

e-Ciencia 2009

Valencia, Spain, October 29-30 2009

Grids y Cloud Computing: Perspectivas y Primeras Experiencias

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Objectives

Grids & Clouds: Perspectives and Early Experiences

- Provide an overview of Cloud Computing
- Describe how Clouds can help Grids
- Discuss some experiences using Clouds and Grids



Cloud Computing in a Nutshell

Grids & Clouds: Perspectives and Early Experiences

Software as a Service

On-demand access to any application

End-user

(does not care about hw or sw)



facebook

Platform as a Service

Platform for building and delivering web applications

Developer

(no managing of the underlying hw & sw layers)



Windows Azure

force.com
platform as a service

Infrastructure as a Service

Delivery of a *raw* computer infrastructure

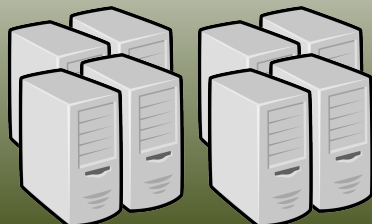
System Administrator

(complete management of the computer infrastructure)

GOGRID

flexiscale

amazon
webservices



Physical Infrastructure

- **Simple Web Interface**
- **Raw *Infrastructure* Resources**
 - Total control of the resources
 - Capacity leased in the form of Vms
 - Complete Service-HW decoupling
- **Pay-as-you-go (On-demand access)**
 - A single user can not get all the resources
 - Multi-tenancy
- **Elastic & “infinite” Capacity**

The Public IaaS Cloud

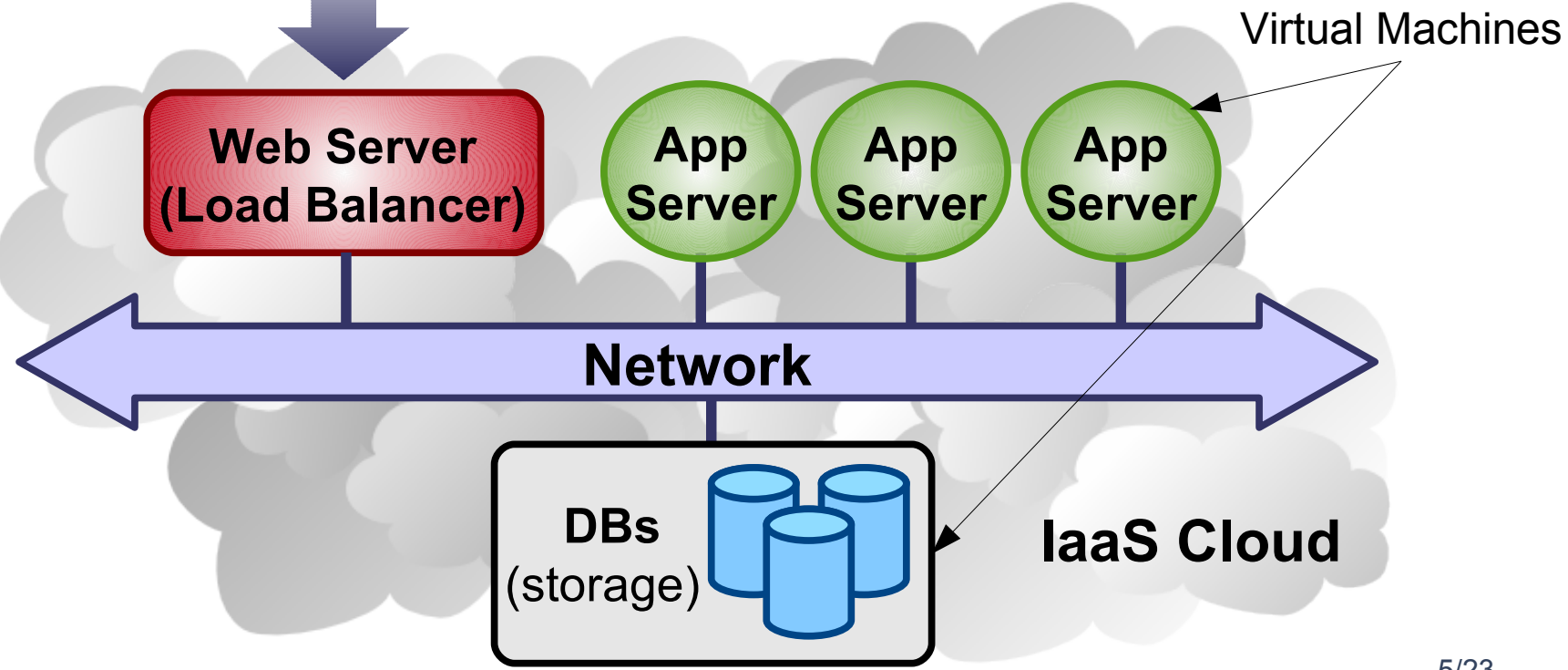
Grids & Clouds: Perspectives and Early Experiences



