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# Building Clouds with the OpenNebula Virtual Infrastructure Engine

**Raúl Sampedro Martín**

**dsa-research.org**

**Distributed Systems Architecture Research Group  
Universidad Complutense de Madrid**



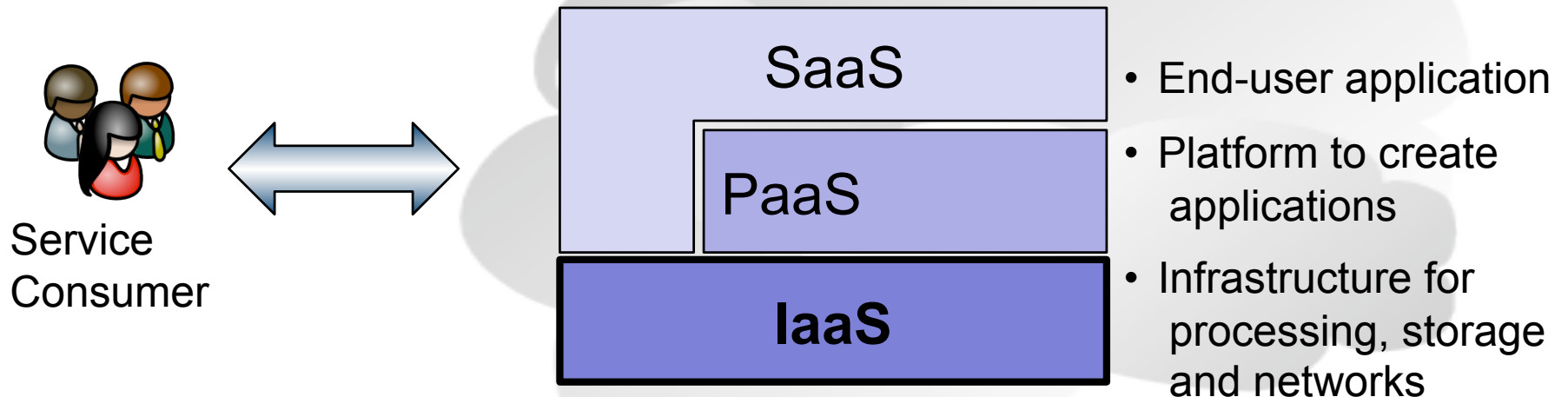
# A Definition for Cloud Computing

## Technology Vision for Cloud Computing

### What is Cloud Computing?

- Resource provision model for enabling on-demand and ubiquitous network access to scalable, elastic and configurable IT-enabled capabilities delivered as a service.

### Delivery Models in Cloud Computing



### Types of Cloud Architectures

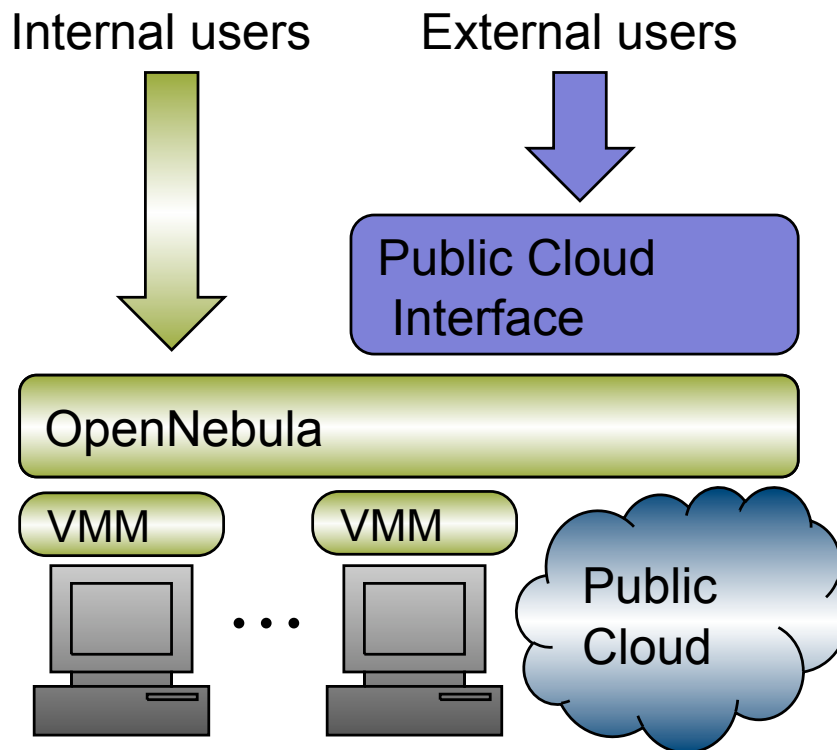
- Private clouds: Flexible cloud-like management of internal infrastructure
- Public clouds: Commercial providers of pay per use capacity
- Hybrid clouds: Composition of two or more clouds

