'expérimentation - qui est le propre de la psychologie expérimentale. Sans doute cela rapproche-t-il la psychologie expérimentale des sciences " dures ".

Tel n'est pas le cas en démographie historique. Les données dont il est question ici ne sont pas les résultats d'une expérimentation. Il s'agit de données historiques relatives à des populations particulières. Des bases de données sont extraites, les reproduire expérimentalement n'a pas de sens. Ce travail constitue déjà un enjeu en lui-même au sein de la discipline, de même que ses résultats.

Ces deux exemples, brièvement évoqués ici, illustrent à quel point des problématiques différentes et, plus généralement, la nature du travail scientifique propre à la discipline est à l'origine de recours différenciés. Il s'agit là d'une hypothèse (parmi d'autres) que nous testons plus avant dans le cadre des autres facteurs que nous avons dès à présent dégagés.

NOTES ET REFERENCES

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4. Huff, Ch. and Finholt, Th., Social Issues in Computing (New York, MacGraw-Hill, 1994), 3

5. Friedberg, E., Le Pouvoir et la Règle (Paris, Seuil, 1993), 19.

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7. A ce stade, nos interviews concernent une soixantaine de chercheurs représentant un très large éventail de disciplines dans tous les domaines. Une enquête plus systématique est en cours d'exécution, portant sur quelques deux cents chercheurs.

8. Nous indiquons de la sorte les " cas " que nous avons étudiés. PSYCHO désigne un chercheur interviewé au sein d'une Faculté de Psychologie.

9. Chercheur, unité de démographie historique.

Groupe de Recherche en Informatique et Sciences Humaines, Université Libre de Bruxelles,50, Av. F.D. Roosevelt, 1050 Bruxelles, Belgium

[1] e-mail: wilkin(at)is3.ulb.ac.be,

[2] e-mail: jmoriau(at)resulb.ulb.ac.be

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Information System for Application Procedure for Registration in Higher Education in Slovenia

Rok Rupnik, Marko Bajec, Marjan Krisper

HIGHER EDUCATION IN SLOVENIA

Slovenia is a small country with population of two million people. Candidates that want to study on higher level have to choose from one of the two Slovenian Universities. The oldest University is situated in Ljubljana, the capital of Slovenia. There are approximately 35,000 students registered each year. The other one is in Maribor. Approximately 12,000 students register and about 1,800 students graduate from this university each year. The establishment of the third Slovenian University on the coast of Slovenia is foreseen in the near future.

APPLICATION PROCEDURE FOR REGISTRATION IN HIGHER EDUCATION

Since 1995 there has been a new application procedure for registration in higher education in Slovenia. The former procedure had disadvantages and was not considered as appropriate any more. Common characteristic of both is that the majority of candidates apply before they finish secondary school and don't know how successful they will finish it. For example: candidates apply in the beginning of March; secondary school scholastic year finishes at the end of June; scholastic year in higher education begins in October.

2.1 Former application procedure

In the former application procedure there were two parts: centralised part and decentralised part. In a centralised part all applications were sent to admission service where data from application forms were captured into a database. After the analytical report was done applications were delivered to the departments. That was the beginning of the second phase, where candidates could apply for entrance examination on 5 additional programs. This means that one candidate could be on more than one list of accepted candidates. Good candidates were on many lists; some didn't appear on any. Because the candidates who were on more than one list could wait for quite a long time for decision, there were updated lists published even more than once a day. This was very confusing for the majority of candidates.

2.2 The new application procedure

Preference among options is an important characteristic of the new procedure. Candidates must name programs in the preferred order on the application form already, not in the later steps of procedure. They are allowed to name up to three programs, which are called options.

Capturing data from application forms

All the data from application forms must first be captured into a database.

Analysis of the application

The analytical admission reports are done according to the first option of all candidates. Programs that have more applications than the study places available can become limited programs, others become unlimited. Each of the programs that can become limited actually becomes limited by the approval of Ministry of Education and formal approval of the government.

Determination of exams

The government approval determines the next step of the procedure. The limited and unlimited options have to be determined. First option of a candidate becomes limited, if it fulfils one of the following conditions:

- the program of the first option is limited
- the program of the first option is unlimited, but according to qualifications candidate must pass either the capability tests or other additional tests

Other options of the candidate become limited, if his first option is limited, otherwise they become surplus. For all the limited options the candidates must be put on lists for capability tests and additional tests if it is a option for a program, for which registration demands determine so.

Capturing of marks

The following kind of marks must be captured:

- Marks of candidates, which have finished secondary school in the past and had to enclose all their certificates with the application form. This is a manual procedure and is done twice. The second capture controls the first one and so the probability of mistakes is practically zero.
- Marks of capability tests and additional tests, which are delivered from departments in form of ASCII file.
- Marks of candidates, that are finishing secondary school in the current scholastic year. These marks are delivered from the National examinations centre in form of ASCII file.

Calculation procedure

For each program and type of final exam (bachelor's degree or internal final examination) there are entrance qualifications and weights for marks for which candidate gets points. Because there are six different scales of marks, the calculation procedure must transform each mark from its original scale to the mark in scale from 0-100. Setting of flags and searching for maximums are also part of this procedure.

Selection procedure

Selection procedure is the main characteristic of new application procedure and is the step, where both procedures differ mostly. It tries to place candidate on his most preferred program, for which he fulfils all the qualifications and has enough points according to his competitives whereas the places available for each program must be considered.

3. INFORMATION SYSTEM FOR APPLICATION PROCEDURE

The information system for application procedure supports all the activities from preparation of all the required code tables and catalogues up to selection procedure. The complexity of application procedure is a result of the fact that it is a centralised system for all the various faculties, art academies and university colleges which have different qualifications. This results in a complex information system.

The most important mission of information system is to assure the consideration of all the qualifications. They are implemented in data model, so the code is independent. The most critical procedures, that information system supports are calculation and selection procedure. Interphase test method was developed for the purpose of testing their function.

Information system was developed two years ago, renovated last year and is now being maintained. In the last year there were some changes in the procedure that exceed the maintenance, so we now talk about renovation and maintenance of the information system. In the next sections the evolution of the information system will be described.

3.1 Development of information system

Information system was developed in time pressure and shortage of time. Because of that we were many times forced to pick up decisions and move steps that guarantied success in time available, what didn't mean, that they were optimal or good.

We had to begin with selection of hardware and software for production system and development. For both admission services (each university has its own) we choosed PC platform, two better PC's for servers and 11 PC's for clients. On both servers we installed operating system Novell NetWare and Database server Oracle 7.0. Operating system for clients was DOS and the development tools were Oracle client tools: SQL Forms, SQL Menu, and SQL Reports. As CASE tool we used SilverRun. Each admission service had it's own LAN, networks were not connected. Two unconnected servers caused many problems during the whole procedure.

The main consequence of time pressure was the partial development of information system. There wasn't enough time to make analysis in the beginning to get the full picture of the system. In every moment of development we were working only on activities to support the current checkpoint of application procedure. To get to current checkpoint and support needed activities we made additions to process and data model and implemented it. Information system was not developed according to information engineering methodology. We could say that information system was not developed but was composed.

Because of partial development some mistakes committed in early stages arose at the end. Especially some default values of flags and some segments of data model were the problem. That was the source of many problems in the last step of procedure.

3.2 Renovation of information system

The first step of renovation was setting conditions for the continuation of work on this project. The most important among them was the purchase of powerful UNIX Workstation for the central database server. The experience with two unconnected servers and with combination Oracle-NetWare was inappropriate, so we decided to work on UNIX operating system which is the native operating system platform for ORACLE database.

In the second year there were some changes in the application procedure. They were the result of analysis done by all the actors involved in it. This was one of the strongest reasons for renovation. From technical point of view there were following reasons for renovation of the information system:

- Functional reasons: Information system was operating correctly, but because of its partial development its use was

complicated.
- Technological reasons: Information system was operating in DOS. In the same year ORACLE announced, that the development of development tools for DOS has stopped. Information system became technologically old over night.

We decided for the following renovation, which was done in two phases:

- First phase: Classical reverse engineering phase to gain the business model was not needed because of the changes in the application procedure and functional reasons for renovation. In this phase we only analysed the information system, especially the data model.
- Second phase: It was a forward engineering phase, where we developed new information system in Windows environment using new Oracle tools. The development was based on documentation of information system, analyses done in the first phase, changed application procedure and experience gained during the development.

3.3 Experience with information system

Users are very satisfied with information system. Working in GUI environment is much nicer than working in character one. ORACLE Designer and Developer are composed of tools that enable the development of complex forms and reports which give user a great support.

Information system also supports significant improvement in the application procedure. This is communication with candidates. Candidates get mail at least twice during the procedure. After capturing of application forms data candidates get mail with their data in the database. The aim of the first mail is to verify the data because mistakes appear during capturing. It gives candidates the possibility to mail back any noticed irregular data in the database. Candidates get second mail when the selection procedure is finished. They are informed about the program they are accepted in with all the explanations. Since such a communication has been adopted, there are much less telephone calls to admission service from candidates, because they get feedback.

4. VISION FOR THE FUTURE

From our experience with the information system and the application procedure as well, we believe that there are some opportunities to improve the whole system. We suggest:

- Changes in application procedure and
- Changes of the IS in technical manner

4.1 Changes in application procedure

One of the major problems that we are dealing with now is that candidates apply at the University before they actually know about their success in graduation as well as what kind of secondary school diploma they will attain. Therefore, all plausible procedures have to be carried out until candidates actually graduate.

We believe that it would be better to divide application procedure in two separated parts. In the first part candidates would only specify data which would not depend on future outcomes, such as graduation success and success in bachelor's degree. Special forms would have to be prepared to acquire this. Received data would be captured into database. Reports would be produced and send back to the candidates in order to check inserted data is correct. A blank form would be included, where candidates would choose their options as soon as they would finish secondary school and bachelor's degree.

Receiving information about candidate's success in bachelor's degree plays very important role in the application procedure. At the point we come to the second part. Now we have all the data needed to start with calculations and other activities need to be done to finalise the application procedure.

Benefits

- We avoid predicting all procedures possible according to the future outcomes. We only deal with the information available at the moment.
- The second part is carried out only for those candidates that would actually pass graduation and bachelor's degree!
- After consideration based on graduation results and results of bachelor's degree, candidates could rationally decide where to apply!

4.2 Usage of new technology

Capturing the data from application forms is a process, which lasts at least four weeks. Small group of people does the coding. Database filling based on codes is much easier and faster. Despite of this, there at least ten people must do the work. Expenses and duration of the process call for better solutions. We recommend two possible alternatives:

- The use of IOCR technology to capture the data
- Usage of Internet based solutions

4.2.1 Usage of IOCR technology

Optical character recognition (OCR) technology enables converting printed or scanned documents into computer-editable text. Intelligent OCR is improved technology which provides new features that increase the accuracy, and throughput for converting printed or scanned documents into computer-editable text. The technology behind this innovative approach to OCR is predictive optical word recognition.

Using I-OCR technology to capture data from application forms would reduce expenses. According to technical details about I-OCR technology, we expect the whole process would not last more then few days.

4.2.2 Usage of innovative Internet based solutions

Idea about using Internet solution to capture data from application forms is even more attractive then usage of an IOCR technology. Every secondary school in Slovenia has access to the Internet. Candidates could then apply at the University using a WWW application. The applying process would be controlled by elected teachers that would be prepared to take responsibility. Internet could be used as communication channel between candidates and Admission Service. There would certainly be a small group of the candidates that have had graduated in the past. We would have to enable those candidates to access the Internet and use the WWW application.

Advantages:

- Reduced costs
- Using WWW application candidates would not be able to enter incorrect records
- Coding would be unnecessary
- Data would be inserted directly into database
- Communication between candidates and Admission Service would be cheaper and faster

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University of Ljubljana,
Faculty of Computer and Information Science,
Laboratory of information systems and database systems,
Ljubljana, Slovenia
E-mail: rok.rupnik(at)fri.uni-lj.si
E-mail: marko.bajec(at)fri.uni-lj.si
E-mail: marjan.krisper(at)fri.uni-lj.si

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Computer based System for Students Admission and Students Records Information System at the Lithuanian University of Agriculture

Stasys Martišius

Introduction

Lithuanian University of Agriculture (LUA) is the only higher school in Lithuania training agricultural specialists. Total amount of students in five faculties is about 4500. The staff - 31 professors, 216 associate professors, 112 senior assistants, 67 assistants, 50 researches and 700 supporting and administrative staff. LUA library has about 570000 books. LUA campus is in 10 km. south-west from Kaunas center. There are five buildings for teaching purposes, student campus and teachers settlement. University computers are connected into LAN. We have four NOVELL, two NT, one LINUX and one UNIX servers. LAN has access to INTERNET via leased telephone line. Our traffic to INTERNET is noticeable in information exchange among higher schools situated in Kaunas. We are not satisfied with slow connection to INTERNET and 2Mb/s radio-link is being installed.

Computer based System for Students Admission

LUA students admission office started using computer based system four years ago. At first we purchased a programme from Kaunas University of Technology and used it for two years. After some changes in admission rules we created our own module using similar database stucture.

Student admission rules are on the web: http://WWW.LZUA.LT/ . Admission period begins in December and continues till July. Aplications, and other documents are accepted by post. Principles of preliminary admission system were tested at Kaunas University of Technology and appeared to be the best ones. There are three competitions during admission period. Each competition takes place after the end of secondary school trimester when subject marks for the last two years and the trimester marks are evaluated. Pupils invited to study after the first competition are free from the second and third competitions. Having failed in the first competition pupils can participate in following competitions with the new trimester marks. Each time about one third of students are invited.

Record of applicant's database contains personal information (family, name, person code, home address), secondary school name and address, speciality, the average mark, marks in special subjects, competition number and some additional information.

The system can print answers to aplicants about their admission or failing (picture 1) and competition list for each speciality (picture 2). There is a possibility to print statistical data, too.

Data about the enrolled students is transfeered to students records system.

Students Records Information System

First-year students are grouped according to their speciality,and foreign language. Every student can change his/her status in the University himself/herself or according to the initiative of faculty administration. All student status alterations (promotion, expel, academic vacations, etc.) are reported by Rector's or Dean's orders.

Every student has the compulsory study program combined from compulsory study modules for his speciality, and a set of electives included into individual study plan. The main reqirement is that the full-time student has to get marks for 20 credit sum (1credit equals 40 academic hours) during one term.

The databases structure and managing programme have been developed according to the above requirements .

Record of students database contains personal information, faculty, speciality, form of studies (full-time or by correspondence), level of studies (Bachelor, Masters), average mark of the last examination session, sum of scholarship.

All student status alterations are entered into Order database. Orders must meet fixed requirements. Order database contains student identification code, date, type code and free text of the order.

Study module database record contains identification code and description of the module, number of academic hours alloted for lectures, self-training, laboratory and practical works.

Individual study plan database contains student identification code, year of studies, number of term, all information about module of studies and examination results or examination delay date.

The system can print lists of students groups (picture 3), students in academic leave and grant-holders.

Study module database information can be printed in the form of study guide for wide use.

Information about individual study plans and examination marks enable us to calculate average mark which determines sum of scholarship, and prepare documents for book-keeping department. It is possibe to print list of students who have chosen the same study module (picture 4), and to know which modules are popular and which can be withdrown from study programmes. After examination sesion marks can be printed in certain form.

The system based on DOS and FOXPRO LAN is under continuous development.

Lithuanian University of Agriculture,
Informatics department, Kaunas-Akademija,
LT-4324 Lithuania
E-mail: smart(at)nora.lzua.lt

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Trends in High Performance Computing

Victor Alessandrini

The impact of the evolution of current CMOS technologies on high performance computiong is discussed, with particuler emphasis on large high-end systems. The merits and limitations of RISC based parallel systemas are underlined, and it is argued that parallel architectures with vector processing capabilities will probably continue to influence large scale computational physics and chemistry in the future. Some strategic actions adopted at IDRIS/CNRS are presented.

