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Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR

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Cloud Computing in a Nutshell

Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR

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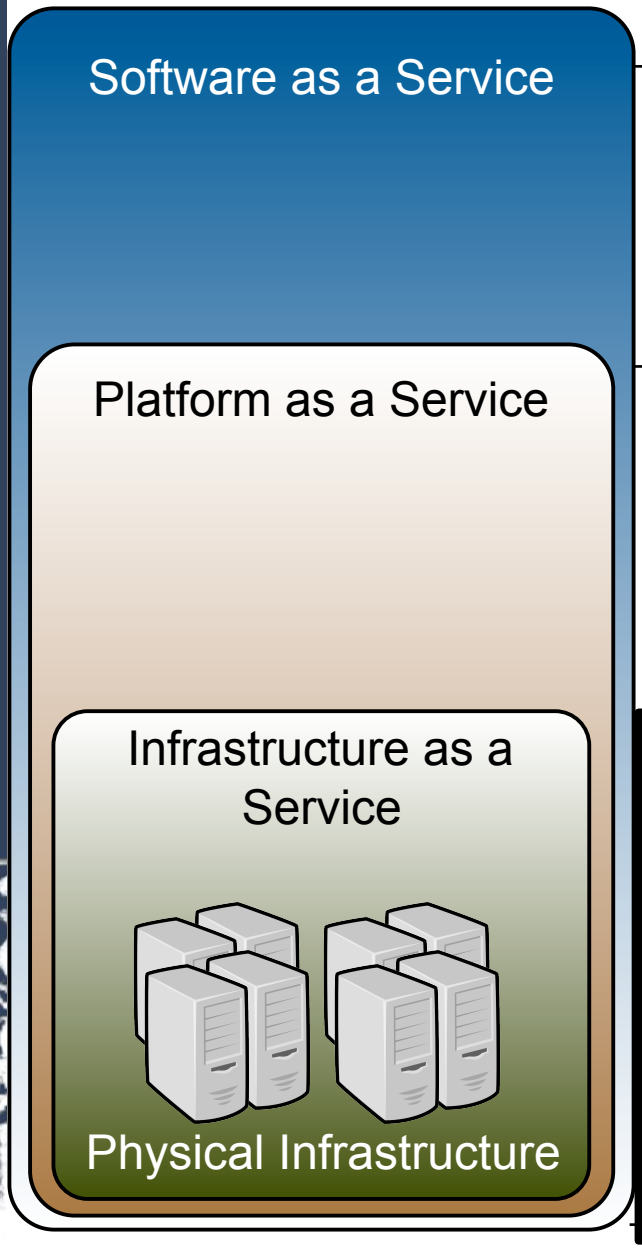

What	Who
On-demand access to any application	End-user **(does not care about hw or sw)**
Platform for building and delivering web applications	Developer **(no managing of the underlying hw & swlayers)**

OpenNebula.org

Innovative open, flexible and scalable technology to build IaaS clouds

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Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR

Innovations

Designed to address the technology challenges in cloud computing management

Standard-based Toolkit

OpenNebula v1.4

Community

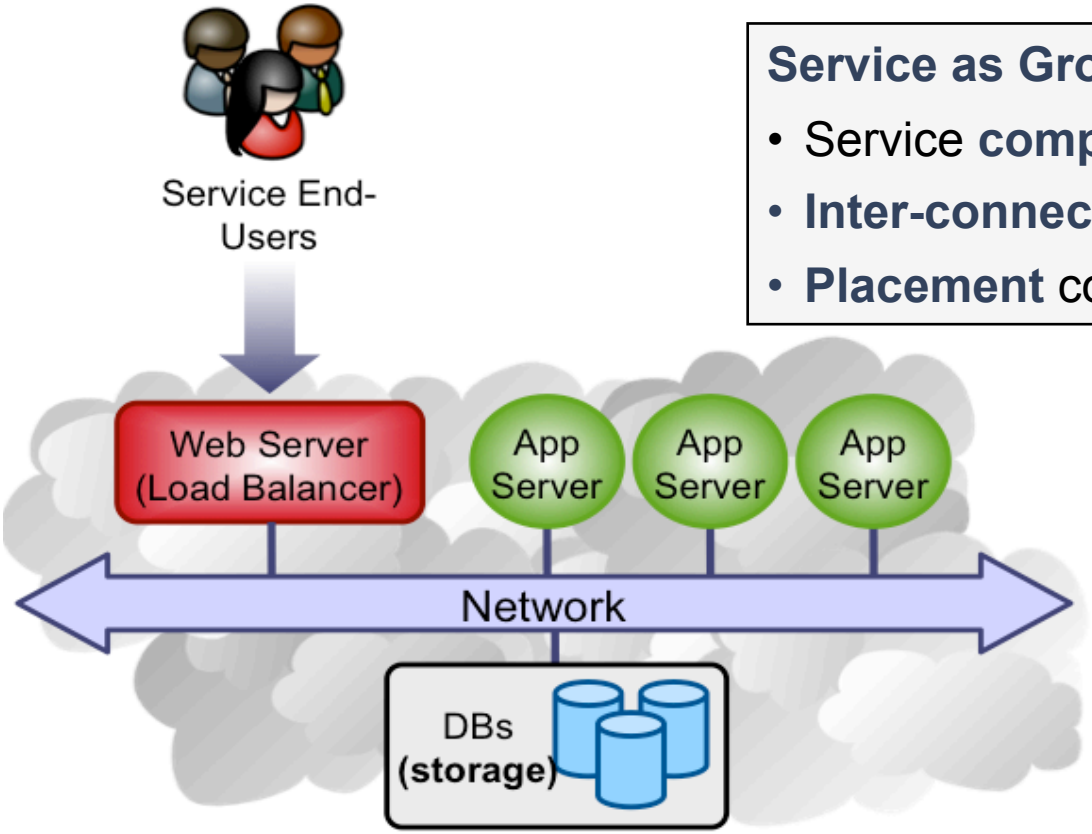
Users, projects and ecosystem

The Innovations: Infrastructure User View

Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR

Elastic Multi-tier Services

- Service as **basic management entity**
- Cloud Restful interface and CLI to **manage virtual machines, network and storage => Based on an open standard**
- **Concurrent support** for other popular interfaces (Amazon EC2)



Service as Groups of VMs

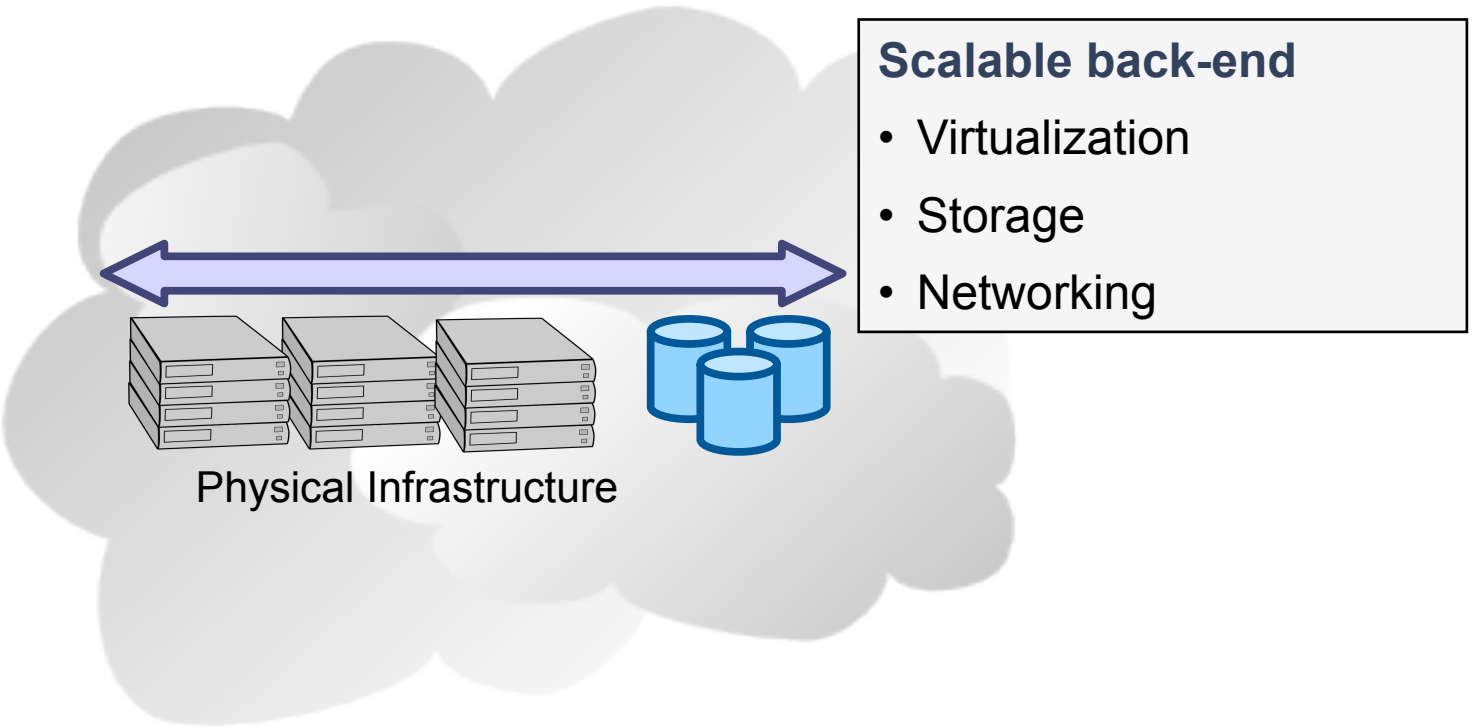
- Service **components** in VMs
- **Inter-connection** relationship
- **Placement** constraints