**Service
End-Users**

Total control of service layout

- Software Stack
- Type & Number of components
- Service Elasticity

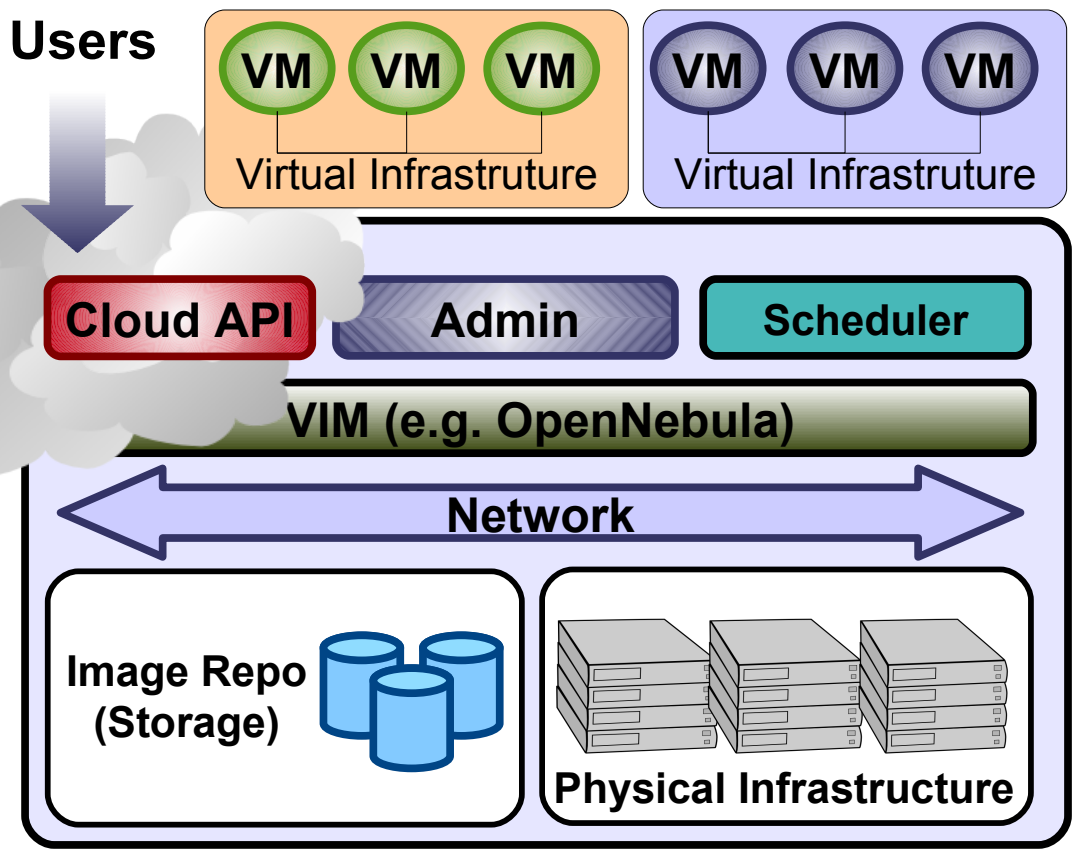


The Private IaaS Cloud

Grids & Clouds: Perspectives and Early Experiences

A “Public Cloud behind the firewall”

- Security concerns
- Flexible management (consolidation, adaptation, provisioning...)