IDRIS/CNRS, Bat. 506, BP 167, 91403 Orsay Cedex, France

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Development of Information Technology at the University of Latvia (State of the Art and Projects)

Harijs Bondars, Maris Treimanis

Objectives of the development of information technology at UL

University of Latvia (UL) has the highest number of students compared to other higher education establishments in Latvia. There are more than 16 000 students, 2 760 employees, 36 majors, 60 laboratories, 12 scientific institutes, 12 faculties, etc.in UL. The development of information technology at the University of Latvia is guided by four main objectives:

- To use computers and INTERNET resources in the educational process at UL (every graduate of the university has to be computer literate, and to be able to use INTERNET resources and computer software in the student's field of study);
- To provide services for scientific institutes and laboratories (these institutions participate in the educational process of graduate students);
- To take part in the development of the Latvian Schools Computer Network - SKOLANET;
- To develop the University's information and administrative computer systems.

These goals can be achieved only by developing a sophisticated system of servers and communications.

Latvian Academic Computer Network - LANET

In June of 1993, the Latvian Academic Network LANET was created at the University of Latvia, with financial assistance from the German government and the Sores Foundation. LANET is aggregate of computing hardware, telecommunications hardware, software, development environment, file systems and experts that provides full INTERNET service to users. LANET also offers to its users training and consultation, provides them with sophisticated computing resources, and manages local or sub- networks, keeping in mind the specific needs of each of them.

The LANET center was created to achieve effective utilization of computing and networking hardware within UL. It is actively involved in the education of students as well as in creation of the necessary environment for scientific work at UL. It provides all UL students and staff with computing hardware resources and INTERNET access. The LANET center also helps to create and run networks within other institutions of higher education in Latvia; to plan, create, and run the project of SKOLANET (a computer network of high schools in Latvia) and educate teachers about INTERNET resources; as well as to develop and maintain the UL management information system.

LANET users

LANET services are used by all departments, laboratories, libraries, institutions, and administration of UL, Riga's Technical University, Latvian Academy of Sports, Latvian Music Academy, Riga's University of Aviation, University of Vidzeme, Institute of Organic Synthesis, Institute of Computer Science, Nuclear Reactor, several schools of Riga, six Valmiera's schools, twenty schools in Kuldiga and its region, four Cesis's schools, some other high schools of Latvia, Parliament of Latvia, Ministry of Science and Education of Latvia, and some other organizations. As of now, there are more than 3000 directly registered users at LANET center (most of them are students and staff of UL). The LANET center organizes education programs, lectures and other educational events for schoolteachers and users of the academic network.

All registered LANET users can utilize not only the INTERNET resources but also other resources of the LANET node like servers.

LANET hardware and software.

LANET consists of the following technical components: the main node, FDDI optical ring, hardware that allows to connect user's local networks to the optical ring, and leased phone lines that allow to connect local networks to the LANET main node in on-line mode, local INTERNET servers, and dial-up phone lines. LANET connection to INTERNET is done through the Latvian Telecommunications Company - Lattelekom. The program System View is used for LANET network management.

The capacity of LANET is determined by the system of servers at LANET and by communications networks. That is why we paid much attention to server system development. Issues about the server system became vital to us when in 1996 we exchanged an IBM donated mainframe 4381 with two processors for a UNIX based four processor server RISC/6000 model G30. At the beginning, the G30 had the necessary capacity, but the growing number of users (over 2000) of INTERNET pushed us to consider more sophisticated and powerful servers for LANET needs. The need to acquire a bigger server was determined also by an objective of UL - to provide its students and staff with an opportunity to use INTERNET services and other computer resources in their daily work (there are more than 16 000 students at UL); by usage in education of software that requires enormous amounts of computer resources (Oracle, DB2, SPSS, Lotus Notes, GIS, WWW, and others); by the growing number of personal computers and local networks; by the increasing speed of connections to LANET (connections to FDDI ring and 128 kb/s connections using leased lines); etc. Comparing many possible solutions, we came to the conclusion that the best choice would be an IBM RISC/6000 model SP. The advantages of the solution using IBM RISC/6000 SP server and high speed communications lines are: a) the ability to administer the network, b) centralized file and date base storage, c) there is no necessity to have separate servers with local computers. These advantages are important because network and date base administrators should be highly qualified and well-paid specialists and it is easier to administer a centralized database as well.

Besides the main server of LANET's main node, there are also other servers that perform specific tasks. In particular, the SUN computer should be pointed out because it is used as a server for SUN users. This server contains files with all necessary software for SUNs and is available to any user (see fig. 1).

LANET subnet - Latvian school computer network SKOLANET.

The “natural” place for creation and development of school computer network is LANET. There are several reasons why we have come to this conclusion. First, the University of Latvia has a long tradition of cooperation with Latvian schools. Second, UL has experience in creating academic networks because it has developed its own - LANET. Since its foundation, LANET center connects schools to its computer network, services computer networks and networking hardware, registers students and teachers from high schools, provides them with log-ins and passwords, with e-mail and file storage, provaide consultation them, helps to select and purchase hardware and software, installs hardware and software, educates teachers and students, etc.

Schools can access INTERNET resources in three ways. First, schools can access the LANET center in dial-up mode using regular phone lines. Dial-up mode is the most common connection mode among schools. There are 114 registered teachers who work in dial-up mode at the LANET center. Second, students and teachers can access INTERNET from INTERNET classes in the University of Latvia. Last year about 170 teachers and students used this option regularly. Third, schools can access the LANET center using leased line connections in on-line mode. Currently there are 7 schools in Valmiera, Cesis, and Kuldiga connected via leased lines to the LANET center.

Informative-Administrative computer system of UL (LUIS).

Two years ago UL started to create its new Informative-administrative system. The system is being developed by using sophisticated IT technology. Currently there have been created and run LUIS base modules. The modules run all necessary registers (students, teachers, majors, etc.) and corresponding servers. Components of LUIS are being used by UL administration, faculties and other structures. Functional possibilities of LUIS are being broadened in order to facilitate functionality of traditional informative-administrative system.

Oracle Case* Method and Oracle Case tools (Designer /2000, Developer/2000, and others) are used to create LUIS.

UL professors, teachers, and students are developing this project.

Information technology project of the Ministry of Science and Education of Latvia

Educational system in Latvia is huge and complicated. Every citizen of Latvia gets in touch with the system directly or indirectly. The system covers all country and realizes many different functions like education, scientific experiments, planning, control, etc. the functions are being performed in different type of organizations like schools, municipalities and ministries.

In the educational system, information technology is being used in very limited ways. There has been started development of informatization infrastructure in the educational system. The infrastructure is upgraded constantly. Effective utilization of the infrastructure is slowed down by lack of educational programs, methodology and software. The reasons of the pure utilization of existing infrastructure are the lack of co-ordination in developing information technology in educational system and the low priority to develop the infrastructure.

Ministry of Education and science ordered to specialists from UL to perform strategic analysis of the educational system. Also, the specialists were asked to develop requirements of complex and complete informatization of the system. These requirements are analogical to the requirements developed by the U.S. National Coordinating Committee on Technology in Education and Training. (“The National Information Infrastructure: Requirements foe Education and Training” , March 25,1994). UL and IBM-Latvia offer a complex solution to the problem.

Realization of the project will computerize education system, its management and services. The development of the information systems infrastructure is subject to several preconditions: it has to be developed on the basis on modern science and technology; common infrastructures have to be used for the various functionality's (education, administration, informative cervices), existing infrastructures of the education system have to be used if they correspond to the objectives and needs of the project; integration of science and education has to taken into account.

Project foresees installation of hardware only to the educated and informed user how to run the hardware and software. It means that the first step is to develop software and educate users, and only then the hardware can be introduced.

In this project we propose to use ATM technology, rather than FDDI. Both types of networks will coexist in the initial phases of the project. In collaboration with Lattelekom (Apollo), favorable conditions have been obtained for INTERNET access and LATNET developments between towns where Universities are located. In further collaboration with Lattelekom we hope to form

ATM links between these sites.

The project has to be finished by the year 2000.

University of Latvia
Raina b. 19., Riga, LV1586 Latvia
E-mail: hb(at)lanet.lv, mt(at)lanet.lv

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Les divers Aspects de l'Administration de Réseau: Exemple du Réseau OSIRIS

P.Guterl, A.Cote, P.Gris, JJ.Pansiot

Le Centre Réseau et Communication a en charge le réseau informatique inter campus Osiris, qui regroupe les trois universités, les centres de recherche et les écoles d'ingénieurs de Strasbourg,.

Les missions confiées au CRC sont de 4 ordres:

- L'administration du réseau.
- Les services réseau pour les utilisateurs.
- La gestion de l'information.
- Le support technique pour les problèmes liés au réseau.

Le réseau Osiris est constitué de deux anneaux fddi servant de backbone, d'une vingtaine de routeurs pour les noeuds d'interconnexions, et environ 200 concentrateurs desservant environ 5000 machines connectées.

Pour assurer la meilleure qualité de service possible dans ces 4 domaines, il a fallu mettre en place des infrastructures permettant de superviser le réseau, gérer les services et l'information et répondre aux demandes des utilisateurs. Nous allons décrire comment et avec quels outils l'administration de réseau a été mise en place.

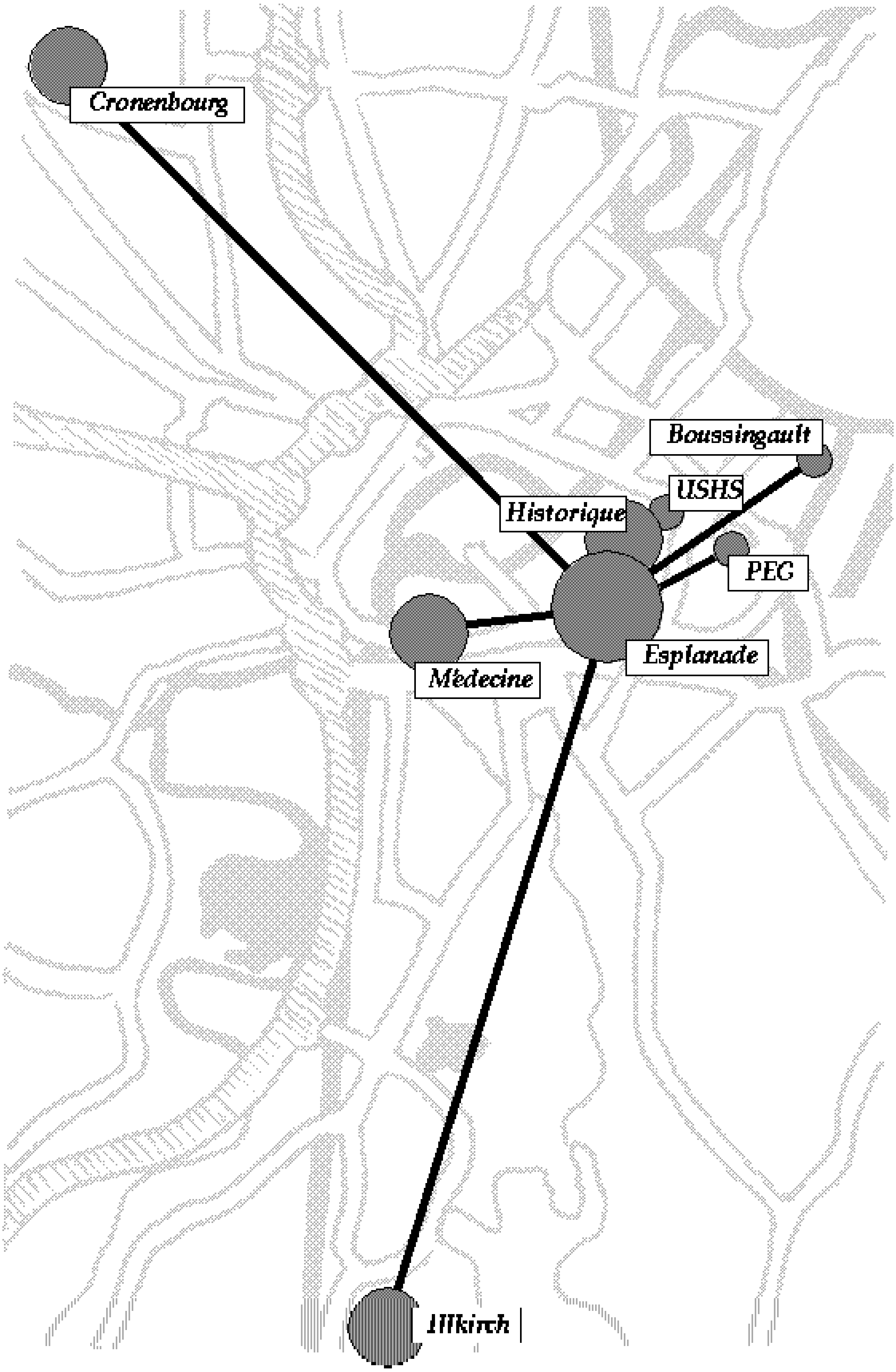
La gestion du réseau recouvre plusieurs aspects:

- la conception.
- La mise en oeuvre.
- Les tâches de fonctionnement:
- Surveiller et anticiper.
- Dépanner.
- Aspects statistiques nécessaires à l'évolution du réseau.

Les objets à administrer dans un réseau sont les supports physiques, les équipements actifs, les services applicatifs (dns, messagerie...) et les applications réseau (telnet, ftp..). Cette supervision est réalisée grâce à des programmes spécifiques, à un logiciel d'administration (Sun Net Manager), et le logiciel Optivity. La base de données, qui sert à gérer le serveur de noms du domaine, stocke les caractéristiques des équipements.

Présentation du Réseau OSIRIS.

Le réseau Osiris existant



Echelle : 1000m

Figure 1: Plan de situation général des principaux campus strasbourgeois du réseau Osiris

Le réseau Osiris est constitué de 10 campus répartis sur l'ensemble de la communauté urbaine de Strasbourg. Ceux-ci sont raccordés par des fibres optiques, 5 liaisons spécialisées et 3 faisceaux hertziens. Les 10 campus représentent 80 bâtiments et l'on dénombre 6000 machines connectées par 127 sous réseaux Ethernet.

Infrastructure physique actuelle du réseau Osiris

Sur cette infrastructure sont véhiculés différents protocoles réseaux dont le principal est TCP/IP mais aussi IPX, Appletalk.

Actuellement, un sous-réseau correspond à une entité telle qu'un laboratoire de recherche, ou un service administratif.

Lorsque le réseau a atteint une certaine dimension, il est impératif d'avoir à jour l'ensemble des schémas au niveau du câblage, pour suivre le cheminement des câbles jusqu'à la tête de réseau dans les bâtiments. Pour avoir une mise à jour la plus fréquente, on a mis à disposition des correspondants réseau les schémas sous forme de fichiers pdf, à travers un serveur W3.

Surveillance des Applications

Un programme teste, de manière périodique les applications sensibles tel le sendmail, le dns, le serveur W3 en simulant une application cliente. En cas de dysfonctionnement, un message est envoyé à une personne de permanence, et suivant les cas, l'application est relancée de manière automatique.

Surveillance de la Connectivité

Un programme dénommé " pingpong " permet de tester la connectivité avec l'utilitaire fping dérivé du programme unix ping. Pour garder une cohérence, les machines cibles sont enregistrées dans une table de la base de données du serveur de noms. Lorsqu'une machine ne répond pas à la requête, un message est transmis à une personne de permanence, qui prendra les dispositions nécessaires en cas de besoin.

