Towards an Architecture for Monitoring Private Cloud

Shirlei Aparecida de Chaves, Rafael Brundo Uriarte, Carlos Becker Westphall

Federal University of Santa Catarina
Networks and Management Laboratory

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1. ABSTRACT

This presentation describes:

- our experience with a private cloud;
- the design and implementation of a Private Cloud MONitoring System (PCMONS); and
- its application via a case study for the proposed architecture, using open source solutions and integrating with traditional tools like Nagios.

2. INTRODUCTION

- Cloud computing provides several technical benefits including flexible hardware and software allocation, elasticity, and performance isolation.
- Cloud management may be viewed as a specialization of distributed computing management, inheriting techniques from traditional computer network management.

2. INTRODUCTION

The intent of this presentation is to:

- Provide insight into how traditional tools and methods for managing network and distributed systems can be reused in cloud computing management.
- Introduce a Private Cloud MONitoring System (PCMONS) we developed to validate this architecture, which we intend to open source.

2. INTRODUCTION

- Help future adopters of could computing make good decisions on building their monitoring system in the cloud.
- We chose to address private clouds because they enable enterprises to reap cloud benefits while keeping their mission-critical data and software under their control and under the governance of their security policies.

3. BACKGROUND

3.1. Cloud Computing Service Models

- Software-as-a-Service (SaaS): The consumer uses the provider's applications, which are hosted in the cloud.
- Platform-as-a-Service (PaaS): Consumers deploy their own applications into the cloud infrastructure. Programming languages and applications development tools used must be supported by the provider.

3. BACKGROUND

3.1. Cloud Computing Service Models

- Infrastructure-as-a-Service (IaaS): Consumers are able to provision storage, network, processing, and other resources, and deploy and operate arbitrary software, ranging from applications to operating systems.
- This presetation focuses on IaaS model.

3. BACKGROUND

3.2. Cloud Computing Deployment Models

- Public: Resources are available to the general public over the Internet. In this case, “public” characterizes the scope of interface accessibility.
- Private: Resources are accessible within a private organization. This environment emphasizes the benefits of hardware investments.

3. BACKGROUND

3.2. Cloud Computing Deployment Models

- Community: Resources on this model are shared by several organizations with a common mission.
- Hybrid: This model mixes the techniques from public and orivate clouds. A private cloud can have its local infrastructure supplemented by computer capacity from public cloud.