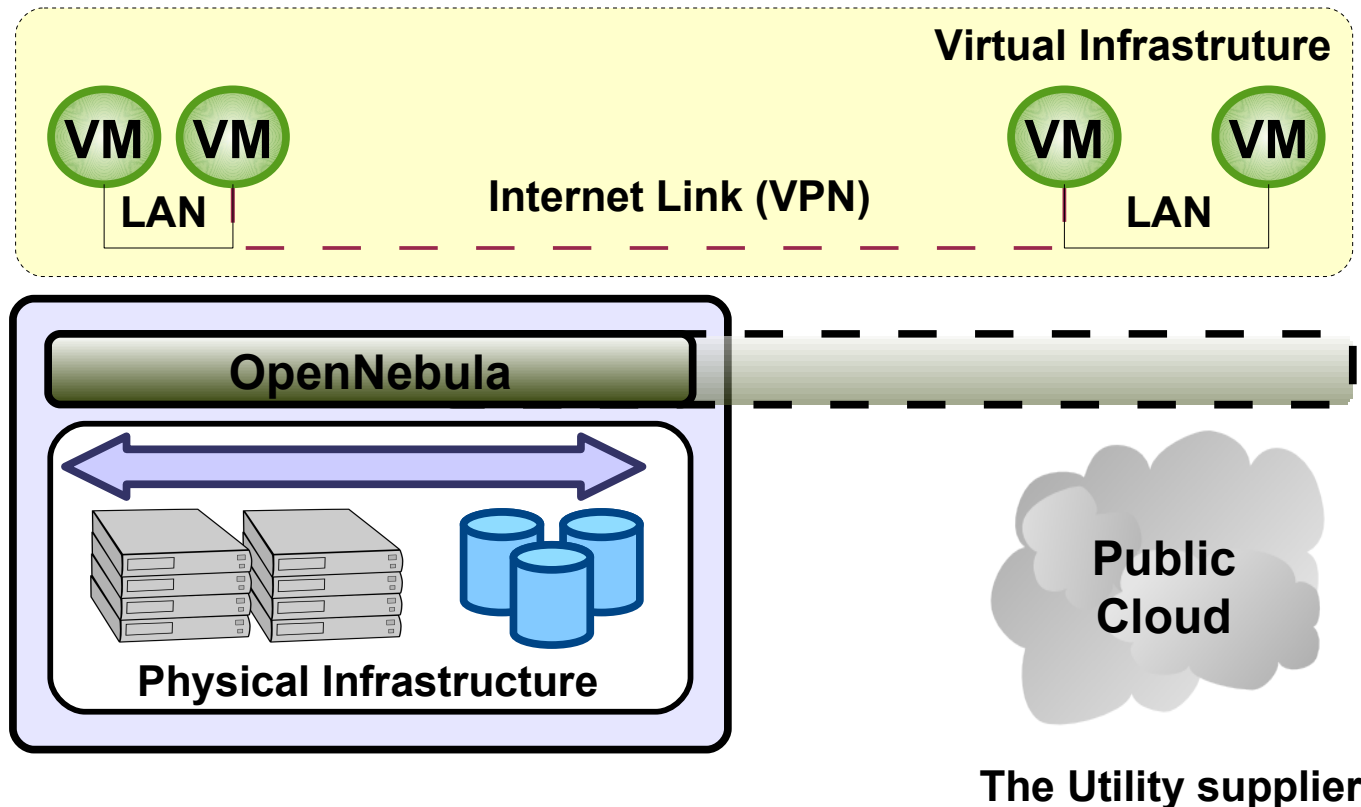
The headaches...

- Orchestrate:
 - Virtualization
 - Networking
 - Storage
- Admin Interfaces
- VM placement

The Hybrid IaaS Cloud

Grids & Clouds: Perspectives and Early Experiences

- Supplement the capacity of the local infrastructure
- Transparent access to the resulting hybrid cloud
- Utility Computing dream made a reality!



- High degree of heterogeneity (software & hardware)
- High operational costs
- Isolate and partition resources contributed to the Grid
- Specific environment requirements for different Vos
- Users simply do not feel like adopting our execution models (*pilot jobs...*)