# What is OpenNebula?

*The OpenNebula Virtual Infrastructure Engine*

## Extending the Benefits of Virtualization to Clusters

- Dynamic deployment and re-placement of virtual machines on a pool of physical resources
- Transform a rigid distributed physical infrastructure into a flexible and agile virtual infrastructure



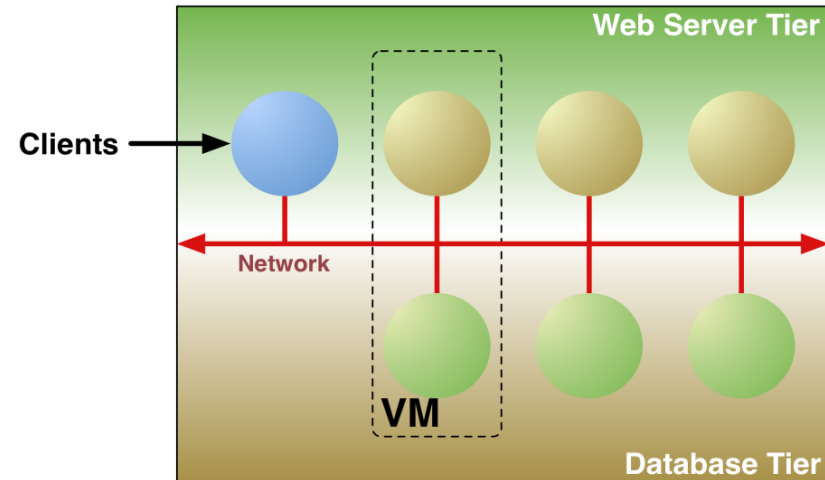
- Backend of Public Cloud: Internal management of the infrastructure
- Private Cloud: Virtualization of cluster or data-center for internal users
- Cloud Interoperation: On-demand access to public clouds