3. BACKGROUND

3.3. Cloud Computing Standards

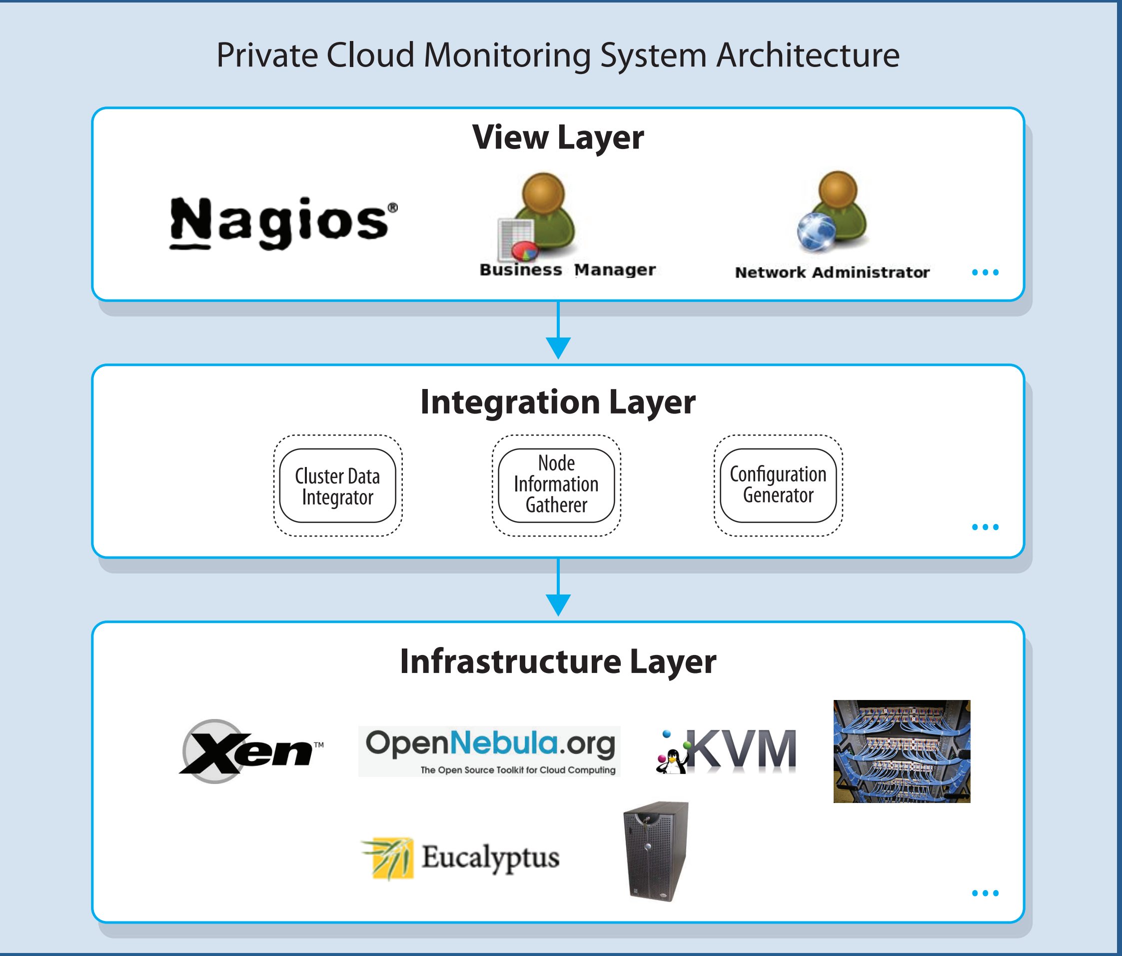
- Open Cloud Computing Interface: This Open Grid Forum group has a focus on specifications for interfacing “*aaS” cloud computing facilities.
- OCCI in Eucalyptus, OCCI in OpenStack, OCCI in OpenNebula...

3. BACKGROUND

3.3. Cloud Computing Standards

- Open Cloud Standards Incubator: This initiative, from Distributed Management Task Force (DMTF), focuses on interactions between cloud environments, their consumers, and developers.
- Example of document: “Use cases and Interactions for Managing Clouds”.

4. MONITORING ARCHITECTURE AND PCMONS



4. MONITORING ARCHITECTURE AND PCMONS

4.1. Architecture

- Three layers address the monitoring needs of a private cloud.
- Infrastructure layer:
- Basic facilities, services, and installations, such as hardware and networks;
- Available software: operating system, applications, licenses, hypervisors, and so on...

4. MONITORING ARCHITECTURE AND PCMONS

4.1. Architecture

- Integration layer:
- The monitoring actions to be performed in the infrastructure layer must be systematized before passed to the appropriate service running in the integration layer.
- The integration layer is responsible for abstracting any infrastructure details.