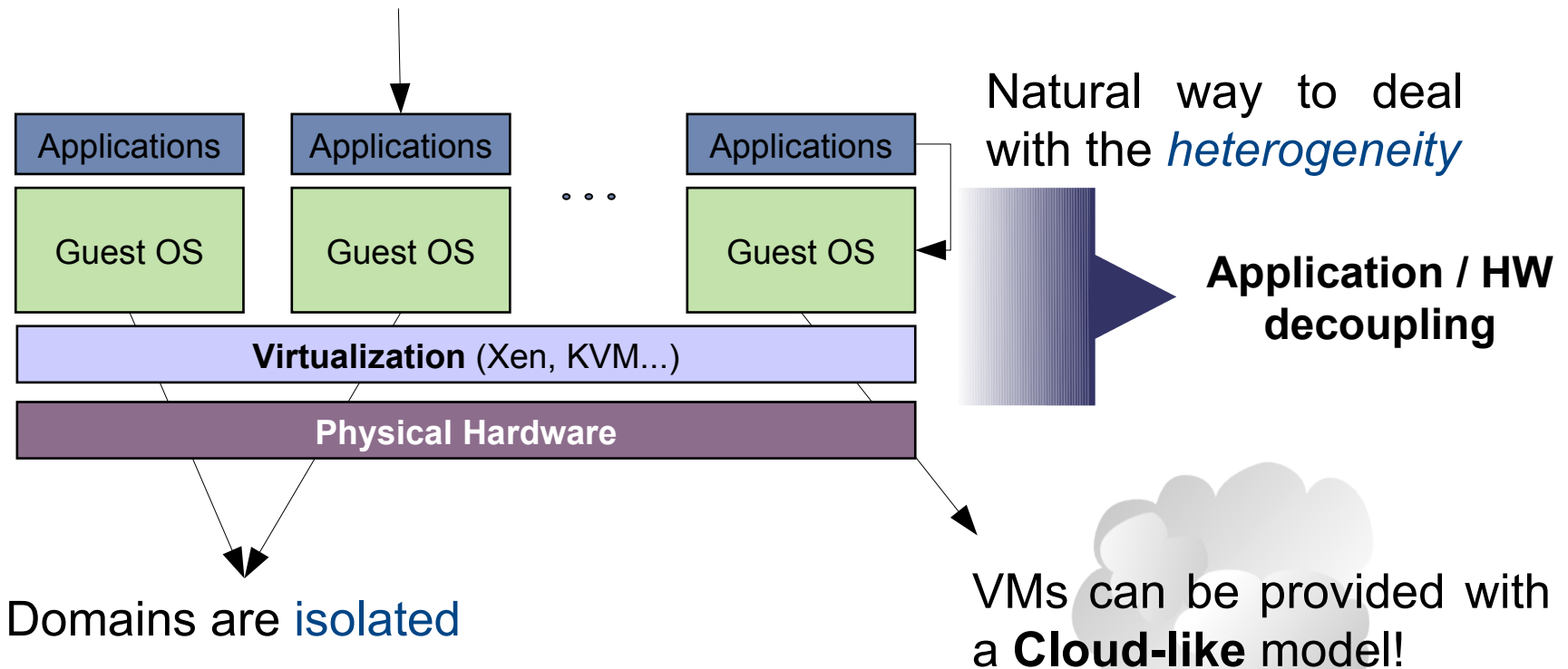
Grids are difficult to maintain, operate and use

Grids, Clouds... and Virtual Machines

Grids & Clouds: Perspectives and Early Experiences

- A VM is an isolated runtime environment (guest OS and apps)
- Hypervisors: Full Virtualized, para-virtualization, HW Virtualization