Cohérence de l'Espace d'Adressage IP

Un des problèmes, fréquemment rencontrés par les utilisateurs, en particulier dans le monde de la micro-informatique concerne la duplication d'adresse ip due a l'appropriation sauvage d'une adresse ip. Dans ce but, on lit périodiquement les tables arp des routeurs par une requête snmp, et le couple d'adresse (ethernet, ip) est comparé aux valeurs des tables stockées dans la base. En cas d'incohérence, (machine non déclarée, modification de l'adresse ip), les données sont stockées dans une table. En consultant les tables via l'interface W3, cela permet de résoudre facilement les conflits d'adressage, en cas de problème.

La Station de Management

La surveillance des machines

La station d'administration sert à la surveillance de machines sensibles grâce au générateur d'événements, on peut ainsi surveiller les divers éléments des serveurs (l'espace disque, l'utilisation de la cpu). Certains équipements génèrent des alarmes snmp lors de l'apparition de problèmes, on peut ainsi prévenir les responsables lors de l'arrivée des alarmes.

La surveillance du réseau

Le logiciel de gestion Optivity permet de gérer les concentrateurs Synoptics et les routeurs. Il est basé sur la plate-forme d'administration Sun Net Manager. On peut ainsi surveiller les paramètres tels que le % d'utilisation du réseau, ou le taux d'erreurs. Des seuils ont été positionnés sur les équipements pour déceler des dysfonctionnements. Les remontées des alarmes propriétaires sont traitées de manière particulière, permettant une agrégation des types d'alarmes et par équipement.

Toutes les alarmes, envoyées par les équipements, n'ayant pas le même niveau d'urgence, un pré-traitement du message d'alarme envoyé par la station d'administration est nécessaire. Seuls les messages "urgent" sont envoyés au gestionnaire.

L'aspect statistique est réalisé grâce à un programme[Mémoire CNAM 1994 M.Dufaut] basé sur les variables SNMP des équipements, la collecte étant réalisée par la couche API de Sun Net Manager, et les données stockées dans une base de données. Les courbes sont éditées quotidiennement ou hebdomadairement.

Centre Réseau Communication,
Université Louis Pasteur,
7 rue Descartes, 67084 Strasbourg, France
E-mail: Patrick.Guterl(at)crc.u-strasbg.fr

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Tweet

Ref: 022302

Organisation d'un Centre de Réseau pour le Support Technique aux Utilisateurs

P.Guterl, S.Behr, R.Biechel, A.Cote, S.Gillmeth, P.Gris , S.Ley, M.Mayer, F.Ostre, JJ.Pansiot

Le Centre Réseau et Communication a en charge le réseau informatique inter campus Osiris, qui regroupe les trois universités, les centres de recherche et les écoles d'ingénieurs de Strasbourg et qui est reparti sur 4 campus.

Les missions confiées au CRC sont de quatre ordres:

- L'administration du réseau.
- Les services réseau pour les utilisateurs.
- La gestion de l'information.
- L'assistance technique pour les probl&è;mes liés au réseau.

Nous décrirons l'organisation du service d'assistance "svp-osiris".

PRESENTATION DU RESEAU OSIRIS.

Le réseau Osiris existant

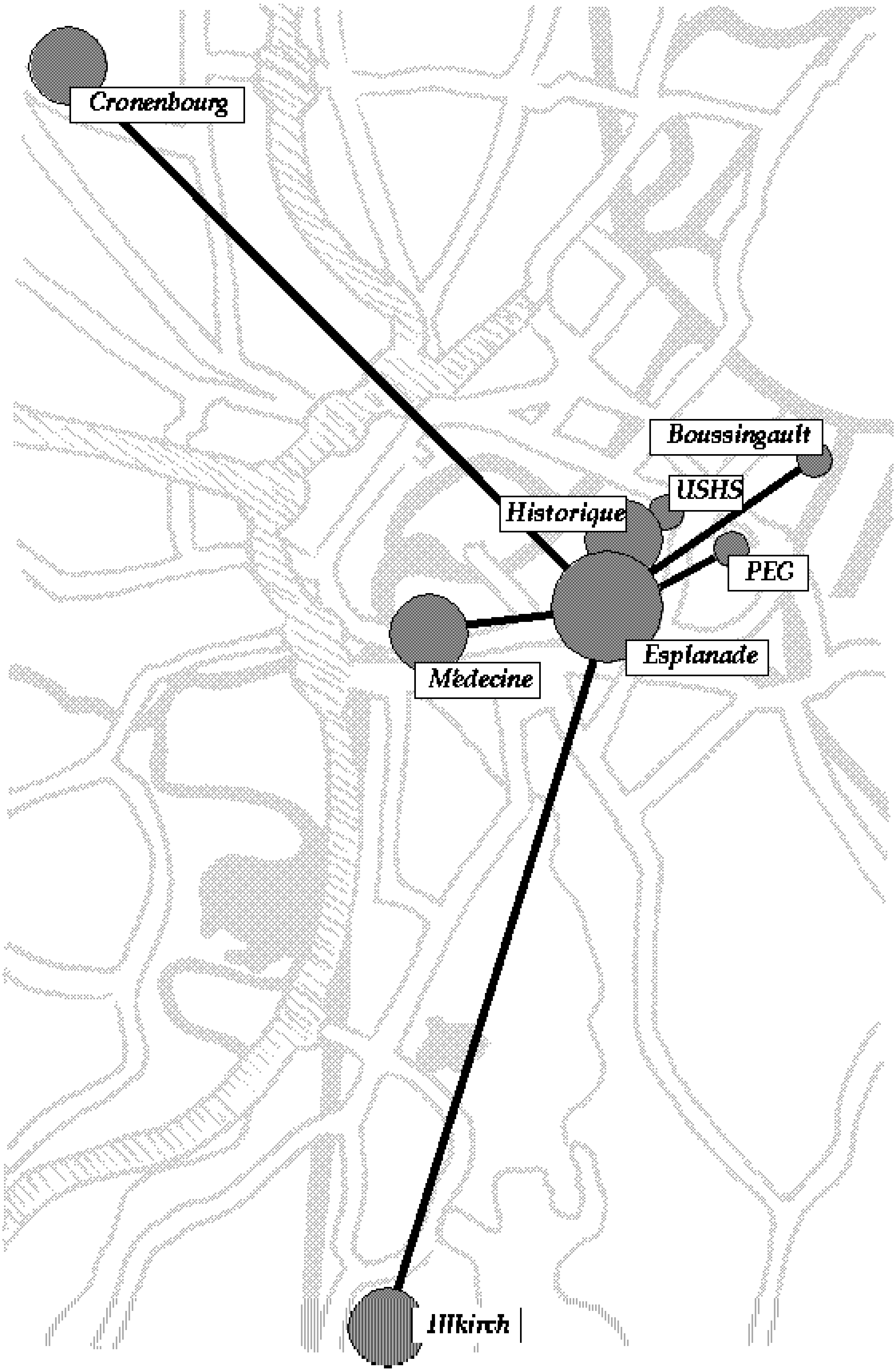

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Figure 1: Plan de situation général des principaux campus strasbourgeois du réseau Osiris

Le réseau Osiris est constitué de 10 campus répartis sur l'ensemble de la communauté urbaine de Strasbourg. Ceux-ci sont raccordés par des fibres optiques, 5 liaisons spécialisées et 3 faisceaux hertziens. Les 10 campus représentent 80 batiments et l'on dénombre 6000 machines connectées par 127 sous réseaux Ethernet.

Infrastructure physique actuelle du réseau Osiris

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Actuellement, un sous-réseau correspond à une entité telle qu'un laboratoire de recherche, ou un service administratif.

DESCRIPTION DU SERVICE D'ASSISTANCE SVP-OSIRIS.

De part la taille du réseau Osiris et pour assurer la meilleure qualité de service possible dans les 4 domaines cités ci-dessus, il a fallu mettre en place des infrastructures permettant de superviser le réseau, gérer les services et répondre aux demandes des utilisateurs. Le pivot de cette organisation est le service de permanence "svp-osiris ", qui est assuré, sur une période hebdomadaire, par les personnes du CRC. La fréquence pour assurer ce service est bimestrielle. Un numéro de téléphone unique et une adresse électronique générique svp-osiris@u-strasbg.fr ont été diffusés à l'ensemble des utilisateurs du réseau Osiris. Ce système permet aux autres personnes de ne pas Ítre trop souvent sollicités pour des problèmes mineurs. Chaque personne du service, ayant un domaine de compétence spécifique, peut intervenir en cas de problèmes graves. L'écueil à éviter, c'est que l'utilisateur continue par la suite à s'adresser à la personne qui était de permanence au moment où son problème est apparu. Après une période d'adaptation, les utilisateurs ont pris l'habitude de solliciter le service de permanence. La diversité des problèmes a nécessité de développer un certain nombre d'applications qui permettent soit de rechercher des informations, consulter des documents ou intervenir à distance. Cet ensemble est basé sur trois logiciels:

- Un serveur privé W3,
- Une base de données SGBD (Sybase),
- Une plate-forme d'administration réseau Sun Net Manager.

Les outils sont accessibles à travers un browser W3. Les applications seront détaillées dans les chapitres où sont décrits les services correspondants.

Le système de roulement, ainsi que la diversité des problèmes à traiter a entraóné la mise en place d'un outil de suivi des incidents. Après une étude de marché, il s'est avéré plus avantageux de développer une application propriétaire qui se base sur le SGBD, les offres du marché étant sur-dimensionées par rapport à nos besoins.

Le principe est que pour chaque domaine, il existe un responsable au CRC. La personne de permanence enregistre le problème, et le responsable est prévenu par mail qu'un incident concernant ces attributions vient d'Ítre ouvert. Une liste des incidents est automatiquement éditée en fin de semaine.

En résumé le fonctionnement de "svp-osiris" lors d'un appel d'un utilisateur est le suivant: quand un utilisateur soumet un problème, la personne de permanence essaie en fonction du type de problème (réseau, e-mail, dns) de le résoudre à l'aide des documents en ligne, ou de l'historique des problèmes, sinon l'incident est répertorie dans la base de données a l'aide d'un logiciel de gestion des incidents. Lorsque l'incident est enregistré, les personnes, ayant les meilleures compétences, sont automatiquement prévenues par e-mail. La première version a été développée sous X motif, la deuxième version utilise un browser W3, ainsi que le langage Javascript pour vérifier la validité des données.

La dispersion géographique ainsi que la taille du réseau nous a amené à mettre en place un système d'informations basé sur des correspondants réseau qui gère un ou plusieurs sous réseaux. On a délégué à ces personnes la gestion de la partie locale de l'adressage, elles peuvent intervenir pour des problèmes simples et sont nos interlocuteurs privilégiés en cas de problème réseau.

Description des services gérés par le CRC

Le service de noms (DNS)

Pour la gestion du domaine u-strasbg.fr, le serveur de noms (dns) est le service essentiel pour le domaine.

La gestion du serveur de noms est faite à partir des données stockées dans la base de données. Les valeurs sont saisies à travers des masques gräce à des applications de type L4G. L'application permet d'enregistrer les différentes options d'un serveur de noms (A, CNAME, MX), et de cette manière on évite les problèmes de duplication de noms ou d'alias et d'adressage IP et on assure une cohérence des données. Un programme écrit en C génère les fichiers spécifiques au serveur de noms et réinitialise le programme in.named.

Pour éviter les problèmes liés à l'adressage IP, les correspondants réseau gèrent l'adressage locale des sous réseaux. Gräce à cette organisation, nous avons un interlocuteur, qui distribue les adresses IP aux personnes désirant connecter un équipement, qui vérifie que les nouveaux équipements sont conformes et ne risquent pas de créer des perturbations sur le réseau. La procédure de déclaration d'adresse IP est à l'initiative du correspondant réseau qui envoie un formulaire de déclaration pré défini par messagerie électronique à la permanence. Les données sont saisies à travers le masque, et lorsque la nouvelle machine est insérée dans le serveur de noms, un message d'acquittement est renvoyé à l'expéditeur. Cette procédure a éliminé les erreurs dues aux incohérences dans les fichiers du serveur de noms, et aux duplications des données. La déclaration de la machine peut se faire sous 24 heures. Gräce aux informations stockées dans la base, la personne de permanence, en cas de besoin, peut retrouver la topologie du réseau à partir de l'adresse ip d'une machine (localisation du sous réseau, interface du routeur concerné ...). Le résultat d'une requÍte de recherche renvoie en plus des caractéristiques d'une machine (nom, adresse ip) son numéro ethernet ainsi que le nom de sous réseau sur lequel elle est connectée ainsi que le nom du routeur et le numéro de son interface. On peut ainsi facilement localiser l'équipement.

Un des problèmes, fréquemment rencontrés par les utilisateurs, en particulier dans le monde de la micro-informatique concerne la duplication d'adresse ip due a l'appropriation sauvage d'une adresse ip. Dans ce but, on lit périodiquement les tables arp des routeurs par une requÍte snmp, et le couple d'adresse (ethernet, ip) est comparé aux valeurs des tables stockées dans la base. En cas d'incohérence (machine non déclarée, modification de l'adresse ip), les données sont stockées dans une table. En consultant les tables via l'interface W3, cela permet de résoudre facilement les conflits d'adressage..

LA MESSAGERIE

En tant que gestionnaire du réseau Osiris, nous avons en charge l'ensemble de la messagerie, tant au niveau du

mailhost du domaine u-strasbg.fr, que de la gestion des boótes aux lettres. La gestion du mailhost relève des fonctions classiques (règles d'écriture dans le sendmail.cf en fonction des caractéristiques locales, gestions des queues de messages..).

Le parc des machines connectées est dominé par les micro-ordinateurs de type PC/Macintosh qui ne sont pas adaptés pour le service de messagerie puisqu'ils ne sont pas en service de manière permanente. Nous avons mis en place un service de boites aux lettres, qui permet à aux personnes remplissant les conditions de disposer d'une boite aux lettres sur le serveur de messagerie. Pour personnaliser ce service les adresses sont réécrites sous la forme Nom.Prenom@service-ulp.u-strasbg.fr. Pour faciliter la gestion, une application à travers W3 a été développée pour créer une boite aux lettres modifier certaines caractéristiques, ou supprimer un utilisateur. Gräce a ce système le responsable de service de messagerie est déchargé de cette fonction, qui est pris en charge par le service de permanence. Le problème majeur a été de développer des programmes permettant de modifier les fichiers sensibles en respectant les règles de sécurité. Le logiciel Eudora est installé sur les micro-ordinateurs, pour gérer la messagerie. La requëte la plus fréquente concerne la perte du mot de passe permettant d'accéder à la boóte aux lettres du serveur Unix. Celui-ci est régénéré automatiquement à travers une application et envoyé directement par messagerie à l'utilisateur.

L'ANNUAIRE

Le CRC a été chargé de la gestion de l'annuaire des personnels de l'Université. Une des caractéristiques de l'annuaire, est que les données sont modifiées très souvent. Pour éviter de mobiliser trop de ressources humaines pour les nouvelles insertions ou les mises à jour, la saisie des données sous un format pré défini sous Excel a été délégué aux entités de recherche. Les données sont insérées à partir d'une feuille Excel dans les tables de permanence. Les mises à jour peuvent être réalisée par les personnes elle-mëme à travers le serveur W3, et l'authentification de la personne est basée sur la messagerie et sur un échange de clé. Cette clé est comparée à celle généré lors de la demande de modifications des cordonnées. L'annuaire peut être consulte par divers moyens: W3, le client ph en particulier celui intégré dans Eudora, ainsi que par e-mail.

D'autres services nécessitent des opérations d'administration sur des stations Unix. L'ensemble des procédures a été automatisé via le serveur W3.