4. MONITORING ARCHITECTURE AND PCMONS

4.1. Architecture

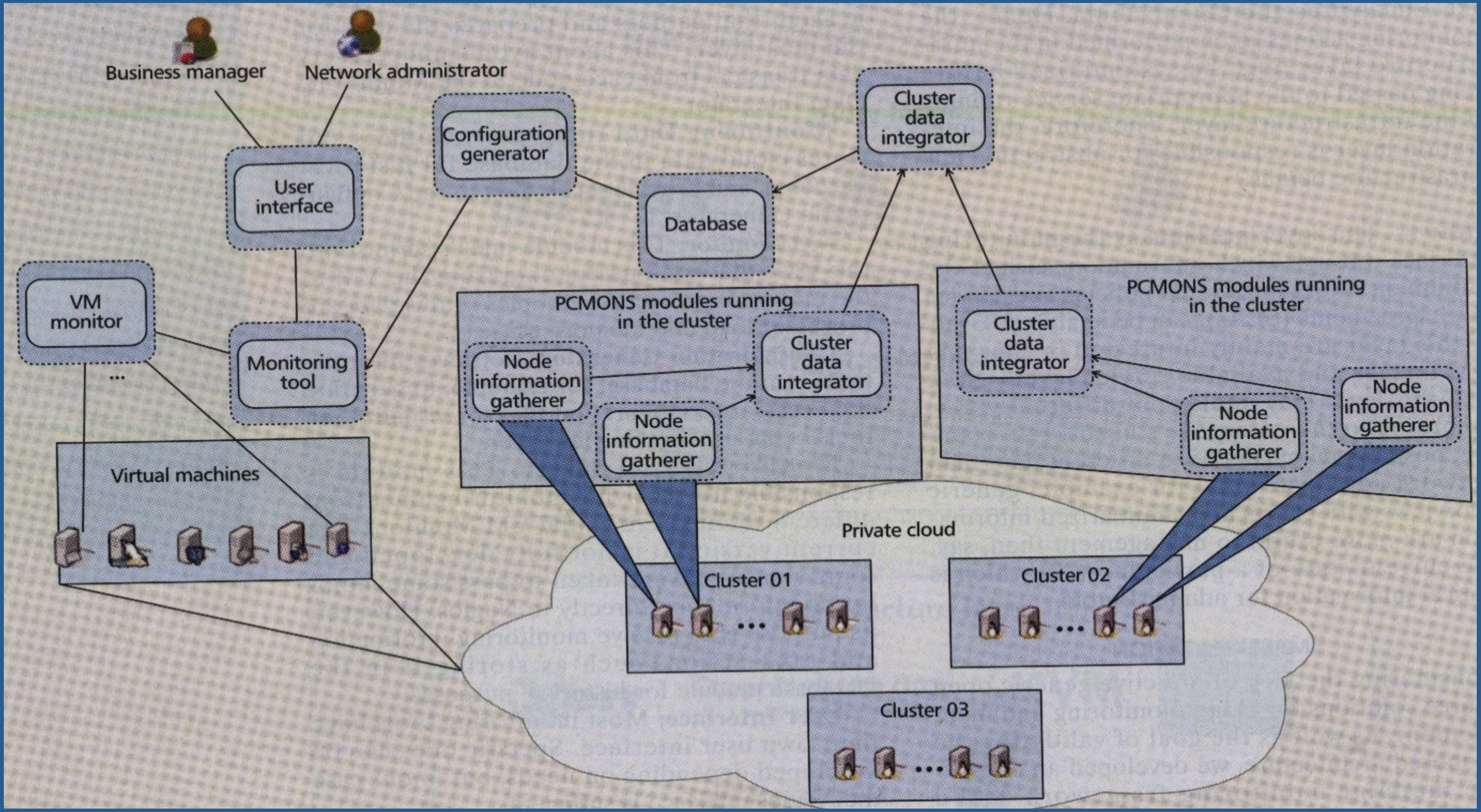
- View layer:
- This layer presents as the monitoring interface through which information, such as the fulfillment of organizational policies and service level agreements, can be analyzed.
- Users of this layer are mainly interested in checking VM images and available service levels.

4. MONITORING ARCHITECTURE AND PCMONS

4.2. Implementation

- The current PCMONS version acts principaly on the integration layer, by retrieving, gathering, and preparing relevant information for the visualization layer.
- The system is divided into the modules presented in the next figure and described below.

A typical deployment scenario for PCMONS



4. MONITORING ARCHITECTURE AND PCMONS

4.2 Implementation

- Node Information Gatherer: This module is responsible for gathering local information on a cloud node. It gathers information about local VMs and sends it to the Cluster Data Integrator.
- Cluster Data Integrator: It is a specific agent that gethers and prepares the data for the next level.

4. MONITORING ARCHITECTURE AND PCMONS

4.2 Implementation

- Monitoring Data Integrator: Gathers and stores cloud data in the database for historical purposes, and provides such data to the Configuration Generator.
- VM Monitor: This module injects scripts into the VMs that send useful data from the VM to the monitoring system.

