

# Hybrid clouds infrastructures in Higher Education Institutions – A proof of concept

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# Cloud Computing- What Is This

- **Cloud computing** is a **model for enabling convenient, on-demand network access to a shared pool of configurable computing resources** (e.g., networks, servers, storage, applications, and services) **that can be rapidly provisioned and released with minimal management effort or service provider interaction**

# Cloud Computing - Characteristics

- **Agility** improves with users' ability to rapidly and inexpensively re-provision technological infrastructure resources.
- **Application Programming Interface** (API) accessibility to software that enables machines to interact with cloud software in the same way the user interface facilitates interaction between humans and computers. Cloud computing systems typically use REST-based APIs.

# Cloud Computing - Characteristics?

- **Multi-tenancy** enables sharing of resources and costs across a large pool of users thus allowing for:
  - **Centralization** of infrastructure in locations with lower costs (such as real estate, electricity, etc.)
  - **Peak-load capacity** increases (users need not engineer for highest possible load-levels)
  - **Utilization and efficiency** improvements for systems that are often only 10–20% utilized.

# Cloud Computing - Characteristics

- **Cost** is claimed to be greatly reduced and in a public cloud delivery model capital expenditure is converted to operational expenditure. This ostensibly lowers barriers to entry, as infrastructure is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is fine-grained with usage-based options and fewer IT skills are required for implementation (in-house).

# Cloud Computing - Characteristics

- **Device** and location independence enable users to access systems using a web browser regardless of their location or what device they are using (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.
- **Reliability** is improved if multiple redundant sites are used, which makes well designed cloud computing suitable for business continuity and disaster recovery.

# Cloud Computing - Characteristics

- **Scalability** via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for peak loads.
- **Performance** is monitored, and consistent and loosely coupled architectures are constructed using web services as the system interface.

# Cloud Computing - Characteristics

- **Maintenance** of cloud computing applications is easier, because they do not need to be installed on each user's computer. They are easier to support and to improve, as the changes reach the clients instantly.
- **Security** could improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels.