# Virtual Machine Management Model

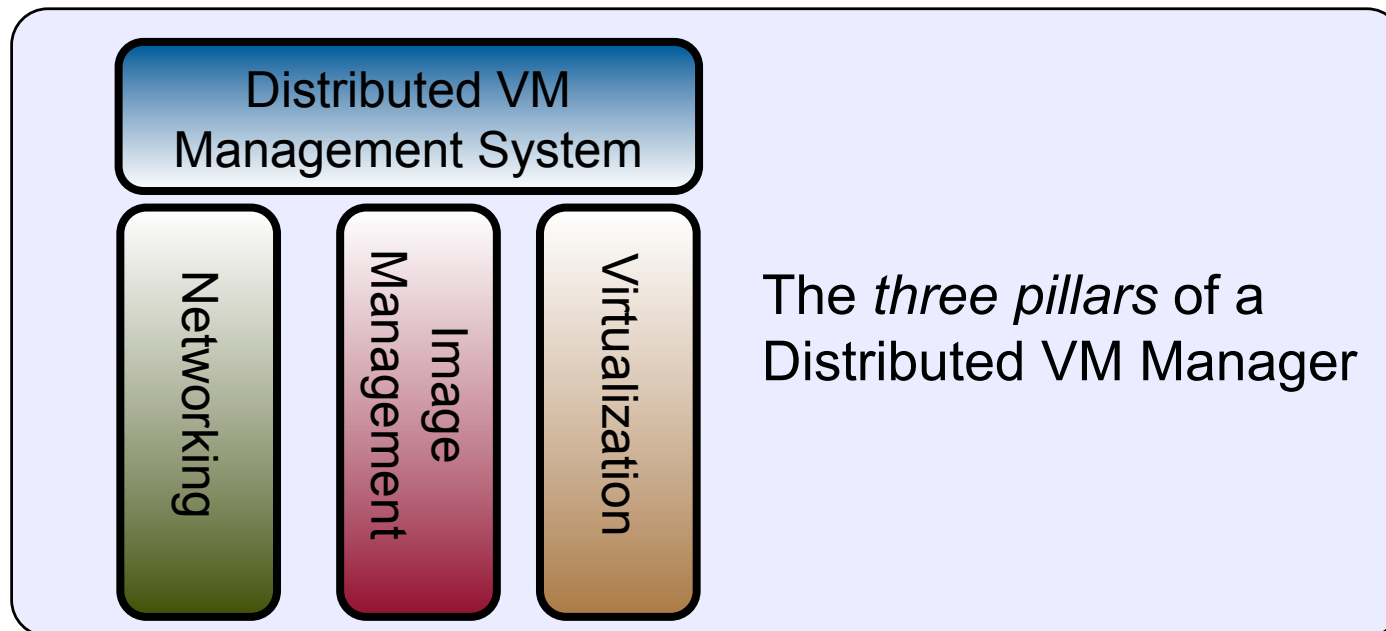
The OpenNebula Virtual Infrastructure Engine

## Service as Management Entity

- Service structure
  - Service components run in VMs
  - Inter-connection relationship
  - Placement constraints
- The VM Manager is service agnostic
- Provide infrastructure context



## Distributed VM Management Model





# Benefits

## *The OpenNebula Virtual Infrastructure Engine*

### System Manager

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- Centralized management of VM workload and distributed infrastructures
- Support for VM placement policies: balance of workload, server consolidation...
- Dynamic resizing of the infrastructure
- Dynamic partition and isolation of clusters
- Support for heterogeneous workload
- Dynamic scaling of private infrastructure to meet fluctuating demands

### Service Manager

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- On-demand provision of virtual machines

### System Integrators

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- Open and flexible architecture and interfaces, open source software
- Integration with any component in the virtualization/cloud ecosystem, such as cloud providers, hypervisors, cloud-like interfaces, virtual image managers, service managers, schedulers...