Execution of legacy applications



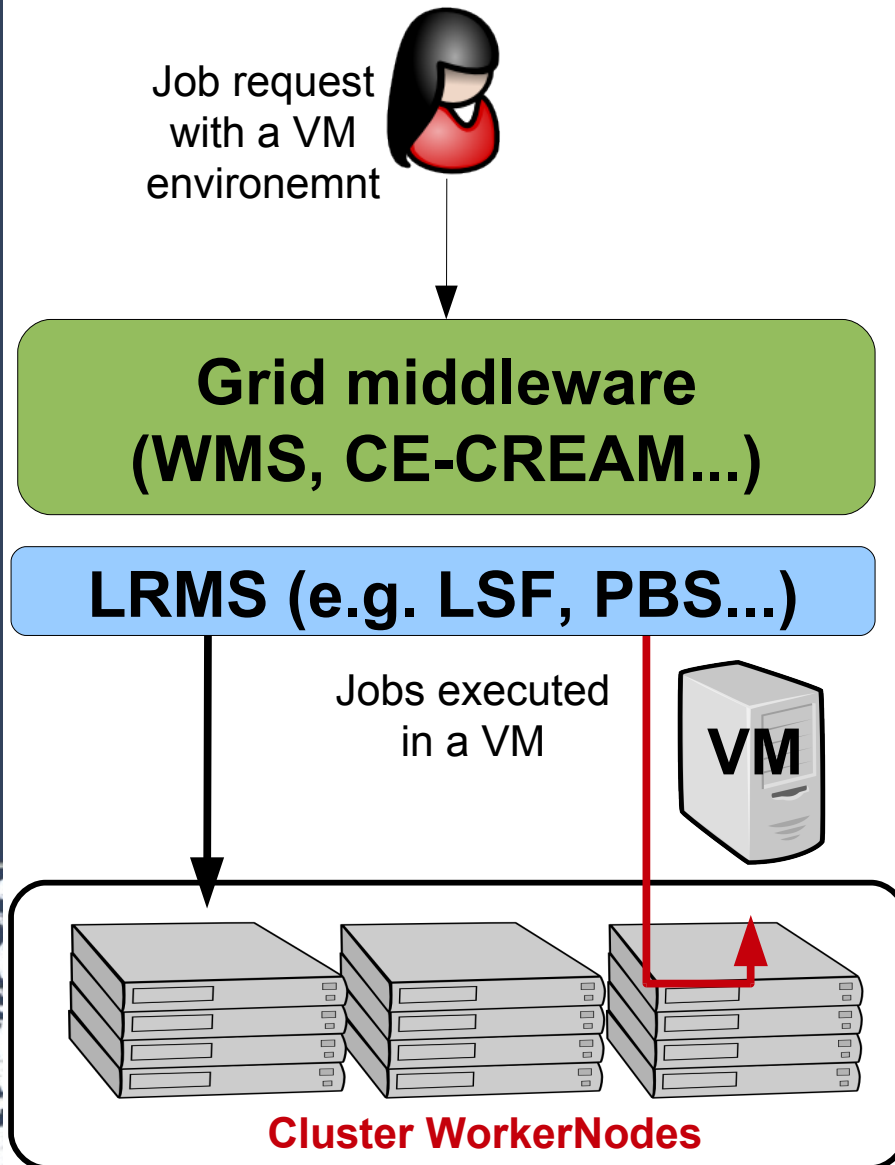
Grids, Clouds... and Virtual Machines

Grids & Clouds: Perspectives and Early Experiences

- Use VMs as basic building block for Grid Services
- **Current Trends:**
 - **VMs as Job Container**
 - **VMs as Grid execution service component**
 - Deal with heterogeneity
 - Simplify & Improve site management
 - Give VOs control over the worker-node SW
 - **IaaS interfaces for a Grid Site**
 - Attract business users
 - Support novel execution models

Grids, Clouds: VM as a Job Container

Grids & Clouds: Perspectives and Early Experiences



Features

- Single LRMS-based
- Integrated with Grid MW

Drawbacks

- Jobs and VMs are different
- Need to integrate other resources (network, storage...)
- Do not decouple totally infrastructure from the Grid services
- Can not leverage VM features (e.g. Migration...)
- Focused on Job execution

Grids, Clouds: VM as Grid Service Component

Grids & Clouds: Perspectives and Early Experiences

Job request
with a VM
environemnt



VM, network & storage
Management



Load-VO Driven
Adaptation

Grid middleware
(WMS, CE-CREAM...)

LRMS (e.g. LSF, PBS...)

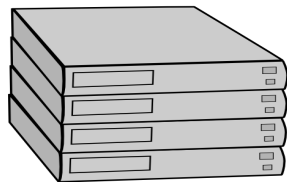
VIM (OpenNebula)

Direct Jobs
execution

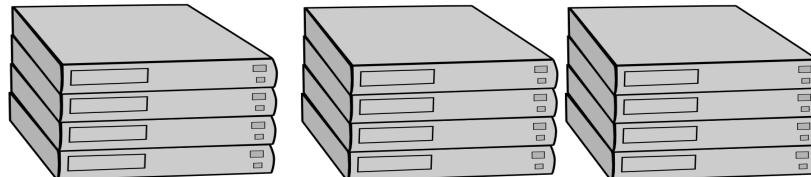
Public
Cloud

Virtual WN (VO)