LA GESTION DES MESSAGES DE SVP-OSIRIS

Le nombre important de messages traités par la permanence, a nécessité une gestion en dupliquant les messages reçus et envoyés dans des fichiers par semaine. Cela permet en cas de litige de retrouver un échange de messages entre des utilisateurs et le service de permanence.

CONCLUSION

Cette organisation permet a un interlocuteur d'avoir un correspondant unique, pour les personnes du CRC, hors de la semaine de permanence, ne prendre ne compte que les problèmes importants, et ainsi pouvoir faire évoluer d'autres projets. Ce système permet également de centraliser les informations internes, ainsi qu'un certain nombre de documents.

Le revers peut être de ce succès est qu'on est de plus en plus sollicité pour des problèmes n'ayant qu'un lointain rapport avec la problématique réseau.

Centre Réseau Communication
Université Louis Pasteur,
7 rue Descartes, 67084 Strasbourg, France
E-mail: Patrick.Guterl(at)crc.u-strasbg.fr

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Les CRIs face aux nouveaux moyens de traitement de l'information

Gérard JEAN-FRANCOIS

1. Introduction

Un CRI (Centre de Ressources Informatiques) est un service commun d'un établissement d'enseignement supérieur, qui a pour mission principale de mettre en œuvre la politique informatique de l'établissement. Si on se réfère à l'évolution technologique, cette politique consistait dans les années 60 à mettre en œuvre une machine qui faisait du calcul scientifique, d'où l'appellation de " Centre de Calcul ".

Pour remplir ses objectifs, le CRI dispose de moyens matériels, logiciels et humains qu'il doit mettre à la disposition des utilisateurs dans essentiellement trois domaines : la recherche, la gestion et le soutien à la pédagogie. Il a très souvent un rôle de conseil pour les achats de matériel et de logiciel, un rôle de formation et d'information à destination des enseignants, chercheurs et des personnels. Lui est confiée très souvent aussi la responsabilité du réseau.

Nous sommes très loin du calcul scientifique et il semble logique de dire qu'aujourd'hui un CRI participe au traitement de l'information. Cette participation est variable d'un établissement à l'autre et intègre plus ou moins les nouvelles technologies qui apparaissent. L'objet de cet article est de faire un bilan de la situation et de proposer des pistes pour prendre en compte et organiser au mieux l'utilisation des nouvelles technologies. L'auteur bien entendu n'engage que lui-même.

2 .Traitement de l'information

Il n'est peut-être pas inutile de rappeler que le traitement de l'information, disponible souvent sous forme analogique, se fait sous forme numérique. Il faut noter aussi que cette information est véhiculée sur les réseaux dont la généralisation est indispensable. L'arrivée du réseau sur le poste de travail et l'émergence des réseaux hauts débits doit être prise en compte pour l'utilisation des nouvelles technologies ce qui entraîne du même coup l'abolition des distances et des délais d'acheminement.

Il existe deux catégories d'utilisateurs du traitement de l'information :

- ceux qui créent l'information à destination des autres
- ceux qui reçoivent l'information

Ces deux catégories sont par exemple dans le domaine de la pédagogie les enseignants et les enseignés. Pour la gestion et pour la recherche on est également dans la même situation et le schéma classique est le suivant :

- le but recherché est de diffuser des résultats sur différents supports (papier, CD-ROM, vidéo, électronique)
- ces résultats sont obtenus à partir de données disponibles sur des supports variés (papier, vidéo, électronique) qui constituent des documents qu'il faudra numériser.
- pour obtenir les résultats à partir des données il faut effectuer des traitements plus ou moins complexes. Certains sont très spécifiques par exemple traitement d'images satellitaires, d'autres sont banals et utilisés par tout le monde c'est le cas du traitement de texte.

Si on approfondi cette chaîne du traitement de l'information on s'aperçoit très vite que tous les domaines spécifiques ont en fait de nombreux points communs faisant appel aux mêmes compétences, deux exemples le prouveront.

Le téléphone : il est devenu tout numérique et les techniques utilisés dans les commutateurs ont d'énormes points communs avec celles utilisées dans les réseaux

La reprographie : il n'existe plus de duplicateurs à alcool mais tout simplement des appareils incluant scanner et imprimante laser qui peuvent être très facilement connectés au réseau, si bien qu'on en arrive à la gestion électronique des documents.

Pour résumer ce problème du traitement de l'information on peut affirmer, sans l'ombre d'un doute, que tous les domaines sont concernés : la pédagogie, la recherche, l'administration. IL faut aussi remarquer que l'utilisation du traitement de l'information a été sous utilisé dans des secteurs tels que les sciences humaines, la culture et aussi la communication.

Nous allons reprendre chaque étape du traitement de l'information et faire une liste non exhaustive des différents moyens utilisés.

3. Diffusion de l'information

Elle est faite dans un établissement d'enseignement supérieur par différents services (en réalité par tous les services) dont les principaux sont :

- le service de la communication
- le téléenseignement
- le laboratoire de langue
- le service publications
- le service de la documentation

Les vecteurs utilisés sont:

- le support papier sous toutes ses formes, notons au passage que l'édition papier fait appel à l'imprimerie, qui a elle aussi évolué et utilise maintenant l'informatique pour faire de la PAO (publication assistée par ordinateur). Est également concerné le service de reproduction déjà cité.
- le film
- la vidéo
- le rébreau sur lequel on diffuse la visio-conférence, les documents sous forme W3, le téléenseignement etc...
- le CD-ROM dont la réalisation sera détaillée plus loin.

Le constat global que l'on peut faire c'est que tout le monde a besoin de diffuser des supports. Pour réaliser ces supports chacun est amené à utiliser des techniques assez avancées par exemple le traitement d'image, mais chaque service n'utilise pas forcément le même logiciel de traitement d'image d'où une dispersion des compétences et surtout un manque de maîtrise des logiciels utilisés.

4. Acquisition des données

Il faut disposer de données sous forme numérique, or les données sont sous forme quelconque et sur des supports très variés :

- - le support papier : si la reconnaissance optique de caractères est devenue courante, la numérisation d'images couleur en haute définition nécessite des matériels pas toujours disponibles.
- - le support film n'est pas toujours simple dans la mesure où on peut avoir des documents sur des supports aux formats disparus.
- - le support est l'objet lui-même : objet de fouille, objet de collection, objet d'art. Pour chaque cas il est nécessaire de trouver une solution adaptée car parfois l'objet est inaccessible et tout dépend du résultat que l'on veut obtenir. Dans ce genre de situation l'appareil photo numérique peut rendre service
- - la vidéo nécessite des interfaces particulières ainsi que la numérisation du son.

Dans le domaine de l'acquisition de données, il est un support qui a priori ne pose pas de problème c'est le support électronique puisque l'information est déjà numérisée, pourtant on est en droit de se poser quelques questions sur les facilités d'accès à la documentation.

L'accessibilité à travers les réseaux à des bibliothèques électroniques contenant toutes sortes de documents pose d'énormes problèmes de recherche de l'information.

Les logiciels tels que les moteurs de recherche apparus sur le Web sont les prémices de l'évolution de la recherche documentaire.

5. Traitement de l'information

Reprenons l'exemple du traitement de texte basique : sa généralisation est certaine dans un avenir plus ou moins proche, d'autant que l'utilisateur moyen n'utilise qu'une faible partie des possibilités existantes. Compte tenu de l'évolution des interfaces utilisateurs qui deviennent de plus en plus conviviaux, on va s'orienter vers une plus grande autonomie des utilisateurs, à titre d'exemple : nombreux sont maintenant les chercheurs qui utilisent des logiciels de retouche d'image.

Reste le problème de l'optimisation du traitement.

Nous sommes face à une explosion de logiciels de traitement, certes ils sont conviviaux, mais faut-il investir dans l'approfondissement de leur utilisation ou faire appel à des compétences existant déjà dans l'établissement ?

6. Méthodologie et mise en œuvre

Pour mettre en œuvre les nouvelles technologies appliquées au traitement de l'information, on peut proposer la démarche suivante :

6.1. il est nécessaire de faire l'inventaire des ressources existant dans l'ensemble de l'établissement. Cet inventaire doit être accompagné d'une évaluation précise des compétences car on peut se trouver dans le cas d'un service qui déclare faire de la PAO alors qu'il utilise un banal traitement de texte.

L'inventaire doit porter sur le matériel, le logiciel, le personnel mais aussi sur le taux d'utilisation. Par la même occasion seront recensés les dysfonctionnements éventuels.

6.2. tout l'existant étant répertorié il est nécessaire de connaître les besoins c'est à dire les projets à venir.

6.3. pour faire l'adéquation entre les besoins et les moyens existants il faut le mettre en place une structure coordinatrice. Le mot structure ne veut pas dire service c'est plus " une fonction guichet " qui face à une demande va réagir en disant par exemple pour réaliser telle partie de votre projet vous vous adressez au service X et pour telle autre au service Y.

Cette structure peut conseiller la sous-traitance et peut éventuellement si elle en a les moyens jouer un rôle de planification.

6.4. réorganisation des services : en fonction de l'existant et des besoins, l'établissement peut être amené en fonction de ses orientations à modifier les objectifs des différents services. Pour les lacunes se posera le problème soit de sous traiter soit de créer de nouvelles fonctions cela doit rentrer dans un schéma directeur.

7. Place du CRI

Comme tous les services le CRI se verra assigner des objectifs rentrant dans le cadre de l'utilisation des nouvelles technologies pour le traitement de l'information. Pour cela on tiendra compte des compétences existantes ou susceptibles d'être acquises facilement. Il est une chose certaine c'est que de toute façon il existe un élément fédérateur le réseau.

C'est autour de lui qu'on peut organiser un ensemble de compétences réparties dans différents services tels que le CRI. Il faut veiller à ne pas avoir un émiettement de services mais au contraire un regroupement de fonctions dans quelques services de taille suffisamment grande afin d'assurer une continuité de services pendant les absences (formation, congés, maladie..).

8. Exemple du CD-ROM

Cet exemple est assez représentatif de l'utilisation des technologies du traitement de l'information et des CRIs se sont déjà trouvés confrontés à cette situation.

Le CD-ROM est un support comme un autre de diffusion de l'information. Nous ne nous étendrons pas sur la conception proprement dite du CD-ROM, c'est tout simplement un auteur qui veut transmettre ses connaissances. Un fois le thème et le contenu défini il faut passer à la réalisation.

Tout d'abord le CD-ROM doit être attrayant. En plus du sujet, il doit être facile d'emploi et beau, ce qui oblige à utiliser les techniques de communication qui vont faire appel à l'ergonomie pour l'interactivité et à la présentation homogène des informations (obligation d'une charte graphique). La nature des données est très variée citons : textes, graphiques, images, son, vidéo.

Il faut les numériser.

La numérisation va nécessiter pour chaque type de support un appareil particulier avec l'utilisation d'un logiciel spécifique.

Envisageons quelques cas qui peuvent se présenter.

Parmi les données se trouvent beaucoup de diapositives qui justifient l'achat d'un scanner. Qui va disposer de cet appareil ? le CRI ou le service audio-visuel ? Qui va l'utiliser ? L'utilisateur en libre service de façon imparfaite ou bien un technicien formé spécialement donc performant ?

Parmi les données se trouvent aussi quelques vues qu'il faut extraire d'un film vidéo tourné par exemple lors d'une expérience. Faut-il investir dans un équipement cher (matériel et logiciel) avec une formation spécifique pour une utilisation très épisodique ou bien faire appel à la sous-traitance ?

Les données étant numérisées il faut les traiter, par exemple retoucher les images. Est-ce l'auteur qui doit le faire ? Doit-on avoir à disposition un service de PAO (Publication Assistée par Ordinateur) ? Si la réponse est oui cette fonction est-elle assurée par l'imprimerie, le service communication, le service audio-visuel, le CRI ?

A L'aide de ce petit exemple on peut appréhender la complexité et le nombre des techniques à mettre en œuvre ainsi que la diversité des intervenants.

9. Conclusion

Pour traiter l'information il faut assurer de façon professionnelle certaines fonctions indispensables. L'établissement doit décider s'il les assume lui-même ou s'il les fait effectuer à l'extérieur.

Si la solution retenue est de réaliser soi-même certaines fonctions cela doit rentrer dans un schéma directeur précis et comporter des moyens financiers et humains.

CRI Université de Caen,
Esplanade de la Paix, 14032 Caen Cedex, France
E-mail: jean-francois(at)criuc.unicaen.fr

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Towards the re-integration of the University of Ljubljana information system

Viljan Mahnic

1.Introduction

At the EUNIS '96 Congress, Peter Mederly presented a paper describing some general characteristics of administrative computing at Central and Eastern European universities (Mederly [1]), viz. the prevalent use of personal computers, the still widespread use of the MS-DOS operating system, and the shortage of networked applications sharing a common data base, in spite of a substantial effort to build suitable computer networks. It was also noted that the majority of universities are aware of these deficiencies and are planning to start the development of a new information system within the next three years.

To a great extent the aforementioned conclusions also apply to the University of Ljubljana, which is the largest university in Slovenia. It has 26 member institutions (20 faculties, 3 academies, and 3 colleges), more than 40,000 students, the teaching and research personnel number more than 2,600, and the administrative staff about 1,250 (for details see Table 1). However, given the fact that in Slovenia (as well as in some other Central and Eastern European countries, e.g. in Slovakia) the faculties have substantial autonomy within their universities, and they often have their own policy regarding the usage of information technologies, the development of an integrated university information system is not only a difficult technical task, but requires a substantial organizational effort.

Table 1: Member institutions of the University of Ljubljana

Id	Faculty/Academy/College	Staff			Students	
		Teaching & Research		Administrative	Undergraduate	Postgraduate
		Full-time	Part-time			
F1	Biotechnical	187	74	177	2702	163
F2	Economics	84	53	48	6503	351
F3	Architecture	49	4	21	838	14
F4	Civil Engineering and Geodesy	70	21	53	989	31
F5	Social Sciences	64	28	28	2588	130
F6	Electrical Engineering	104	0	72	1480	91
F7	Computer and Information Science	42	0	11	819	49
F8	Mathematics and Physics	79	8	40	624	54
F9	Chemistry and Chemical Technology	89	23	62	1320	72
F10	Pharmacy	31	7	23	739	1
F11	Natural Sciences and Engineering	72	15	57	1079	48
F12	Machine Engineering	113	26	94	1543	60
F13	Sport	52	17	41	664	28
F14	Arts	293	53	109	4890	238
F15	Medicine	271	0	174	1442	126
F16	Education	115	50	43	2669	17
F17	Law	27	10	15	1725	23
F18	Theology	37	2	12	492	12
F19	Veterinary	54	10	59	360	37
F20	Maritime Studies and Transport	30	41	13	1562	0
A21	Music	45	57	11	334	26
A22	Theatre, Radio, Film, and Television	28	13	19	106	2
A23	Fine Arts	40	9	19	272	32
C24	Social Work	17	13	9	677	0
C25	Health Care	44	25	40	1192	0
C26	Public Administration	17	13	7	3324	0
		2054	**572**	**1257**	**40933**	**1605**
	TOTAL:	**2626**				
		3883			**42538**	

The aim of our paper is:

- to supplement Mederly's investigation with certain details in order to show that there are great differences between faculties within a single university that render the development of an integrated information system more difficult;

- to point out some experience that has proved useful in overcoming these difficulties in the course of building a unified student records information system at our university;
- to make some recommendations on how to achieve the reintegration of different parts of the system.

Accordingly, section 2 of our paper is devoted to a detailed analysis of the present situation in the following areas: the finance information system, the personnel information system, and the student records system. In section 3, some experience from the development of the student records information system is described, while section 4 makes proposals for future activities.