# Features

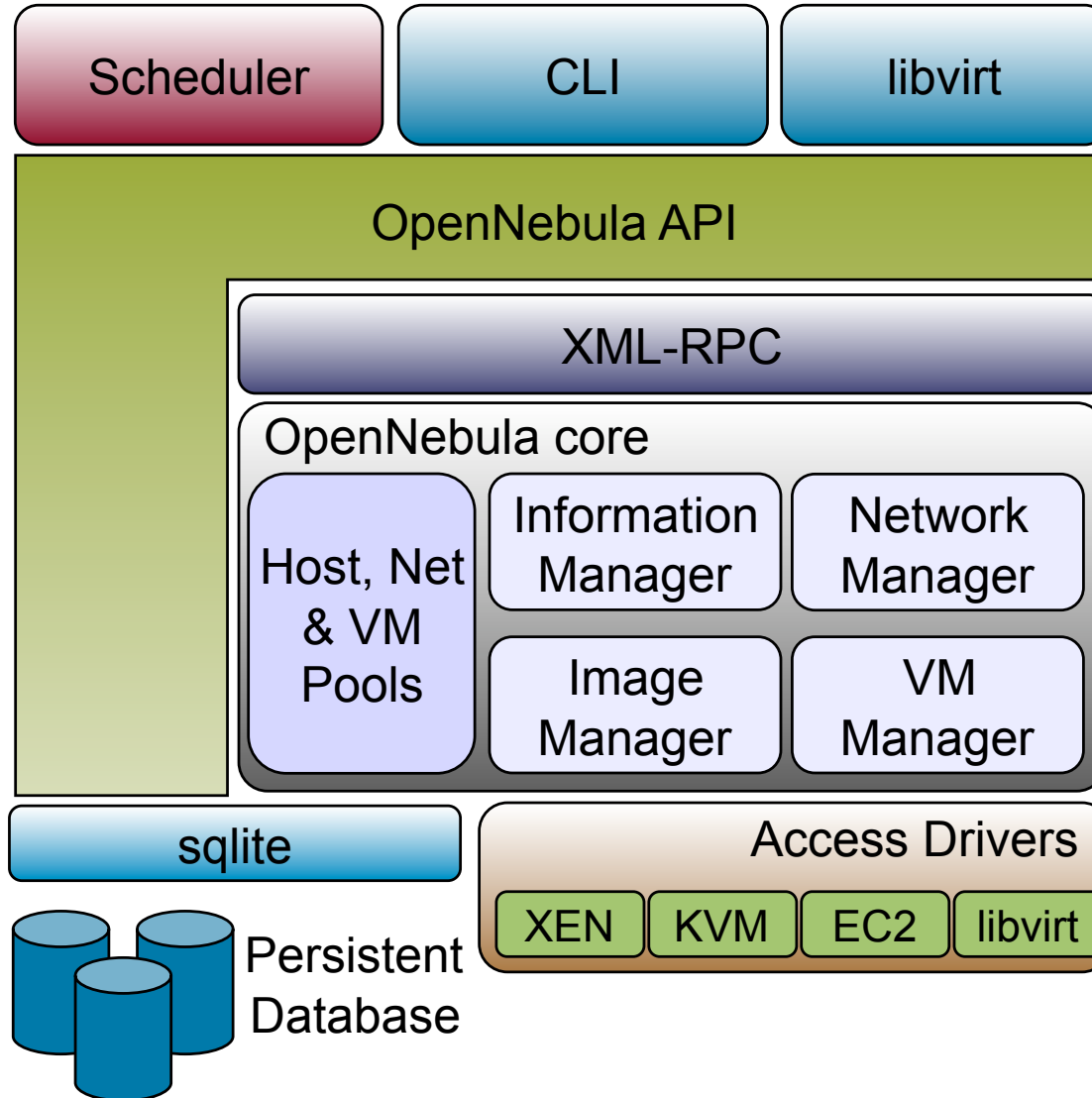
## The OpenNebula Virtual Infrastructure Engine

Feature	Function
UserInterface	<ul style="list-style-type: none"><li>• Unix-like CLI to manage VM life-cycle and physical boxes</li><li>• XML-RPC API and libvirt interface</li></ul>
Scheduler	<ul style="list-style-type: none"><li>• Requirement/rank matchmaker</li><li>• Generic framework to build any scheduler</li></ul>
VirtualizationManagement	<ul style="list-style-type: none"><li>• Xen, KVM and libvirt connectors</li><li>• Amazon EC2</li></ul>
ImageManagement	<ul style="list-style-type: none"><li>• General mechanisms to transfer and clone VM images</li></ul>
NetworkManagement	<ul style="list-style-type: none"><li>• Definition of virtual networks to interconnect VMs</li></ul>
FaultTolerance	<ul style="list-style-type: none"><li>• Persistent database backend to store host and VM information</li></ul>
Scalability	<ul style="list-style-type: none"><li>• Tested in the management of hundreds of VMs</li></ul>
Installation	<ul style="list-style-type: none"><li>• Installation on a UNIX cluster front-end without requiring new services in the remote resources</li><li>• Distributed in Ubuntu 9.04 (Jaunty Jackalope), due in April 2009</li></ul>