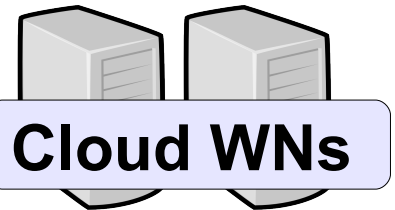
Cloud WNs



Physical WNs



Physical Infrastructure

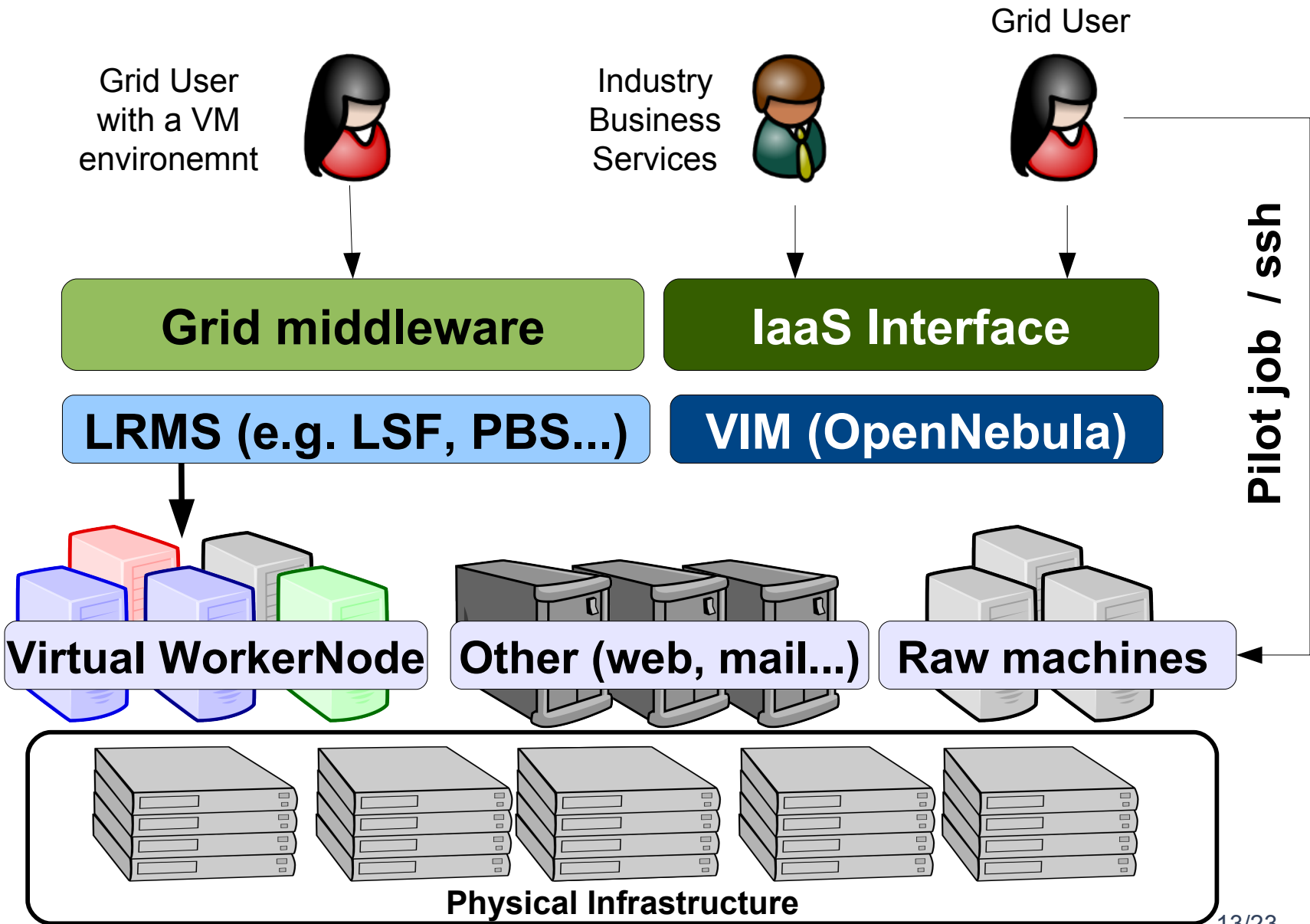


External
Cloud

Grids, Clouds: IaaS Interface for a Site

Grids & Clouds: Perspectives and Early Experiences

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VMs as a Job Container

- INFN: Workernode on demand



"Enabling Distributed Job Submission in Dynamic Virtual Execution Environments for EGEE Users", D.Salomoni, M.Cecchi, A.Ghiselli, A.Italiano, M.Orrù, D.Rebato, V.Venturi, L.Zangrando

VMs as a Grid Service Component

- CERN: LSF + VMO/OpenNebula + Custom VM images. Tested with real life Grid experiments (ALICE)

"The batch virtualization project at CERN", Sebastien Goasguen, Ewan Roche, Tony Cass and Schwickerath Ulrich.