4. MONITORING ARCHITECTURE AND PCMONS

4.2 Implementation

- Configuration Generator: Retrieves information from the database to generate configuration files for visualization tools.
- Monitoring Tool Server: Its purpose is to receive monitoring information and take actions such as storing it in the database module for histirical purposes.

4. MONITORING ARCHITECTURE AND PCMONS

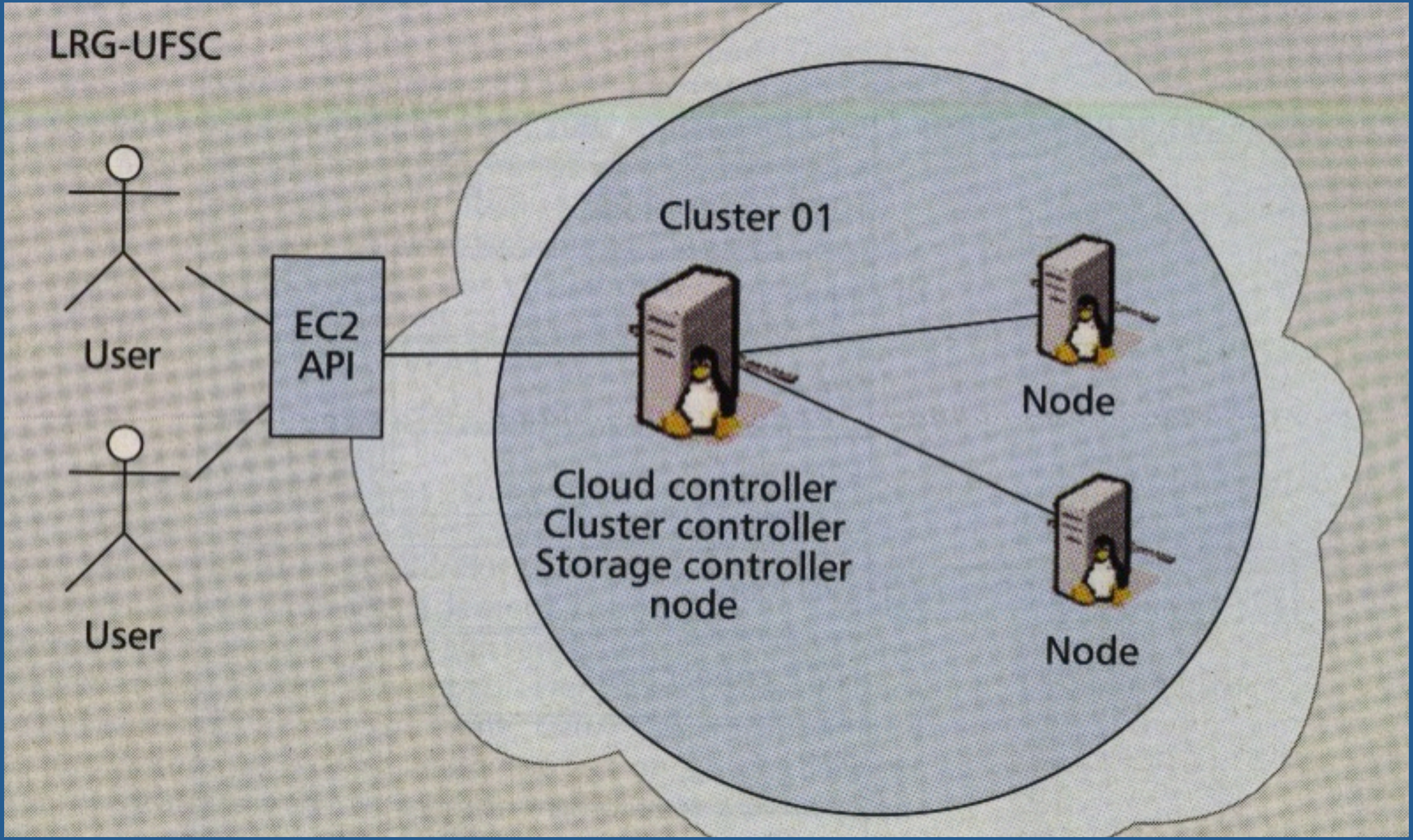
4.2 Implementation

- User Interface: Most monitoring tools have their own user interface. Specific ones can be developed depending on needs, but in our case the Nagios interface is sufficient.
- Database: Stores data needed by Configuration Generator and the Monitoring Data Integrator.