# Open and Flexible Architecture

The OpenNebula Virtual Infrastructure Engine

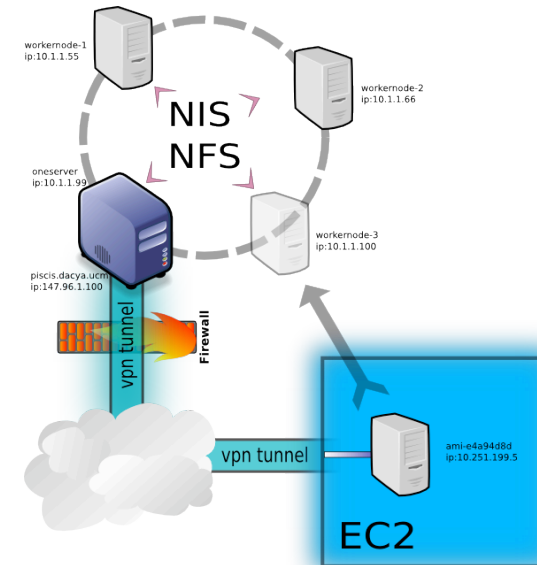


# Use Cases

## The OpenNebula Virtual Infrastructure Engine

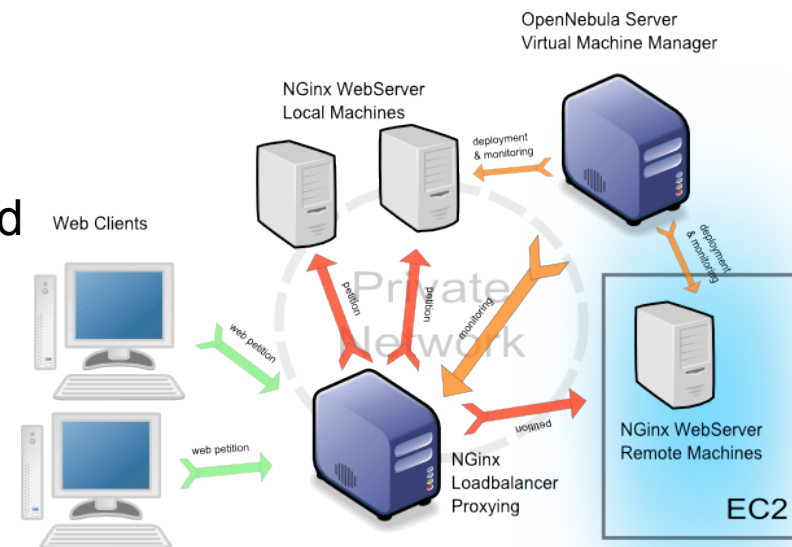
### On-demand Scaling of Computing Clusters

- Elastic execution of a SGE computing cluster
- Dynamic growth of the number of worker nodes to meet demands using EC2
- Private network with NIS and NFS
- EC2 worker nodes connect via VPN



### On-demand Scaling of Web Servers

- Elastic execution of the NGinx web server
- The capacity of the elastic web application can be dynamically increased or decreased by adding or removing NGinx instances





# Ecosystem

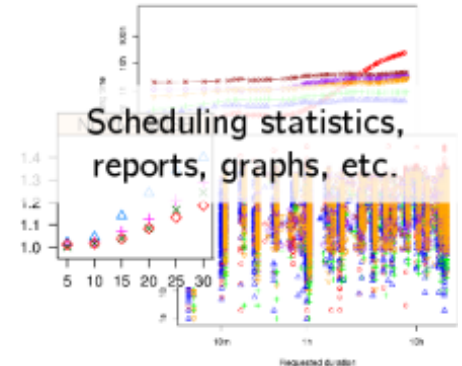
## The OpenNebula Virtual Infrastructure Engine

### Schedulers

- Haizea: Open-source VM-based lease management architecture (allows AR of capacity).



Lease requests  
"I need 10 nodes, each with  
2 CPUs, 4GB of memory,  
from 2pm to 4pm"



### Interfaces

- Libvirt: Provides an abstraction of a whole cluster of resources as one host, hiding specific hypervisor details.
- Nimbus: Can be used as a WSRF or EC2 front-end.

### Plug-Ins

- ElasticHosts: Enables the dynamically increase capacity of your virtualized infrastructure to meet fluctuating peak demands using a cloud provider.

# The OpenNebula VM Manager

THANK YOU FOR YOUR ATTENTION!!!

More info, downloads, mailing lists at  
[www.OpenNebula.org](http://www.OpenNebula.org)

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[www.reservoir-fp7.eu/](http://www.reservoir-fp7.eu/)

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