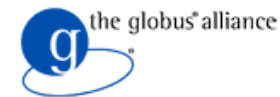
- NIHKEF: Torque/PBS + OpenNebula + CoW VM repository

"Virtual Machines at a Tier-1 site." Sander Klous (Nikhef)



IaaS for Scientific Computing

- Globus Nimbus – AliEn & STAR experiments



<http://workspace.globus.org/>



- Study Public Clouds (Amazon EC2) to deploy an EGEE site
- EGEE site as a private cloud to deploy Grid services
- IaaS Interfaces for EGEE sites
- StratusLab will integrate, distribute and maintain a cloud turn-key toolkit for EGEE sites

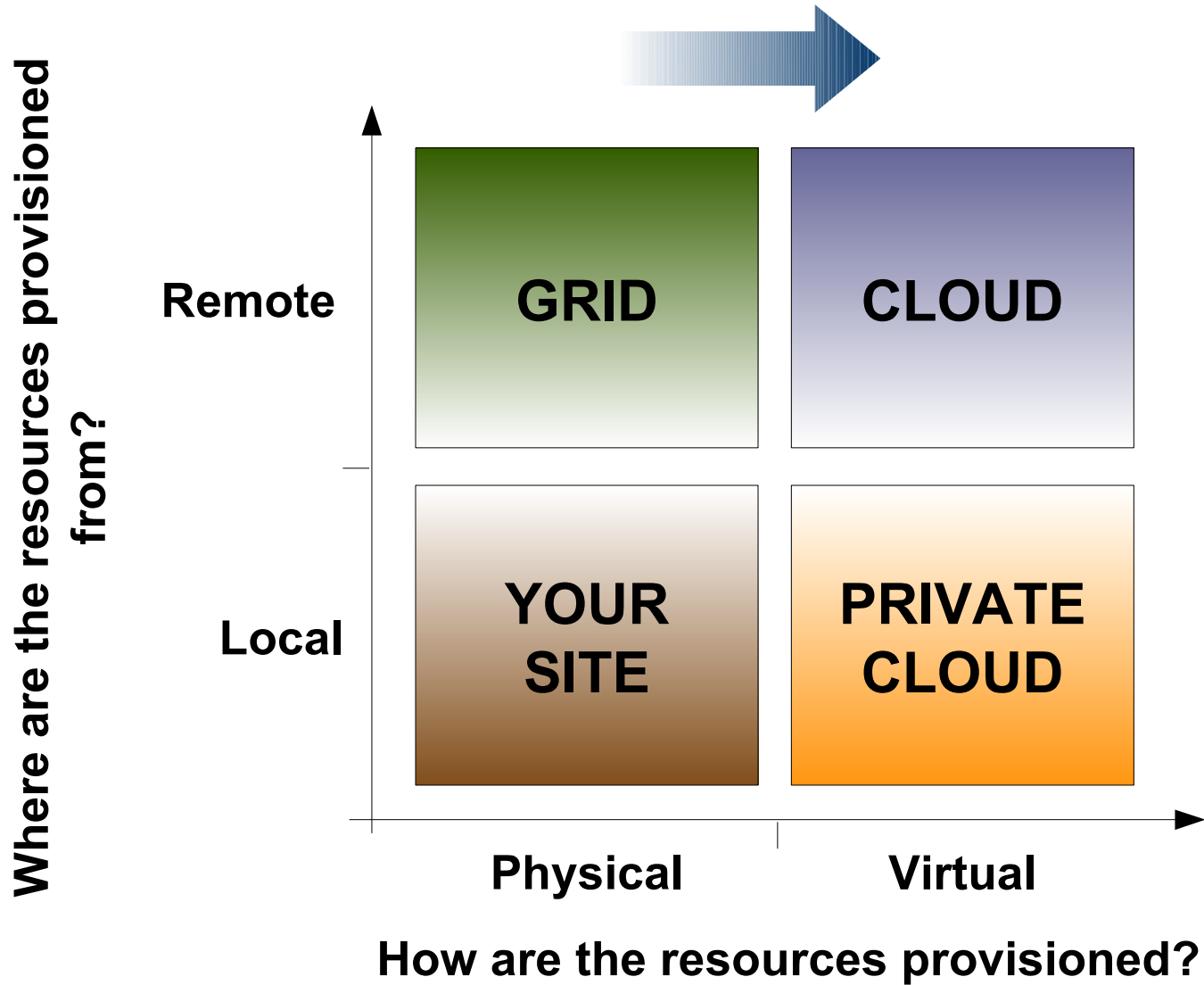
EGEE & RESERVOIR Collaboration

- Use Virtual Worker-nodes to provision Grid Services
- Explore Hybrid Cloud Computing for Grid Sites
- Virtualize a Complete EGEE site