# Cloud - Components

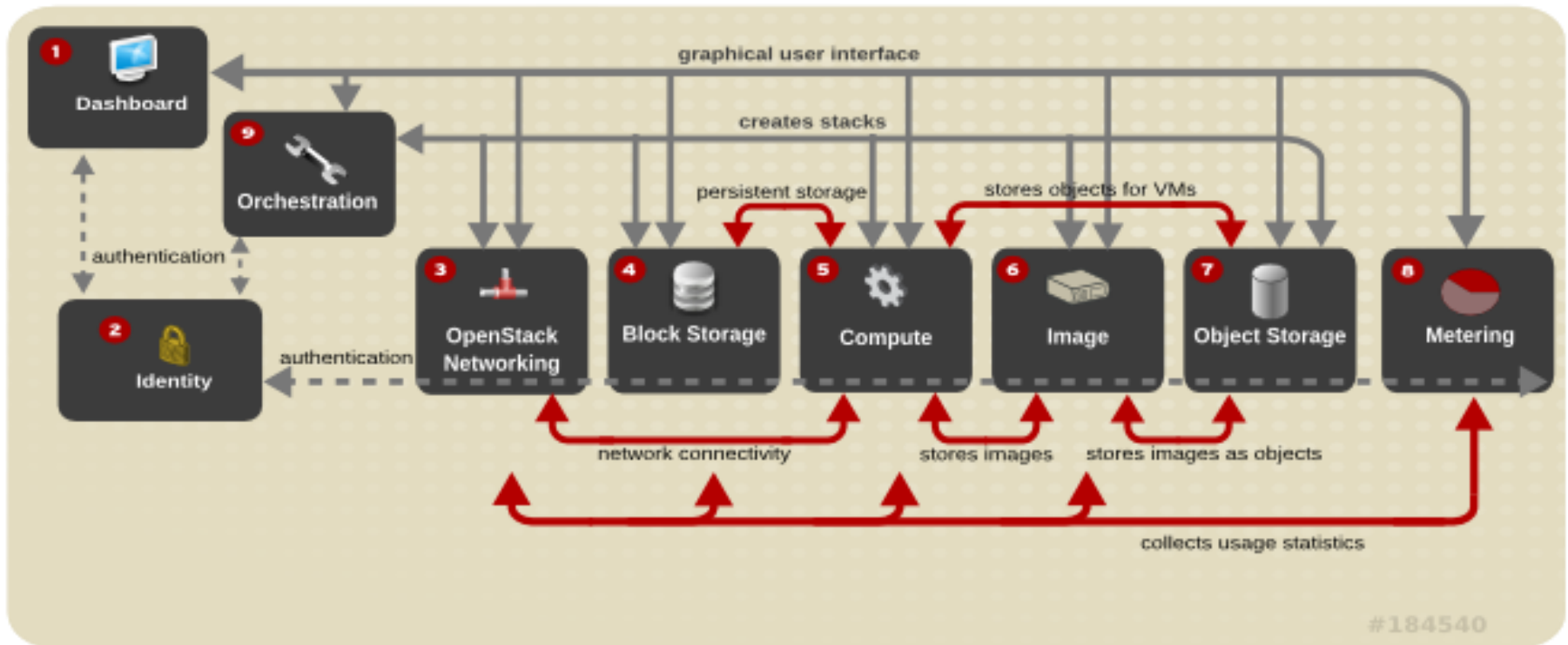
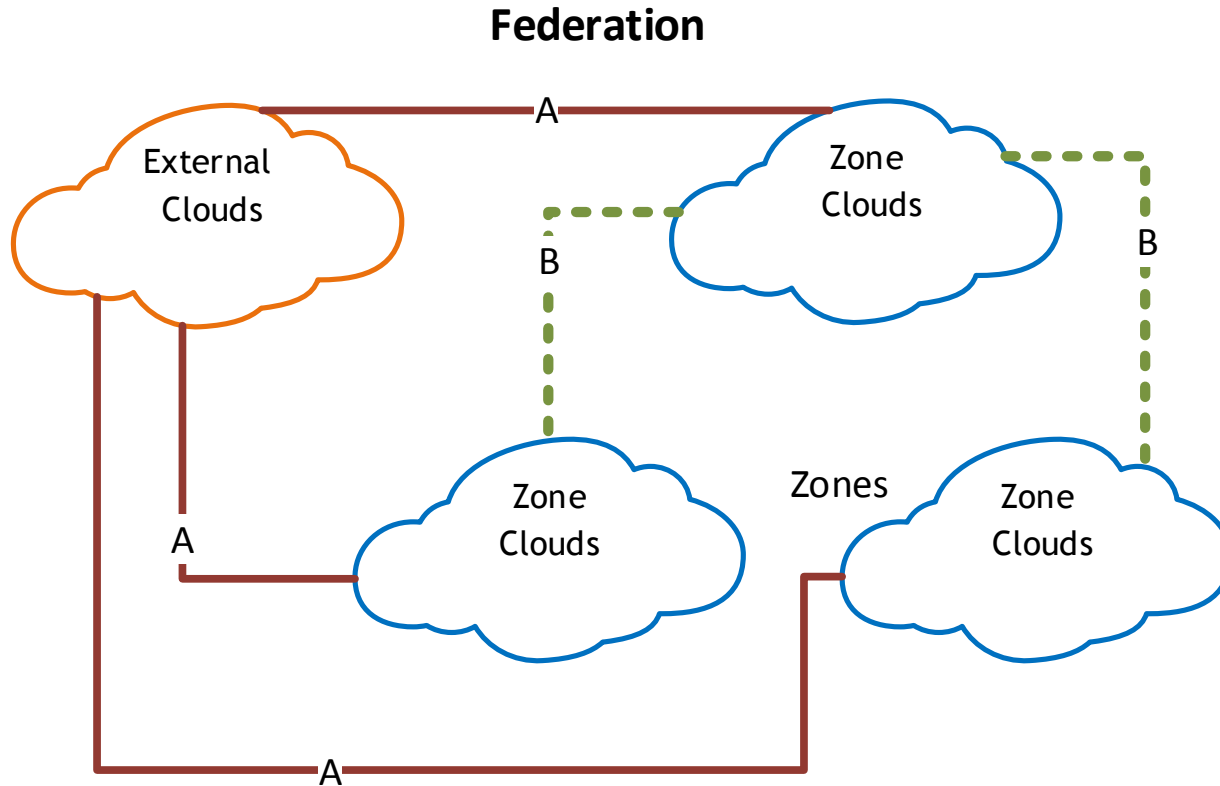


Fig 1 – Openstack example

# Proposed Model

- Guidelines for a study which is being developed based on the design of a model for **Academic Cloud Federation**
- Hybrid clouds **federation model relies on the integration of several private clouds** presents in higher education institutions in order to disclose it as a single cloud with more features and resources.

# Model proposed federated Cloud



Zone Clouds	Clouds of various institutions of higher education
External Clouds	Clouds external to institutions, public or private partners
Connections type A	Connecting links between zone clouds and external Clouds
Connections type B	Connecting links between the various zone clouds

**Fig 2- Proposed Model**

# Proposed Model

- First pillar of the model is the **intrinsic autonomy attributed each institution**, which is very important.
- The other pillar model is the **need to support for different approaches**, taking into account the degree of relationship and integration pursue by each institution.

# Proposed Model

- The model gives the possibility of the federation itself or its constituent clouds, each independently, to be interconnect with strategic partners or public clouds.
  - This approach opens paths to versatility and flexibility in the federation level of integration.
- As more institutions join this federation more resources are likely to be shared as well, providing ground to research in areas such as quality of service policies, administrative security, management and access control or auditing

# Proposed Model

- Connections between each of the institutional clouds or with external clouds always assume at this stage the Internet connection of each of the Institutions.
- The **RCTS** network is a high-performance network for institutions with higher communication requirements that includes universities, government laboratories and polytechnics.
- The connection between the various institutional clouds is performed on a high-performance network, managed by **FCCN**, with different high access bandwidth, reducing the constraints inherent in the use of internet connections provided by commercial operators.

# Questions?