2. Analysis of the present situation

The analysis of the present situation is based on the results of a survey that included all member institutions of the University of Ljubljana. Each member institution completed a questionnaire which contained questions about applications within each of the aforementioned systems. For each application the following data had to be specified:

- operating environment (basic information about computer equipment and operating system)
- network environment (whether the application is running standalone or in a network)
- the source of the application (who supplied the required software)
- implementation environment, if known (e.g. Clipper, Oracle, C etc.)
- the connection among applications (whether different applications running in a network share a common database)

The survey revealed that only personal computers are used for administrative computing, and that DOS is still the prevalent operating system, although the computers are in most cases powerful enough to allow the use of Windows 3.1 or Windows 95 operating system. Such a situation is a consequence of the fact that most programs are written in Clipper or similar tools, which only allow the development of DOS applications. Novell NetWare is the prevalent network operating system, while some institutions use Windows-NT in combination with Windows 95 on individual workstations.

It also became evident that most applications (except in the student records information system) were bought as standard packages from different suppliers. However, these purchases were not co-coordinated and, consequently, we have a great number of different, mutually incompatible applications that are probably appropriate for individual member institutions, but can not be integrated into a coherent information system at the university level. It was found that in the finance information system alone 26 member institutions purchased software from 26 different suppliers, while 7 different suppliers supplied applications for the personnel information system.

Details of the information systems under examination are given in the following subsections.

2.1. The finance information system

Computers were first introduced in the finance information system. At present, all member institutions use several applications, typically general ledger, accounts receivable and accounts payable, pay-roll, and inventory system. Some institutions also run some other applications, e.g. research projects, invoicing, cash in hand, stock records etc.

However, the diversity of suppliers and incompatibility of applications is most evident in this area. While 5 member institutions succeeded in integrating all applications into a unified information system using a common database, a great number of them still use standalone applications. Moreover, at some institutions these applications are purchased from different suppliers and are written in different languages, thus making integration into a coherent system difficult or even impossible.

2.2 The personnel information system

Compared to the finance information system, the use of computers is far less intensive in the area of personnel records. Only 7 member institutions out of 26 use special applications for this purpose, while the remainder use computers mainly for the writing of documents using Word or WordStar. Two member institutions do not use computers at all.

A detailed examination of 7 institutions that use special applications for personnel records reveals the same deficiencies as in the area of the finance information system. Each member institution has bought the application software from a different supplier, most applications are standalone, and they do not share a common database with other applications.

2.3. The student records information system

The main characteristic of the student records information system (Mahnic & Vilfan [2]) is the use of unified software for all applications in this area (entrance examinations, enrolment, examination records, alumni records, various analyses and statistical surveys). Also, some institutions use programs for the maintenance of examination schedules and programs for the entry of examination applications. Examination applications are entered by students themselves, thus diminishing the work load of the institution administration.

All these applications were written in co-operation between the Faculty of Computer and Information Science and the University Computing Center with the support of EU Tempus program (project JEP 1852 "Computerization of Administration and Management in Higher Education", 1991-94). They run in a local area network of personal computers sharing a common database. However, some member institutions with a small number of students still use only one standalone computer for this purpose.

Although the implementation environment (i.e. Clipper) of the student records information system is now obsolete, the system itself represents an important step towards the reintegration of the university information system:

- a unified data model was established which provides for the comparability and compatibility of data from different member institutions, and simplifies the task of data synthesis at the university level;

- a unified software was developed for all member institutions in spite of the differences in their organization, administrative procedures etc.

3. Some experience from the development of the unified student records system

When we started the development of the unified student records system in 1991 the situation in this area was similar to the situation in the finance and personnel information systems: different member institutions used different applications, while quite a lot of them used computers only for the processing of enrolment data, but not for examination records, alumni records, entrance examination etc.

We were aware that the success of the project depended not only on technical factors, but also on organizational and psychological ones. Therefore, besides a systematic approach using corresponding methodology and CASE tools for the analysis and design of the new system, special attention was devoted to the establishment of corresponding co-operation between member institutions and confidence in the development team. At the beginning, a group of 6 member institutions signed an agreement to participate in the project. The group was sufficiently small to be manageable, but sufficiently heterogeneous to be representative of the university as a whole. In later phases of the project, when the first tangible results were evident, some institutions joined voluntarily, while other institutions adopted the corresponding applications after the successful completion of the project.

During the design of the new system, the utilization of experience of other institutions and initiatives in foreign countries was very important. By closely examining the Mac initiative in the United Kingdom (McDonough [3], Powell [4]), the German initiative for administrative computing in higher education (Frackmann [5], Frackmann [6]), and the information policy of Dutch university management (Schutte [7]), we recognized the importance of the development of unified software for several higher education institutions.

Using the principle of non-coercion, it became evident that customer satisfaction is the main guarantee that the new system will be successfully put into operation. For this reason, the new system had to offer better functionality than the old one, and a smooth conversion from the old system had to be assured. To retain user satisfaction we were sometimes forced to incorporate certain institution-specific solutions that had not been agreed by all the partners in the project. However, through the use of special installation parameters we achieved a degree of flexibility that enabled us to develop unified software for all member institutions in spite of differences in their administrative procedures, organization etc.

4. Recommendations for future activities

Given the present situation, the development of an integrated information system for the University of Ljubljana will be a difficult task. According to Vrana (Vrana [8]), the most important aspects which contribute to success or failure are political decisions and support (with a contribution of 40%) and organization (with a contribution of 25%).

Although the new legal framework laid the foundations for the reintegration of the university and gave the university management more authority, it has proved impossible to change the peculiar organizational structure in a short time. In such a situation it is difficult to take adequate political decisions and obtain necessary support. Therefore, we are lacking some important factors that affect the success of such an endeavour. Nevertheless, using the positive experience from the development of the student records information system and the contemporary information technology infrastructure, some substantial improvements can be achieved in the three information systems analysed.

From the technical point of view we recommend gradually replacing the present PC-based systems by a modern client-server architecture, and to start the development of the unified software that will use a common database for all member institutions. The necessary infrastructure was established last year by building an optical network which connects all member institutions. On the other hand, the University Computing Center has at its disposal the required development tools and hardware equipment (viz. Oracle 7, Alpha workstations).

This goal can be achieved most easily in the personnel information system. Compared to the student records and finance information system, the personnel information system is less complex and therefore easier to implement. Additionally, at present only a few member institutions use computer applications for personnel records. Based on experience from the development of the student records information system, we suppose that it would not be difficult to establish a group of 5 to 8 member institutions that would act as the initiators of a common project with the aim of:

- developing unified software that would later be adopted by other institutions, and
- establishing a unified database of all university staff that will also later be used by applications from the new student records and finance information systems.

The re-engineering of the present student records information system can also be done without major problems, since all member institutions (except one) already use the same software and the same database schema. Special attention will have to be devoted to the connection with the system for the centralized processing of enrolment applications (Bajec, Krisper & Rupnik [9]), which is unified for all Slovenian universities and independent colleges.

The main problem seems to be the finance information system not only because of the great diversity of applications at different institutions, but also because of the vaguely defined relationships and responsibilities between the university management and individual institutions. It seems that the individual institutions see these applications as vital to their autonomy, and they are suspicious of all change. Nevertheless, the situation can improve by counselling individual institutions on which software to buy, and by purchasing software for several institutions together. In this way, substantial savings can be obtained through negotiations with suppliers and quantity discounts, the number of different suppliers will decrease (only the best will remain), and the member institutions will gradually start to use mutually compatible applications. All these factors will facilitate the introduction of an integrated information system in the future.

5. Conclusions

An analysis of the present situation in the following areas was given: the finance information system, the personnel information system, and the student records system. While all member institutions are using the same software for their student records system, a variety of different, mutually incompatible applications from different sources is used in the areas of finance and personnel administration.

However, using positive experience from the development of the student records information system, some substantial improvements can be achieved in the three information systems analysed. Given that only a few member institutions use computer applications for personnel records, it seems that reintegration can be most easily achieved in the area of the personnel information system. The reintegration of the student records information system is also feasible, since the main effort in building the unified database and unified software was already done during the development of the present system. The most difficult problem is the finance information system: in this area we propose the gradual replacement of existing applications with standard packages from carefully selected suppliers.

International collaboration within EUNIS (European University Information Systems Organization) and the utilization of the experience of universities with similar problems (e.g. Comenius University from Bratislava, the Czech University of Agriculture, Prague) may also contribute to the success of reintegration.

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Faculty of Computer and Information Science,
University of Ljubljana,
Trzaska 25, SI-1000 Ljubljana, Slovenia,
E-mail: viljan.mahnic(at)fri.uni-lj.si

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Center - A distributed computing center of the future?

[1,2] Ludek Matyska, [2]Eva Hladká

Introduction

The role of computer centers at universities had undergone a very dramatic reshaping in the past decade. It is no more a single ``computer aware'' center of the university, it is becoming much more a coordinating place, responsible for a kind of computer related infrastructure. However, new roles are also emerging, and in this paper we discuss a potential which may be gained by merging services of individual computer centers together.

The extremely fast proliferation of personal computers lead to a belief that computers are becoming a tool not too different from other ordinary tools used in our everyday life. The information society of tomorrow began to look like a kind of paradise where everybody uses his or her computer to connect to sources of information, to ease any work to be done. The computer centers started to become an obsolete notion and many universities considered to reduce or even to close them. In the Central and Eastern Europe of the nineties, the situation was even more dramatic due to the very fast changes there.

But, as with any other complex and sophisticated tool, it is not ease to use it without a lot of training and experience. Situation started to change with the emerging of local area networks and their interconnection with the Internet. While at the beginning it was easy to join few computers into a LAN, the interconnection of LANs called for new expertise and, as such, for some kind of centralized control over its deployment. What is more important, new services were looked for and the vital role of computer centers reemerged.

Contemporary Role of Computer Centers

As contemporary computer centers are no more the sole owners of computing related technology at the universities, they have to focus their attention to services which are most efficiently done from a center. While individual users have usually their own personal computers on their desks-- computers whose raw computing power and memory and disk capacity is larger than that of large computers of the past-- these computers must be somehow connected to the network. The infrastructure building and maintenance is thus one of the indispensable new roles.

Another important role is related to reliability and robustness. While individual users can backup their data, just a tiny fraction is actually used to do it on a regular basis. It is much more easier, convenient and cheaper to provide such a service from some central place. It is also much more reliable, as there are usually more than just one device allocated (or allocatable) for this task. Another point is the disk capacity. A failure of individual disk in a personal computer usually means that the computer will be out of service for some noticeable time. On the other hand, computer centers usually build their (large) disk capacities using some kinds of RAID's, where a single disk failure may not be even noticeable by the end users. In general, all the services provided by computer centers are (or may be) backed up in some way, and the redundancy needed is substantially cheaply achieved at this level.

Last but not least, there come the information services used and/or provided by the university. The university management is becoming more distributed, with the responsibility for decision delegated to lower parts of the managerial hierarchy. However, the responsibility for data correctness calls for some centralized supervisors. The information technology allows, when properly used, to take the best from both worlds-- the data are kept centrally, at the computer center, while the access is provided in a distributed way. Similar situation also holds for information provided by the university (e.g., through the web). While the information may be collected, and even prepared, i.e., edited, formatted and the like, in a distributed fashion over many parts of the university, it may then be stored in an individual server, managed by the computer center.

As we have seen, there are still at least three roles where the computer centers have their irreplaceable responsibilities:

1. The infrastructure.
2. The reliability.
3. Information services.

Computer centers are not, however, independent entities in the networked world of today. The increased mobility of researchers and students, coupled with the increased number of people using services of more than just one particular computer center, needs to be supported by a kind of convergence of individual computing centers. It may not be surprising that it is again the ``power'' users, i.e., users of high performance computers, looking always for ways how to increase the computing power they have at their disposal, who are the first one to ask for similar (if not identical) computing environments. However, these users will be very fast followed by others, and it is vital for the computer centers to be well prepared before the main wave will hit them.

The Center

The META Center 3-year project was launched in the last year as a part of the TEN-34 CZ activities of the Czech Republic. Its main goal is to connect the largest computing centers of the Czech universities, namely the West Bohemia University in Pilzen, Czech Technical University and Charles University in Prague, and Technical University and Masaryk University in Brno into one virtual computing center. The primary target of this pilot project, lead by the Masaryk University and supervised by the first author of this article, is a group of academic users of high performance computers at the respective sites, but it is in no way limited to them. The primary goal is to create a large virtual computer with a uniform user interface. This virtual computer is spanning a large geographical area (the distance between Pilzen and Brno is more than 250km). The interface is understood in the broadest sense, i.e., encompassing all the provided services. The META Center is also built as an open center, where more computers may be connected in and where new partners may also become involved. This push a very strong limits on what may be done and how.

A truly heterogeneous virtual computer is built, whose nodes are computers of individual centers. There are three POWER Challenges from SGI, large AlphaServer from Digital and a 19 processor IBM SP2 to be connected in one whole. From the user's point of view the result of the project will be seen as just one large META Computer. Users will be allowed to log to any node while having immediate access to all the META Center resources. This means that user of some program (service) may not be even aware (or take care of) which particular node runs her program, more or less in the same way as users of parallel computer don't care which particular node they are using.

Administration

As may perhaps be predicted, the political and administrative problems are the harder ones. We already identified some places where common agreement is necessary:

- The account creation. In order to have a truly transparent access to the whole META Computer, it is necessary to have account on all its individual nodes. Individual centers have to coordinate their rules for account application with the final goal of trusting each other is such a way that granted application at any particular node will be valid for the whole META Computer.
- The security measures must be unified (at least to some extent), because the security level of the whole META Computer is simply the security level of its weakest part. All centers must adopt similar policies on what is allowed in this area.
- Unification of application program installation and user interface. Individual computing centers differ substantially in their ways of application program installation and especially in ways how these programs are made available to end users; this difference must be removed and all the programs must be accsible in a unified way.
- The interfaces to utility programs must be unified as well. A common interface to queuing system is essential in the area of high performance computing, but this also applies to mailing program interface, to the on-line helps provided and to many similar utilities.

Technical side

The whole META Center project is not possible without a reliable and high performance network between its individual nodes. The sites are currently connected to the TEN-34 CZ backbone, an ATM academic network running at 34Mbps. All the involved computers have direct access to this ATM backbone which means that a virtual channels may be created among them. Both IP over ATM and LAN Emulation mode of the underlying ATM network will be used to create a kind of dedicated routes through which the META Computer nodes communicate. An ATM metropolitan area network running at 155Mbps is currently available at Prague and at Brno, opening thus a possibility to connect a subset of nodes at higher speed than allowed by the backbone alone.

A distributed file system is provided on top of the network connection. After considering all possibilities, the AFS distributed file system from Transarc [2] was chosen as a primary filesystem of the META Center. The main reasons were:

- AFS truly supports the heterogeneous environment as it is available on most important platforms and operating systems, including Linux and Windows NT.
- AFS is a state of the art distributed system, already in use at many sites around the world.

- AFS allows a high data migration freedom, as only the address of volume location server must be known to all clients. Chunks of data (the volumes) may be freely moved to different servers without any need to reconfigure the clients accessing them.
- AFS has a local cache filesystem, increasing thus access speed and decreasing the network load.
- AFS is far more secure than NFS, it also allows to keep higher control over accessibility of individual files than ordinary UNIX file access mechanism.

An AFS multilicense covering all universities involved in the project was purchased. Each university (computer center) established its own AFS cell. There are, however, some peculiarities and problems connected with the use of AFS, which have consequences to the META Center implementation.