Resource Provisioning Models

Grids & Clouds: Perspectives and Early Experiences

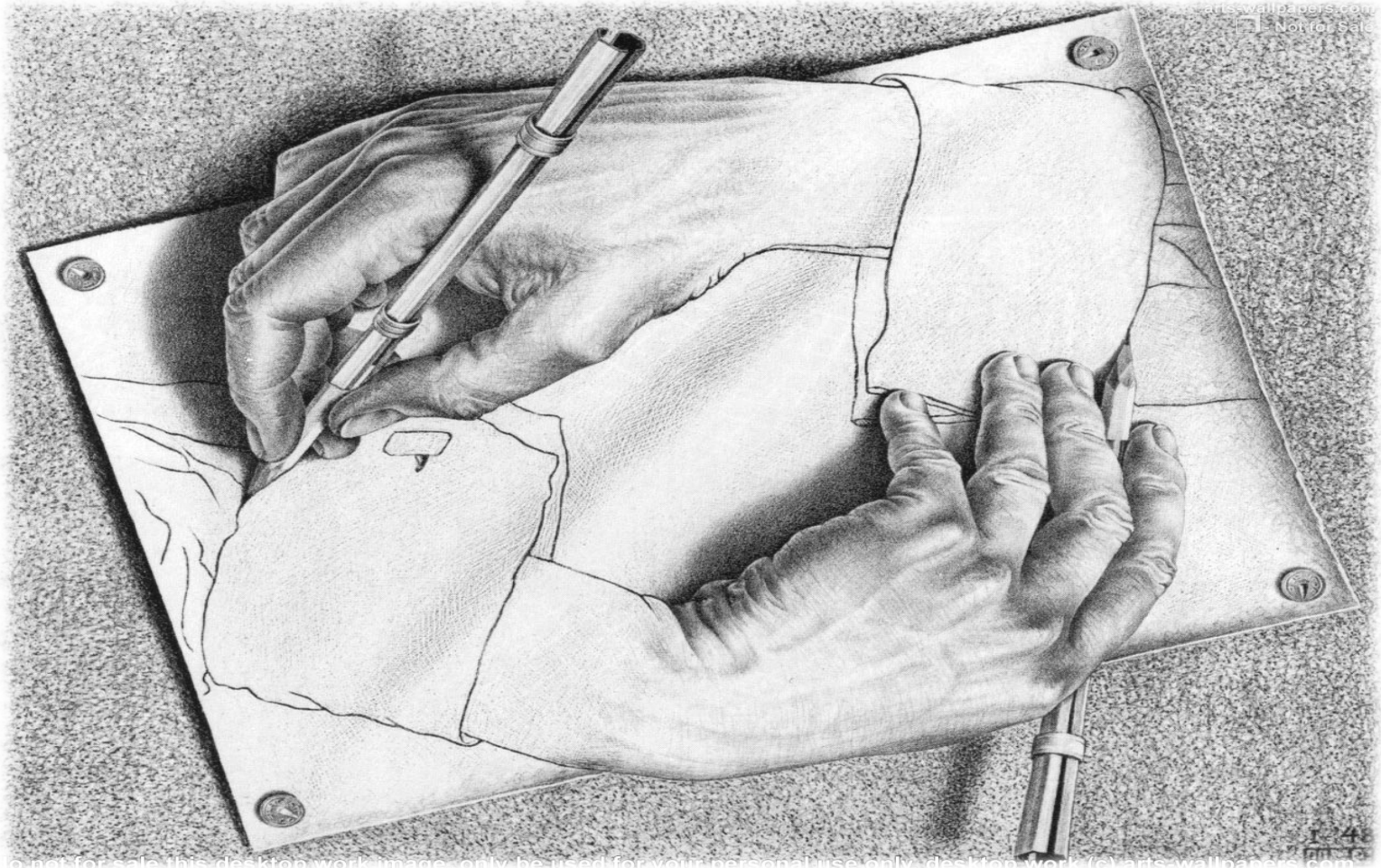


Conclusions

Grids & Clouds: Perspectives and Early Experiences

- Virtualization, cloud, and grid are complementary technologies and will coexist and cooperate at different levels of abstraction
- Virtualization can solve many obstacles for Grid adoption
- Virtualization and cloud do NOT require any modification from the end-user perspectives
- Separation between service and infrastructure layers will allow the application of the utility model to Grid computing
- The use of Cloud interfaces for Grid sites may attract other users to e-infrastructures
- We'll see cloud activities in the future EGI

THANK YOU FOR YOUR ATTENTION



QUESTIONS?