5. CASE STUDY

- We built an environment where VM images are available for users that instantiate a web server, thus simulating web hosting service provision.
- Instantiated VMs are Linux servers providing a basic set of tools, acting as web hosting servers.
- Apache Web Server, PHP language, SQLite.

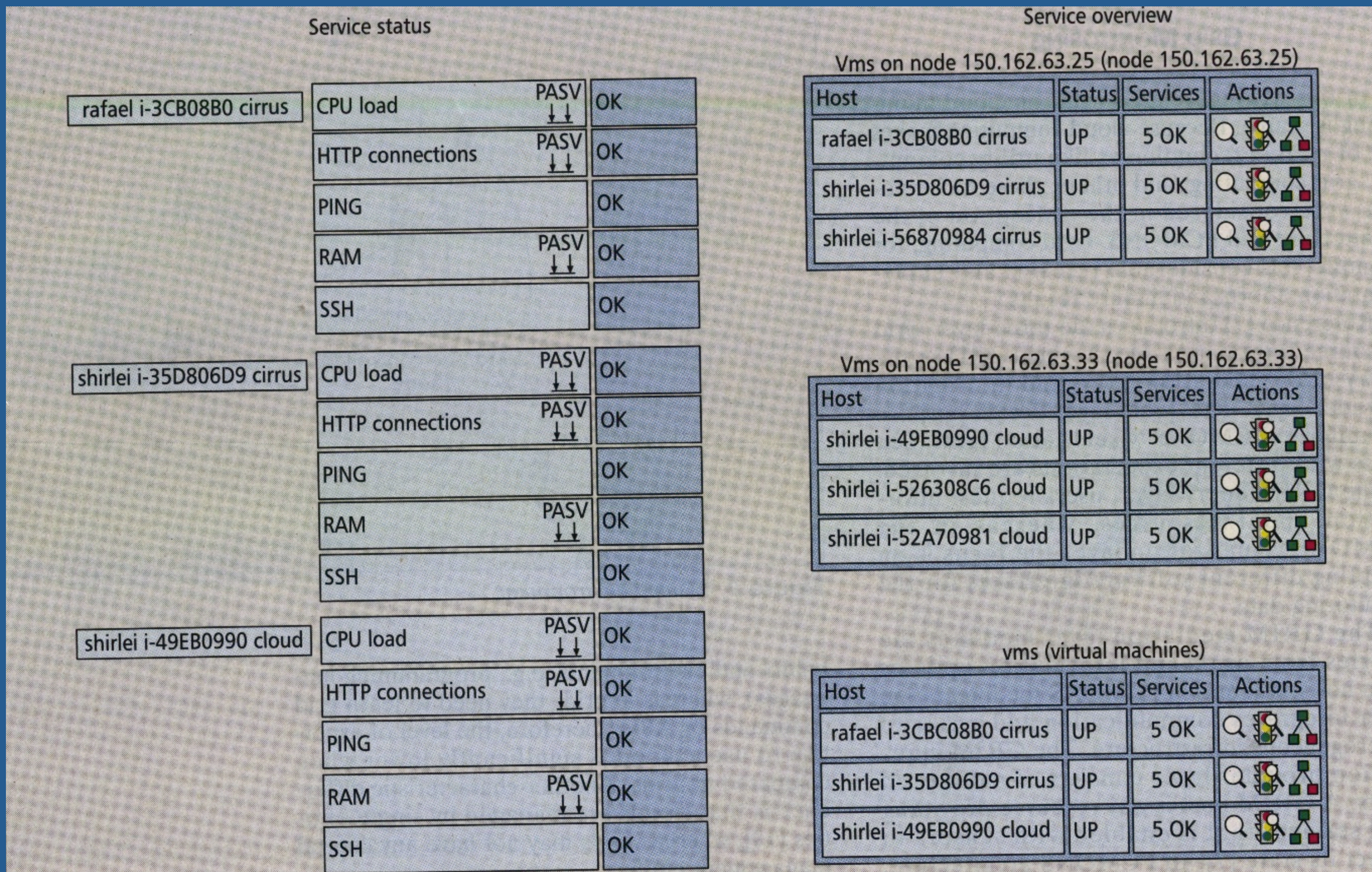
Testbed environment



5. CASE STUDY

- Open SUSE was chosen as the operating system of the physical machines (Xen and YaST).
- Eucalyptus (interface compatible with Amazon's EC2). VM images were downloaded from the Eucalyptus website.
- VM Monitor module is injectec into the VM during boot, allowing data monitoring.