- AFS builds its own filesystem structure on top of native filesystem. Usually AFS lacks the support for the newest native filesystems available (e.g., there is not yet support for the XFS filesystem from Silicon Graphics, which means that there is no support for 64bit filesystems). Moreover, the another layer slows down the read/write operations (we found that AFS has as low as just 25% of the performance of the native filesystem, if client and file server are the same machine). The local cache can compensate this slowdown only for the read operations.
- AFS is not fully available for Linux outside USA. While it is possible to access the Linux binaries, the source code is not available even for those having source code license. As a result, the Linux binaries are usually outdated and they don't fit always well with the newest AFS patches or with the newest Linux operating system versions (i.e. they are not compatible with the Linux operating system version necessary to use the ATM cards). As for the NetBSD, even the binaries are not available outside the USA.

Overall, we found AFS to be a valuable tool for the read only filesystems (parts of the operating systems and the application software) but of just a limited use for read/write filesystems (like the user directories). AFS is definitely not a choice when a high local I/O throughput is required (e.g. ab-initio calculations). The AFS is therefore used in META Center to store the read only directories with application programs and shared parts of user home directories. Users have an option to either have all their home directories stored in the AFS or to have (small) local filesystems at each node and use AFS as a shared data repository. AFS is also complemented by the use of the local native filesystems which are made available through (a limited) use of NFS.

The use of AFS naturally lead to the adoption of Kerberos for the user authentication [3]. We are currently using Kerberos 4 implementation (from KTH, Sweden)-- the Kerberos 5 is again available in USA only. To allow for an easy and smooth path for future expansion, each computing center is running its own Kerberos realm and we use the interrealm authentication to move the tickets around. We had to modify a lot of standard programs (like login, telnet, telnetd, ...) to make the interrealm crossing as smooth as possible and especially to eliminate any need for users to know precisely where the realm borders lie. While quite successful, we discovered that Kerberos 4 interaction with the AFS own authentication mechanism is not ideal and that sometimes users have to reissue their passwords to have access to all their resources.

Load Sharing Facility (LSF [1]) from Platform Computing, Inc. was chosen as a job queuing and load balancing tool for the whole META Center. A LoadLeveler is used on IBM SP2 and a gateway is to be developed to connect both these systems. Again, each computing center runs its own LSF cluster with an intercluster communication established to allow for a proper load balancing between individual computing nodes. The use of AFS and Kerberos lead to a problem whose best solution we are still searching: how to ensure that proper authority will be given to user's jobs when they finally left the job queue and/or when they are running for a very long time (days or even weeks).

The same set of application programs is not available at each node of the META Center. The transparent access allows to use them without knowing where they are may actually run. The queuing system is aware of the location of all major programs and reroutes individual request to nodes where they may be (best) served. There is, however, no such support for interactive programs.

Conclusion

While the META Center project is just in its first phase (the project started on September 1996), we already identified several major advantages of the META Center over the individual centers:

1. It simplifies the access to centralized services of different nodes. It also allows to share ``personalized'' environments between sites, including access to personal files.
2. It increases the utilization of individual computers and software licenses available-- it is no more necessary to buy everything to every site.
3. It provides much higher reliability at much lower cost-- users at individual university may continue to work even in case of ``their'' node failure.

The META Computer, which is scheduled to be put into full experimental operation at the end of 1997, will be used both as a large distributed computer and as a testbed for the unified user interface of computer centers of major Czech universities.

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[1]Faculty of Informatics,
[2]Institute of Computer Science
Masaryk University, Botanická 68a, 602 00 Brno, Czech Republic
E-mail: ludek(at)ics.muni.cz, eva(at)fi.muni.cz

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Information Strategy - a tool for institutional change.

[1]Andrew Rothery, [2]Ann Hughes

Introduction

This paper will outline the national development of Information Strategies in the UK and the approach taken at Worcester. In addition, we will consider claims made in respect of Information Strategies and comment on the effect of Information Strategy development on the role of IT/Computing Services in Higher Education (HE) institutions.

Information Systems and Information Technology Strategies have traditionally been the responsibility of IT/Computing Services but the Guidelines for Developing and Information Strategy, published by the Joint Information Systems Committee (JISC) of the HE Funding Councils in the UK, pointed out the shortcomings of such strategies:

- "they tend to be technology driven" - an implication that expenditure can be wasted on irrelevant technical innovations
- "they tend to focus on the narrow fields of management related information rather than the academic information which provides the foundations for teaching and research"
- "they have a tendency to seek ways of using technology to improve current processes" - with an implication that this avoids the question of re-assessing the processes themselves

Information Strategies are intended to avoid these faults, and two claims are particularly significant in this respect:

1. An Information Strategy is a set of institution-wide attitudes and a process rather than a documentbrp> 2.Strategy should not be "technology led" but led by information users' needs. Information Strategy will dictate the IT Strategy, not the other way around.

In addition there is an expectation that the process of developing an Information Strategy may be a tool for institutional change at a level outside the traditional scope of an IT/Computing Service.

There is a widely held view that some IT uses have been developed `for IT's sake'. There is a tension here regarding the role of IT/Computing Services - to serve or to lead the way? The notion of an Information Strategy suggests that IT should serve - but we will return to this point.

The JISC Guidelines

In 1994 the JISC established the Information Strategy Steering Group to investigate the potential for developing Information Strategies within HE. Coopers & Lybrand was commissioned to undertake the research and produce a report. A questionnaire was circulated to all UK HE institutions and a number were visited for more detailed discussions.

This resulted in a genuine interest in the use of Information Strategies as a possible means of ensuring value for money from technology, exploiting technological advances, coping with increased numbers of students and reduced funds, and attempting to bring about a change in attitudes, especially towards the ownership and accessibility of information within the institution. The eventual outcome was the publishing of the Guidelines for Developing an Information Strategy in December 1995 (http://www.niss.ac.uk/education/jisc/pub/infstrat).

The JISC Guidelines are very clear that the type of Information Strategy that they are attempting to produce is not just a document, nor is it concerned only with computing or libraries. They define an Information Strategy as "a set of attitudes" and the Guidelines are therefore a guide to a process intended to achieve (or at least partially achieve) those attitudes. An Information Strategy Document is therefore not the most important output of the Information Strategy; that should be the changes in working practices throughout the institution.

The Guidelines break the process up into six stages which will now be described briefly.

Set Up

This stage is designed to ensure top level commitment to an Information Strategy, to identify its scope and who is responsible for its development. It includes identifying previous related information and other strategies, resources for undertaking the work and informing colleagues of the process.

Setting the Context

The objective of this stage is to establish the context in which the Information Strategy would need to operate. This involves identifying the priorities, intentions, approaches to teaching, learning and research; and also the challenges facing the institution and its development plans. This stage also includes identifying a route for the Strategy to gain formal approval within the institution.

Defining Information Needs

This stage involves defining information groups within the scope of the Information Strategy, the development of standards for those groups, and an infrastructure to deliver them. Gaps and problems with any of the groups are identified and projects designed to resolve them.

Defining Roles and Responsibilities

In order for the Strategy to be on-going, it is necessary for people to be identified with active roles and responsibilities for its various aspects. There may be some overlap with those who developed the Strategy initially. The Guidelines identify the following main roles:

Information Strategy Committee

Information (Strategy) Manager

Information Custodians

Information Users

Information Services

Implementation

An important part of the process is to develop an understanding of the need for, and the essence of, an Information Strategy; and much of this should have been achieved during the process of development. However further work will be required to ensure that everyone within the institution is involved, to keep all colleagues up-dated as to progress (and changes) and to encourage those resistant to the ideas promulgated.

In addition, projects to resolve issues will have been identified and whilst these may not all be implemented at this stage, they will require planning for future implementation.

Monitoring and Review

This is essential to check the effectiveness of the Strategy, to assess the changing context and amend the Strategy when necessary. The Guidelines suggest that this should be built into the normal operating cycle of the institution.

Pilot Sites

The Guidelines were generally well received and in January 1996, volunteer `pilot sites' were sought. Out of 26 applications, six were chosen:

Bath College of Higher Education

The Queen's University of Belfast

The University of Glamorgan

The University of Glasgow

The University of Hull

The University of North London

Three main criteria were taken into account in their selection; they should:

reflect the diversity of HE,

represent all four funding councils,

demonstrate their commitment and enthusiasm to the project.

The pilot sites are expected to be open about their experiences in regard to the development of their Information Strategies. A JISC Conference was held in January 1997 at which each pilot site was represented and presentations given on various aspects of the development of the Information Strategy. Workshops on specific aspects of the development process have also involved pilot sites, as have conferences organised by other bodies. At the same time, other HE institutions started their own Information Strategy developments.

Progress of the Pilot Sites

The work of the pilot sites has been co-ordinated by a JISC-funded post. The Co-ordinator was appointed in July 1996 and included in her role was liaison between the pilot sites to encourage best practice and to assist sites where possible. Workshops have been held to enable the pilot sites to get together to discuss their projects and a mailbase list was also established to encourage discussion between them.

The pilot sites commenced work on their Information Strategies in June 1996 and by the end of July 1997 should all have produced draft strategy documents. In general the `Set Up' and `Setting the Context' stages were completed by September 1996. By far the greatest part of the project has been devoted to `Defining Information Needs', with most of the pilot sites taking around seven months to complete this stage. This involved workshops with staff to identify and prioritise information needs and to specify projects to satisfy those needs. Their strategy documents will include plans to implement those projects in the coming year.

Information Strategy at Worcester

Worcester College of Higher Education (WCHE) is a university sector institution with about 4,500 students. It awards a wide range of undergraduate and postgraduate degrees.

WCHE decided to develop its Information Strategy shortly after publication of the JISC Guidelines in parallel with the JISC pilot sites and decided to follow the JISC Guidelines in general terms.

However, in June 1996, at the `Set up' stage, WCHE set up a single development group rather than the two-tier approach, a Steering Group and a Working Group, suggested by JISC. Evidence from Worcester and the JISC pilot sites suggests that this is quite adequate for the smaller institution with a relatively compact and centralised organisation.

The membership of the WCHE development group was as follows:

Vice Principal (Chair)

Library and Information Services Manager

Director of IT

Deputy Registrar

Learning and Teaching Co-ordinator

Head of Science

Head of Academic Services of an associated College

Overall information policy statement

JISC Guidelines do not explicitly recommend drafting a policy statement, keeping strictly within the spirit that an Information Strategy is not a document. However, pilot sites and WCHE have found it useful at the `Setting the context' stage to draft an `information policy' or `guidelines on the management of information'; or a vision of how information should be handled. For instance, the WCHE development group set out eight short statements which were called `information objectives' and these form a succinct statement on information policy.

Information analysis

The `Defining Information Needs' stage is the major part of the development process and should involve a wide range of staff within the institution. The Guidelines outline two possible methodologies: functional analysis and life-cycle analysis. In practice most of the pilot sites have used a variation of functional analysis; although one pilot site undertook a student life-cycle analysis which is likely to result in quite a radical change in the way student information services within the institution are organised.

The Worcester development group carried out its information analysis with an initial approach based around a `functional analysis' of the College split into eleven `information groups':

1. Institutional strategy/ 2. Quality - 3. Taught 4. Research activity information
5. Learning and teaching resources - academic knowledge as contained in teaching materials, books, software, web, and information on how they are organised or located
6. Student details
7. Staff details
8. Services
9. Financial information
10. Physical assets - buildings, equipment
11. Marketing information

The scope extends beyond traditional management information, particularly Groups 3 and 5, which include curriculum and knowledge information.

Following the methodology suggested by JISC, each group was further analysed in terms of information items. For each item, the source of the information, its `custodian' and its users were identified. An initial evaluation of the quality of the management of the information was also made.

These initial analyses proved useful in finding some immediate recommendations for action and improvement. However, at WCHE it was apparent that the development group alone could not complete the initial analyses. Experience confirmed that really, the best way to carry out an information analysis in any depth would be to create a separate working group for each information group, with representatives from those who look after the information and those who use it. At Worcester it was agreed that a programme of workshops should be organised to take place during a second phase over the next two years. This will also have the effect of encouraging dissemination of the Strategy process more widely. There is clearly a question of resources - the organisation, co-ordination and putting into effect of such a programme requires considerable staff time.

The large scale of such an approach is very daunting and most institutions start by focusing on priority areas, with the intention of moving on to other areas at a later stage.

Lifecycle and process analysis

The WCHE development group found that systematic analysis by information group was not on its own the most productive way of identifying ways in which information management and communication could be improved. It carried out some pilot analyses of alternative approaches. JISC refers to `lifecycle analysis' but Worcester and the pilot sites distinguished between two slightly different types of analysis: one is the analysis of a very specific activity (`process analysis'); the second is the analysis of a `lifecycle', which in effect is a sequence of processes seen from a particular perspective.

The WCHE group investigated the lifecycle experience of a student registering at the College, some processes involved in doing research, and the process of writing an essay. Other examples would include the process of preparing a course, the lifecycle of recruiting staff, the academic planning lifecycle. Again, at Worcester, carrying out such analyses in full was included in the workshop programme for Phase II.

An advantage of this approach is that lifecycles and processes focus on the specific needs of an individual's or department's work or experience, so issues of quality of communication and access soon become apparent.

Clearly a disadvantage is that there are thousands of different processes and so it is not possible to systematically work through them all. However, a small selection of lifecycles or processes are enough to cover most information types and can be chosen to highlight a particular priority issue.

Attitudes rather than documents?

Our experience confirmed that creating an Information Strategy is clearly a process rather than a document - and one which could well become a permanent feature of quality assurance within institutions.

Documents are not absent however! An Information Strategy produces a whole box of documents. There is the overall policy document and there are documents and reports arising from information analyses. Recommendations for action emerge constantly as the process develops, and these have to be documented, as do action plans for putting improvements in place. Information Strategy documentation is a stream.

It is apparent that the Information Strategy can certainly transform the way information is handled and communicated - and since information includes academic information this has an immediate impact on learning, teaching and research as well as administration. A good claim for Information Strategy is that it can transform the way people communicate and work within the institution.

The role of IT/Computing Services

Finally what about the role of the Director of IT or other staff in the IT/Computing Service? Certainly they do not have a leading role. With a Chair at a senior level, broad representations on development groups and wide representation at workshops, there is a community wide approach.

Nevertheless, we found at Worcester and at pilot sites that most (but not all) recommendations had an IT requirement. Therefore IT Services will be involved substantially with the implementation of recommendations. Indeed, because of the focus on user and community needs, the developments which emerge will automatically come with a much stronger institutional commitment than if proposed by IT staff alone, and this is clearly helpful to IT/Computing Service departments.

In view of this, the IT/Computing Service must play a part in the Information Strategy process at Steering Group level and within workshops.

Furthermore, there is a role in creating vision. Just as progress cannot be made by merely applying new technology to existing practices, it cannot be made by applying existing technology to new practices. In order to escape the limitations of the current paradigm, there has to be an element of vision in both practices and technology. Though not exclusively so, it is IT professionals who are familiar with what might be possible and who might be researching into new possibilities. This resolves the “who leads” issue mentioned earlier. Technology should not dictate what people should do, but it should provide a vision to help in moving forward. So here is another role for the IT/Computing Service.

In conclusion, the role of the IT/Computing Service, though not central to the Information Strategy process is certainly essential. Indeed its role in implementing IT developments will be enhanced if its work carries the strong institutional commitment which emerges from the Information Strategy process.

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[1]Director of IT,
Worcester College of Higher Education,
Henwick Grove, Worcester, WR2 6AJ, UK
E-mail: a.rothery(at)worc.ac.uk
[2]JISC Information Strategies Co-ordinator
, C35 Cherry Tree Buildings,
Nottingham University, Nottingham, NG7 2RD, UK
E-mail: m.a.hughes(at)nottingham.ac.uk

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Role of the computer center in migration to Information Society- A case study at Lajos Kossuth University of Debrecen

Zoltán Gál, Ida Rápolti, Katalin Rutkovszky, György Terdik

1. Introduction

Almost all citizens have been touched by the information society, which is affecting various fields such as employment, education and professional training, family life, ways of life and costumer's habits, culture and leisure, health and politics, hence nearly all fields of our daily lives.

The formation of the information society is a spontaneous process which is controlled basically by demand and market mechanism. It requires money, time and effort, and there are returns only after the users have exploited the advantages of the new system.

In the educational process the memorising of knowledge is of decreasing importance, and methods of seeking information are gaining ground. Students may search for data and programs from electronic databases. Instead of passive learning, active learning comes to the fore. With the development of multimedia, instructional tools readable from CD-ROM are appearing in addition to the school textbooks. Audio-visual learning is diminishing the amount of learning by reading. Virtual, interactive visual aids are becoming available.

New forms of teaching mean that learning is being customised to the individual. Students may not always be required to be present in the classroom. Subject-matter for any given topic may be sought when required and learning takes place at the student's own pace. During the learning process students need not follow a single linear logic, they are free to proceed in the order determined by their own curiosity. These methods effectively promote the development of creativity in contrast to passive receptive learning.

The form of education does not remain traditional. In addition to and after primary-, secondary-, and further education, on-going learning takes place depending on individual demands. As a result of the possibilities provided by the computerised world networks, scientific research - firstly in the natural and technological sciences, but also in the philosophical sciences - is becoming more and more a matter of interactive team work, it accelerates and increasingly becomes independent of the spatial conditions: the local personnel; laboratory, observatory, and computing facilities; and libraries and archives. E-mail has already become the scientists' most important means of communication: actual international meetings being arranged here or there generally mean only the starting- and ending points of ongoing series of electronic conferences taking place on the network.

The medium of disclosure of the results of scientific research - in other words scientific publication - is increasingly the network. From theoretical physics to classical studies, the number of scientific journals existing only in electronic form is growing in the most diverse disciplines, while texts, data, illustrations, and so on intended for preliminary scientific information can be stored in the pre-publication phase on the local network of any given institution so that anybody may access them through the global networks.

2. City, University and CIC

Debrecen with 260.000 inhabitants is the second largest city in our country. It is economical, intellectual and artistic center of Eastern Hungary. The cultural and scientific life of Debrecen is dominated by the institutions of higher education.

The **Lajos Kossuth University of Debrecen** has Faculty of Arts, Faculty of Sciences and College of Technology. The Faculty of Economical Sciences and Faculty of Low has been established recently. The number of students is about 9000. The number of teachers, researchers and administrative and technical staff is roughly 1700.

In 1991 the University took steps towards establishing a new level of cooperation between the Institutions of Higher Education of city (University Medical School of Debrecen, Agricultural University of Debrecen, Lajos Kossuth University of Debrecen, Debrecen University of Reformed Theology) and one research institute (Institute of Nuclear Research). The Association of the above institutions is **Universitas** leading to the re-establishment of University of Debrecen by the European model in the future.

The **Center for Informatics and Computing** (CIC) has been founded 30 years ago. That time we worked on Polish made computers, ODRA 1013, ODRA 1204. The next stations in our history were in 1974 when we got the Russian made R30 and in 1984 when an East-German made R55-M computer was set up. Since the foundation we have got important role in both research work of our university departments and in education. We have built up good connections with other universities and institutes of the region. Having worked on several research projects our staff gained remarkable experience in teaching and developing applications.

The formal University Church is shared by the Computing Center and some parts of the University Library.

At the beginning of 90 years the architectural development (new computers, network, software) caused structural and role changes in our center.

We are running the following servers:

- SUN SparcCenter 2000 (2 processors, 256 MB RAM, 20 GB HDD)
- VAX 6000/510 (128 MB RAM, 12 GB HDD)
- MicroVAX 3500 (16 MB RAM, 1 G HDD)
- 2 MicroVAX II (16 MB RAM, 400 MB HDD)
- DECSystem 5000/133 (32 MB RAM, 1.7 GB HDD)
- KLTESRV Novell server (40 MB RAM, 2 GB HDD)
- AlphaServer 1000 (256 MB RAM, 12 GB HDD)

In according with functions and services we have four sections in the center:

- Network Management (6 persons)
- Operating Systems (5 persons)
- Operational Section (9 persons)
- Software Development (6 persons)

3. Network infrastructure of UDNET and KLTENET

The Universitas built his own local area network in 1993. The goal was to make connection among institute's LANs with high speed MAN technology named UDNET. This project was managed by Lajos Kossuth University's Center for Informatics and Computing (CIC). It was necessary to make development criteria and strategies for the whole city network for few years. In the plan we estimated the number of nodes to be connected to the LANs, the capacity and bandwidth utilization of each node, the application programs for users, the necessary network resources for good response times, potentially high bandwidth consumer connections. The planned network had to be expandable in topology and in data transfer speed also. In that time multimedia applications were new promising applications and this fact was reasonable to take in consideration in the network planning phase.

One of the main question was introduction of a single network protocol or utilization of more than one protocols. Network manageability was a strict development condition. For getting information about the network behavior was necessary to decide about how complex need to be the management system of the UDNET. Network reliability and security were other important network development criteria.

3.1. Physical level links

The topography of the network was defined by the relative placing of the buildings. Outside, among the buildings we utilize eight fibers optical cables, inside of buildings six fibers type cables are placed. The interior links at each institute use multimode fibers. Because of higher distances the MAN's links are monomode optical cables with 20 fibers. The topology of the Lajos Kossuth University's network (KLTENET) is star/tree like the other institute's LANs. The root of the KLTENET is placed in the CIC. The length of the optical cable inside of buildings is 400 meters, the optical cable length among buildings at KLTE is more than 2500 meters. Among buildings an optical medium makes 10Base-F connections. The remaining fibers are for future developments. On the end of active fibers are modular expandable and SNMP manageable backbone devices.

The OSI 1 and OSI 2 level devices are Cabletron, CISCO and Proteon repeaters, hubs, bridges and switches. First segments were 10Base2 Ethernet segments but in last time we build only structured cabling conform CAT5 standard. In the big buildings are placed more than one backbone devices utilizing FOIRL backbone connections. The 10Base2 segment constructions and homologation are in the CIC's sphere of action. In case of eventual segment fault the CIC effectuate the necessary fault isolation with cable tester instrument and repairs the physical connection.

All users on MAN makes access to the Internet services by a leased line between Debrecen and Budapest. This leased line is a part of the Hungarian national academic research IP based backbone network (HBONE). In 1993 the bandwidth was 9.6 kbps which was increased in 1995 and 1996 to 64 kbps and 512 kbps respectively. This connection has a 9.6 kbps X.25 backup link to Budapest. Both lines are connected to the second AGS+/4 router in the CIC.

3.2. Backbone devices

At the KLTENET in each building a router interface is connected to the switch or bridge device. The routers are CISCO products and are AGS+/4, 4500 and 4700 types. The bridges are exclusively Cabletron MMAC8s modular devices with EMME, CXRMIM, FOMIM modules which makes logical connections among different collision domains. In the CIC and other places where the bandwidth utilization is highest there are CISCO 3100 10Base-T/100Base-T switches for traffic isolation and security. The servers in the CIC are connected to different router interfaces from the segments with desktop nodes. Because of password security the system administrators have their nodes connected to the same segment with the server they supervise. The root of the KLTENET is the AGS+/4 router with twelve AUI and one FDDI interfaces. The topology of KLTENET is represented in fig.1.

3.3. Network protocols

On the KLTENET can be distinguished four categories of nodes: Personal Computers, Novell Netware fileservers, VAX/VMS servers and UNIX servers. This categories determine the routed protocols: IPX, DECnet, IP. The IPX packets are encapsulated in Ethernet II type frames. In some situations there are Netware servers with two DNI cards which separates one segment size intranets from the rest of the network. At the beginning were used very frequently nongraphic type e-mail clients based on

DECnet, but in the latest time the DECnet protocol transports the smallest amount of information on our network. In 1993 we used store-and-forward NJE (Network Job Entry) protocol over DECnet for EARN/BITNET connection. After EARN has been wound up we stopped to route DECnet protocol to Budapest.

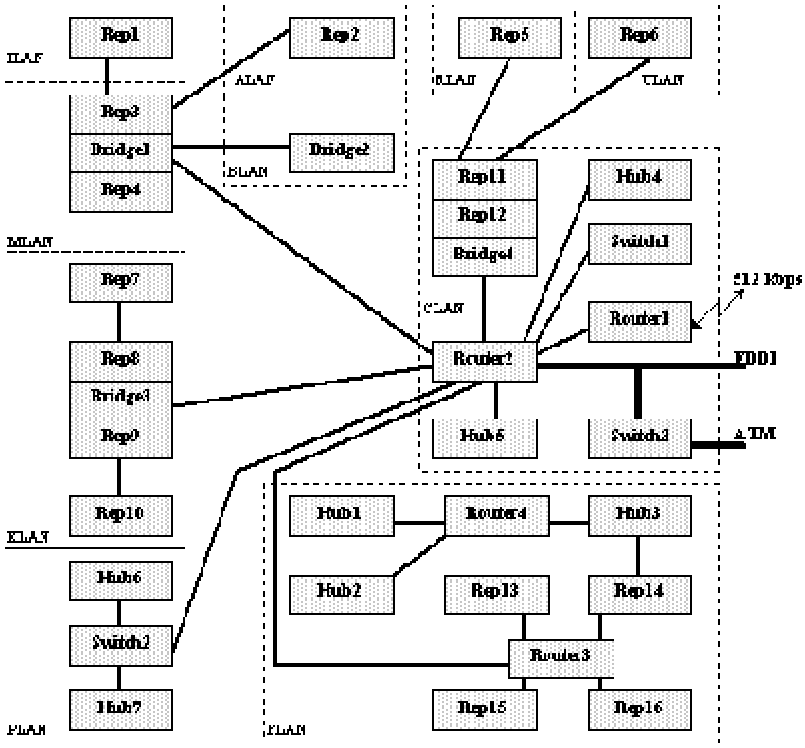

Fig. 1. Topology of KLTENET (May 1997)

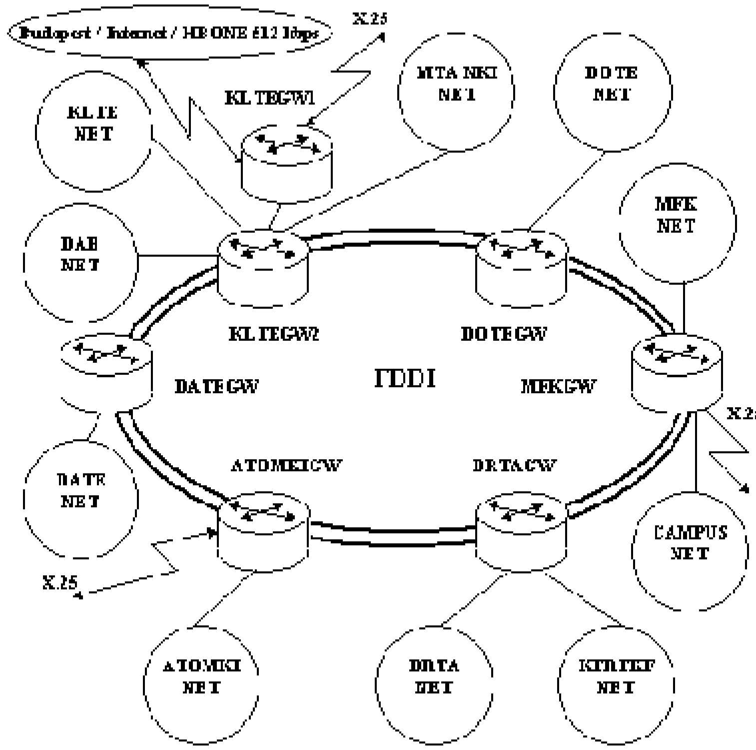

Fig. 2. Topology of UDNET (August 1996)

On the KLTENET the most intensive used protocol is IP. Majority of applications runs over IP network protocol. Because all routers on FDDI ring and inside of institute's networks are CISCO products it is possible to use EIGRP (Enhanced Interior Gateway Routing Protocol) as routing protocol. UDNET has single connection to the Internet by a leased line at CIC, so we have no registered autonomous system. UDNET uses 50 C class IP networks from which 18 C class IP networks runs in KLTENET. We use static routing to the Budapest and our IP networks are included in AS1955. The topology of UDNET until August 1996 is shown in fig. 2.

3.4. Network management

The backbone device management of KLTENET is based on SNMP, RMON and DLM (Distributed Local Management) services. The used management software: Remote LANVIEW and SPECTRUM made by Cabletron. The Remote LANVIEW manages Cabletron hubs, repeaters and bridges. The SPECTRUM v4.0 is used for managing all CISCO and Proteon switches and routers. Both parts of the software, SpectroSERVER and SpectroGRAPH runs on the same SUN SS10 (144 MB RAM, 3 GB HDD) hardware platform.

For each node connected to the KLTENET we maintain important information like physical address, IP address, Internet name, etc. This information are stored at the registration in one database with own graphic client interface developed in Delphi. The number of registered Internet nodes on KLTENET is more than 1100. The growth of IP nodes is in correlation with the European exponential tendency. The domain name server at CIC provide secondary DNS service to all other domains in UDNET.

3.5. B-ISDN extension of UDNET

In the last year other new institutes were necessary to be connected to the optical backbone of the UDNET. There were some places where the number of fibers was not enough for making separate voice and data connections among institutes. The bandwidth of FDDI in some situations produced bottleneck, why the Fast Ethernet technology was not also satisfactory for new connections. The phone networks of each institutes are enough up-to-date to satisfy user demands but the direct interconnection among PBXs was not realized until last year. It was an objective claim to utilize the remaining ``black'' fibers for making a private PBX network among academic institutes in Debrecen. The first extension step with ATM technology of UDNET was finished in September 1996. The broadband integrated network of the UDNET is represented on fig. 3.

Two Newbridge Mainstreet 36150 ATM switches are connected with ATM STM1 interfaces. The ATM switches have identical modules: ATM/STM1, FDDI, E1. On the STM1 link there are three PVC (Permanent Virtual Circuits) defined: one PVC for FDDI data connection and two PVCs for two E1 voice connections. The ATM devices realize remote FDDI bridging between the two switch FDDI interfaces. In this way need no ATM LAN emulation. The FDDI frame - ATM cell adaptation is provided conform ATM AAL5 prescription. For the two FDDI rings the ATM is total transparent. The voice channels provide constant bit rate links with AAL1 for PBXes. Because of long distance between Campus PBX and MFK switch it was necessary to use two E1 optical modems with CCITT G.803 interfaces. The second FDDI ring use single attached station (SAS) connections. The logical links of the FDDI ring and the PBX network are shown in fig. 4 and fig. 5. Both ATM switches and the PVCs are managed with Mainstreet 46020 management software.