Representative Nagios interface of the monitored cloud services



5. CASE STUDY

- First column shows object names (VM, PM, ROUTERS...). VM names are an aggregation of user name, VM ID, and name of PM where the VM is running.
- The other two columns show service names and their status (OK, Warning, Critical).
- It shows host group created by PCMONS and VM/VP mapping.

6. RELATED WORK

6.1. Grid Monitoring

- Reference [7] introduces the three-layer Grid Resource Information Monitoring (GRIM).
- Several design issues that ashould be considered when constructing a Grid Moitoring System (GMS) are preented in [8]. We have selected some and correlated then with PCMOMS.

6. RELATED WORK

6.1. Grid Monitoring

- Reference [9] identifies some differences between cloud monitoring and grid monitoring, especially in termes of interfaces and service provisioning.
- Another diference is that clouds are managed by single entities [10], whereas grids may not have any central management entity.

6. RELATED WORK

6.2. Cloud Monitoring

- Reference [11] defines general requirements for cloud monitoring and proposes a cloud monitoring framework.
- PCMONS supports two approches, agents and central monitoring, and is highly adaptable, making the migration to a privite cloud straighforward.

7. KEY LESSONS LEARNED

7.1. Related to Test-Bed Preparation

- Software platforms for cloud computing, such as Eucalyptus and OpenNebula, support a number of different hypervisors, each with its own characteristics.
- An example is the KVM hypervisor: it has great performance but requires hardware virtualization that not all processors provide.

7. KEY LESSONS LEARNED

7.2. Design and Implementation

- We opted for solutions well established in the market to facilatate the use of PCMONS in the running structures with little effort and prioritized an adaptable and extensible solution.
- We planned to define some basic common metrics for private clouds, but later found that metrics are often specific to each case.

7. KEY LESSONS LEARNED

7.3. Standardization and Available Implementations

- Before choosing a specific tool for private clouds, it is important to verify to what extent cloud standards are implemented by the tool.
- Some tools, such as OpenNebula, have begun implementing standardization efforts, including the OCCI API.

8. CONCLUSION AND FUTURE WORK

- This presentation summarizes some cloud computing concepts and our personal experience with this new paradigm.
- The current portfolio of open tools lacks open source, interoperable management and monitoring tools. To address this critical gap, we designed a monitoring architecture, and validade the architecture by developing PCMONS.

8. CONCLUSION AND FUTURE WORK

- To monitor specific metrics, especially in an interface-independent manner, a set of preconfigured monitoring plug-ins must be developed.
- For future work, we intend to improve PCMONS to monitor other metrics and suport other open source tools like OpenNebula, OpenStack...

9. REFERENCES

References indicated in this presentation:

- [7] W. Chung and R. Chang, “A New Mechanism for Resource Monitoring in Grid Computing,” Future Gen. Comp. Sys. Jan. 2009.
- [8] M. Yiduo et al., “Rapid and Automated Deployment of Monitoring Services in Grid Environments,” APSCC, 2007.
- [9] L. Wang et al., “Scientific Cloud Computing: Early Definition and Experience,” IEEE Int’l. Conf. High Perf. Computing and Commun., 2008.

9. REFERENCES

References indicated in this presentation:

- [10] M. Brock and A. Goscinski, “Grids vs. Clouds,” IEEE 2010 5th Int’l. Conf. Future Info. Tech., 2010.
- [11] P. Hasselmeyer and N. d’Heureuse, “Towards Holistic Multi-Tenant Monitoring for Virtual Data Centers,” IEEE/IFIP NOMS Wksps., 2010.