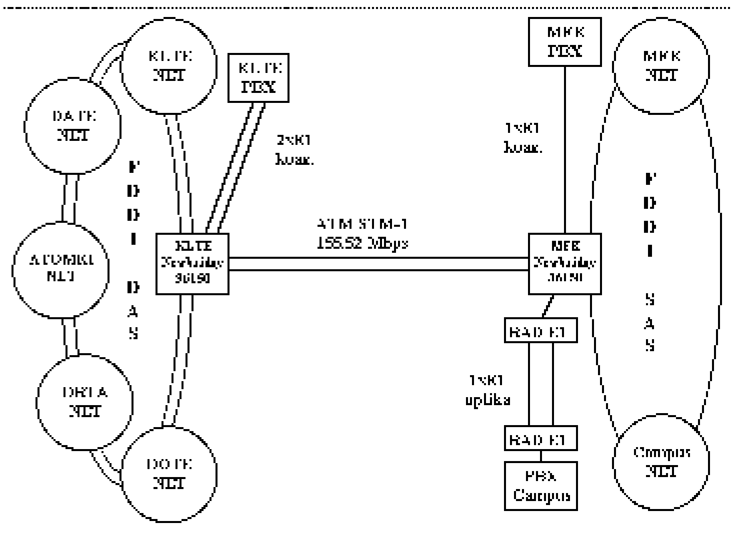

Fig. 3. The B-ISDN extension of UDNET (May 1997)

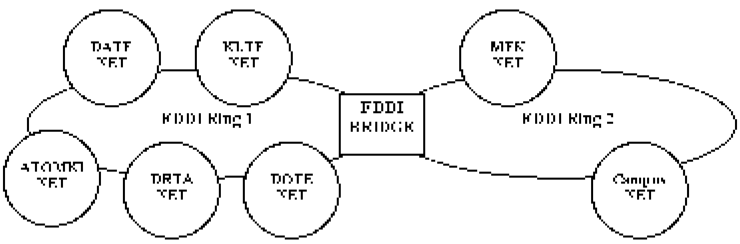

Fig. 4. Topology of UDNET- data (May 1997)

Fig. 5. Topology of UDNET - voice (May 1997)

4. Basic services provided by CIC

4.1. Management of Servers

Two commonly used servers are available in CIC for members of the Universitas. One of them is a SUN SparcCenter 2000 (named: DRAGON). This is the biggest computer in East-Hungary, with more than 2500 registered users.

There are translators for Pascal, SPARCworks C++, SPARCworks FORTRAN, gnu c, c++, java. The SPSS for statistical calculation and ORACLE for database management are also available on this server both for teaching and research purposes.

Our Internet services on this server:

- **E-mail**

There are several clients installed: mail, mailx, elm, pine.

- **FTP,** anonymous FTP server, ftpmail ftp://dragon.klte.hu

We mirror the next often used software: Utilities for Windows NT, OS/2 Utilities, Utilities for Windows 3.1, Utilities for Windows95, Antivirus programs, Utilities for MS-DOS, Oracle related files.

- **News**
- **Gopher**gopher://gopher.klte.hu
- **WWW**http://www.cic.klte.hu

In our web pages we provide information about the CIC, the available services, documentation which are necessary to use the network. We collected useful links of searching engines. There are some pages such as quest-book, advertisements connected to ORACLE database management system.

Students may create and place their own home-pages on the web. Several departments describe their own educational and research work with creating own home-page.

At the University Library, which is the second National Library in Hungary, the Voyager integrated library system is running. The OPAC records are accessible both on local and remote networks via WWW and telnet, so the system offers services to the whole academic community and to Internet users (http://www.lib.klte.hu).

The other main server, the VAX 6000/510 (named: **TIGRIS**) is used as the biggest mailserver in the Universitas, so every student and teacher can get a mailing account. We have more than 4500 registered users. As the CIC is the Regional Center of DEC Campus program we provide support of software buying and installing, license-administration and consulting for institutes of higher education in East-Hungary.

There are translators for PASCAL, FORTRAN, ADA, C, C++. For database management we use ORACLE7, and the 4GL application development tools.

4.2. Database management

The CIC focuses the activity on database systems as well. Such as database systems have become an essential part of a computer science education including aspects of database design, database languages and database system implementation. We use for it ORACLE, UNIFACE, GUPTA systems and tools of ORACLE CASE.

As the part of the unified Administrative Management System of the University a Novell based solution is applied for administrative mails. At the departments we have installed Pegasus Mail clients and created useful distribution lists. We provide support for users continuously.

We developed a Lotus-Notes based application for registry of the official mails of University Rector's Office.

We have a terminal room with 30 PC's connected to the Internet and several terminals of the servers. Students of the Universitas are working on these computers using the Internet services, practice different program languages and commands of operational systems. They write and print their documents. The room is open from 7 am to 21 PM on workdays.

4.3. Teaching activities

Courses for graduate and postgraduate students:

- Database management systems: SQL, ORACLE, UNIFACE, GUPTA
- Design of database systems: ORACLE CASE
- Operating systems: VMS, UNIX
- Practices in programming languages: Pascal, C, C++
- Hardware, network

Courses for University staff:

- MS-DOS, Windows, Word, Excel
- Use of Pegasus Mail
- Basic elements of VMS and UNIX
- How to use the network (KLTENET, Internet)
- How to write HTML documents

5. Conclusion

In the last years of this decade the nature and quality of tasks was changed radically. The role of our computer center is increasing continuously in the higher education in the city as we presented above. In order to make the information systems widely used by every member of information society in the future, there should be more focus at University Computer Center.

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1) Carl Malamud, ``'Stacks: Interoperability in Today's Computer Networks'', Prentice-Hall, Inc

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Center for Informatics and Computing
Lajos Kossuth University of Debrecen,
4010 Debrecen, Hungary
E-mail: Zgal(at)tigris.klte.hu, Rida(at)tigris.klte.hu, Kata(at)tigris.klte.hu, Terdik(at)cic.klte.hu

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Developing an Information System at the Engineering Faculty of Porto University

Lìgia M. Ribeiro, Gabriel David, Ana Azevedo and J. C. Marques dos Santos

1 Institutional Environment

1.1 Background

Descending from the Polytechnic Academy created in 1837, FEUP is nowadays a prestigious public institution concerning the national teaching and research of Engineering. When the University of Porto was created, in 22th March 1911, the Science Faculty substituted the Polytechnic Academy. An engineering course was offered within the curricula. Later, in 1915, this course became autonomous giving birth to the Technical Faculty. The present name of Faculdade de Engenharia was adopted in 1926.

The University of Porto is, at present, the largest university of Portugal, with approximately 22,000 students, 1,800 teaching staff (760 with a PhD) and 1,000 administrative, technical and auxiliary staff. FEUP is itself the biggest Faculty of the University of Porto, with near 5,000 students and 400 teaching staff, 240 with a PhD. FEUP possesses scientific, educational, administrative and financial autonomy and presents a departmental structure, composed of six areas, and several central services to support its activities. This organisation is depicted on Figure 1.

Presently FEUP offers eight undergraduate courses, 15 MSc and 8 scientific areas for PhD degrees.

Besides teaching, the Faculty carries on research activities and renders services through 9 research centres and 12 interface institutes. These R&D infrastructures account for many national and international projects being simultaneously an excellent back-up for MSc and PhD work (near 400 and 300 respectively, at present). These organs have important connections to industries, particularly in the northern Portugal, optimising the scientific, technical, human and material potential of the Faculty towards the development of applied (and also fundamental) research.

1.2 Communication Facilities and Library Information Resources

The Engineering Faculty local area network, FEUPnet, is an Ethernet IEEE 802.3 network installed in the campus by the Computer Centre (CICA), in December 1989. The backbone consists of coaxial segments in the several FEUP buildings and fibre optic cables that interconnect these buildings in a star topology. An appropriate switch/router provides for each building a bandwidth of 10 Mb/sec. The number of nodes connected to the FEUPnet has blown up since the early nineties. At present there are near 1300 nodes within the twelve class C networks that make up the FEUPnet. These nodes comprise a central cluster with seven UNIX servers, plus several departmental NT and UNIX servers, computer labs with NT workstations and X-terminals, personal microcomputers, terminal servers, printers and CD-ROM towers, widely spread within the different buildings.

Everyone at FEUP can share network resources and gain full access to the Internet. A 1.44 Mb/sec channel connects the local FEUPnet to the national communication network, RCCN. This channel is currently being upgraded to 4 Mb/sec to guarantee a 1.5 Mb/s bandwidth to the 234 middle and secondary schools that are going to be connected to FEUP in the near future. This project, on the behalf of the Portuguese Science and Technology Ministry, aims to offer, during this year, Internet connectivity to the middle and secondary schools, bringing them to the era of global networking and virtual collaborative communities.

Besides being accessible through the Internet, users may access the FEUPnet using traditional analogue telephone lines and ISDN. Near 400 of FEUP students use these facilities to do remote work and access the information resources available, namely those offered by the Library. Although the Library focus is on the internal resources more or less fifty thousand books, eight hundred periodical titles, CD-ROMs, videocassettes, iconography material, maps, etc. the registration of external, and mainly electronic resources, is also being done.

Both the Computer Centre and the Library are strongly engaged with the development of the information system of the faculty. The Computer Centre has the responsibility of the SiFEUP project and houses its core team, which congregates the following competencies: information manager, system manager, database administrator, Web programmer, database programmer, designer and data entry operator.

2 SiFEUP: Strategic and Implementation Plans

In the past, a multiplicity of autonomous and disconnected subsystems has been developed within our institution. These subsystems include, among others, applications to control human resources, student records, accounting, R&D projects and publications. These subsystems present important voids preventing the existence of a coherent environment and the automation of a significant number of functions.

The initiative of creating an information system to enable faster access and dissemination of scholar, scientific, technical and other info-resources, stimulating a stronger collaboration among members of the academic community within FEUP and other higher education institutions, as well as with industries, was taken by the faculty direction board in 1996. Its strong commitment with the project was essential to make it possible. In effect, the different departments and R&D units within FEUP have large freedom in managing their resources and a high level influence is necessary to push towards the development of an integrated campus wide information system.

To accomplish this task, the direction board formed a working team whose main motivation was to find a balance between the development of an articulated system, moving towards full integration, and the incentives to the information providers within FEUP to creatively produce and disseminate info-resources.

The starting point has been the elaboration of a document with a survey of the status of the information system in FEUP and its intended evolution. The model of information space considered has three dimensions: (1) information providers; (2) information resources; and (3) information end-users.

It was decided that only the elements of the academic community, the units of the FEUP organisation structure, the courses, and the outside partners could maintain info-resources of their own in the system. The decision that only officially recognised units within FEUP could be information providers for the SiFEUP was essential to define the overall high-level organisation of the system (see Fig.2).

The information resources (info-resources) accommodate a wide variety of information types and must integrate multiple sources and repositories, namely the Library sources, several network databases, and Internet resources (e.g. Netnews).

The end-users belong mainly to the internal academic community, although users at other R&D institutions and industries, particularly on the north of Portugal, are also important consumers. The general national and international publics are the ultimate end-users of the SiFEUP. Concerning end-users, different levels must be recognised, both internal and externally, to which different permissions of access to the system must be assigned.

Some of the most important objectives of SiFEUP are:

1. To store and recover institutional legal data (e.g. financial and employee data);
2. To increase internal communication effectiveness one-to-many (diffusion), many-to-one (recovery), one-to-one (transfer);
3. To offer to the institutional managers, at different levels, a decision support system;
4. To continually increase educational quality, giving to the students information about the school, course plans, bibliographic and computational resources, research and social activities, and support services;
5. To create on-line educational materials, namely to gain recognition as a centre of excellence on new learning techniques and to promote open access to education and provision for distant learning;
6. To support R&D activities, in particular to help resource discovery and diffusion of research results;
7. To provide the needed information about the current FEUP activities to the educational and industrial partners, as well as to the general public, establishing an Internet presence in accordance with the institutional mission.

Once the objectives identified, other aspects were accounted for in the system development, including:

1. The system is quite large, the information is dynamic and presents different validation periods;
2. The system growth is expected to be fast;
3. The info-structure accommodates a wide variety of information types, like text, tables, graphics, images, audio and video data;
4. Besides Portuguese, the info-resources must also be available in English;
5. The system must be flexible and modular. New components must be easily incorporated, such as new types of info-resources, new information providers, or new facilities needed by the end-users;
6. The diversity of information providers is large, implying a disciplined intervention;
7. Sensible information, like student marks and financial data, must be secure.

To organise the information space understandably the system must prevail the end-user. This means that the framework facilities and functions should be brought into the system by the specific needs of the end-users, that should not be forced to understand the full organisation of the space. Besides, the system should be integrated into the user's computing environment to make simple the integration of data from the end-users applications.

The Web technology, mainly because of its simplicity, availability and versatility, was chosen to join up the different components of the SiFEUP. The Web is the ultimate interactive end-user interface with the information system.

The Web, however, is oriented towards informal browsing in related documents. It's not an efficient mean to discover resources of interest. Without this ability end-users perceive only a limited fraction of the full potential for sharing resources and do collaborative work. Database systems have already successfully addressed this problem and the SiFEUP make use of their potential.

The information system coherence has thus two modes: the consolidation of the structured data by a relational database and the information access by Web browsers.

The information system involves an important part of unstructured data, organised within a framework supported by a central working team. Within this framework, FEUP information providers build their own info-resources and facilities without bureaucratic constraints, according to their preferences and specific goals.

For instance, the basic information relative to the FEUP departments is structured data easily searchable using pre-defined criteria. The database itself contains the URL of the HTML pages designed and maintained by each department own team.

In order to ensure maximum security concerning sensitive data, like student marks and financial data, separate databases are maintained on servers in isolated networks. Periodic downloads of them are done to the SiFEUP.

3. Current Status and Evaluation

The project started with the elaboration of a comprehensive report establishing the logical subsystems and the general architecture. This document is not too detailed, so that space enough is left for further specification. It works as a framework where the permanent requests, coming from very different sectors, are put in context, helping to establish priorities in the corresponding answers.

The following example illustrates the importance of this plan. The Psychologist, in charge of the Student Support Office, wanted to build an application to support a kind of informal Employment Agency for last year students. The problem was to organise and communicate employer requests and student offers, taking into account competencies and preferences. Normally a standalone program would be built and placed it in a desktop computer of the requesting service. The interested people would then fill another form, repeating lots of data already given at several other desks in the Faculty.

An effort was done to integrate this new facility in the SiFEUP. As a topic called Former Students was former included, it was realised that the Employment Agency could have permanently updated information on identification and academic performance, not only of the students contacting the project desk but also of all the students in the school. The goals of the application were amplified to include the follow-up of the professional career of the former students in order to evaluate the actual impact of our courses in the community and to stimulate a sustained contact with them, which could be complemented by permanent education programs.

The application is now working, as part of the SiFEUP, benefiting from the common database and, at the same time, adding value to it by enabling future correlation's and studies.

Although only a relatively small number of the planned components are already available, some improvement is thus noticeable.

The main current problems are:

1. The lack of technical staff. This delays the release of new components. In fact, most of the development effort comes from students working as temporary collaborators or within curricular projects;
2. The need to increase co-operation between the FEUP units. The policy of assigning the responsibility of keeping the data updated to the corresponding unit requires a co-operation that is not always easy to obtain. As happens with every organisational change, there are habits to modify and different models and perspectives about the institution to acquire.

The measure of the adequacy of the SiFEUP becomes fully significant only in the framework of an evaluation of the performance of the Faculty itself. This global evaluation is still beginning. Meanwhile, as the development of the SiFEUP is done in-house by a team who knows how it works, a first degree of correction is guaranteed. Several meetings with the directors of departments, services and courses have been promoted. There is an e-mail address where people send comments, suggestions and requests. A guest book page in the system where everybody can leave a public message is also available. From these feedback's, adjustments are done in the system in order to extract the information in the way and at the time it is more useful to its consumers.

4. Conclusions

In this paper we have presented our experience on creating a modular and flexible system to organise, access, communicate and search large amounts of information, related to the Engineering Faculty educational, research and administrative activities.

The motivation behind the project and the approach selected are both described. We show that a dual-based approach, on the Web and database technologies, is adequate to benefit from the capabilities of storing, structuring, and searching large amounts of data, with adequate exploring tools and levels of security, and to access these same data with a simple, versatile and wide used tools.

The experience here summarised may be useful for other sites that wish to create, manage, access and share large amounts of on-line information, in an integrated and extensible fashion.

Faculdade de Engenharia da Universidade do Porto,
Rua dos Bragas, 4099 Porto Codex, Portugal
E-mail: lmr(at)fe.up.pt
URL: http://www.fe.up.pt