The Innovations: Infrastructure Manager View

Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR

Flexible, Efficient and Scalable Management of the Cloud

- **Administration interface** for the centralized monitoring and management of the infrastructure
- Support for the definition of workload and resource-aware **allocation policies** such as consolidation (energy efficiency) , load balancing, affinity-aware, capacity reservation…
- **Integration** with existing management tools in the data center



The Innovations: Infrastructure Manager View

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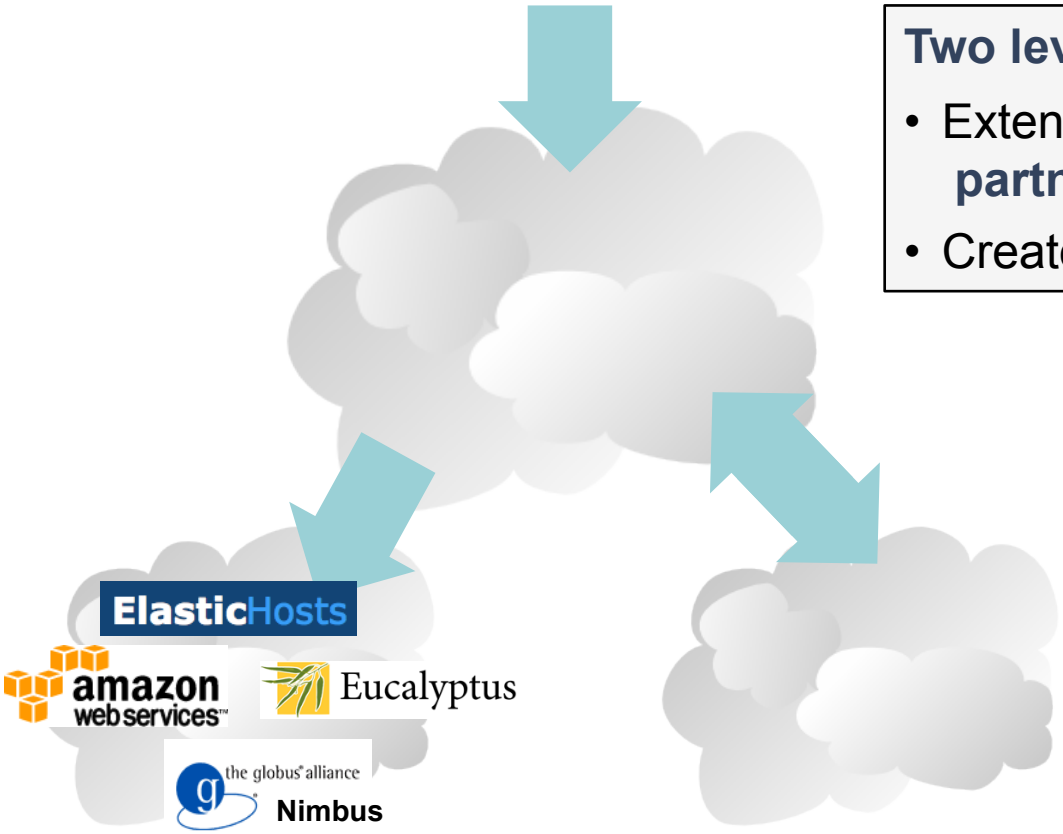
Hybrid Cloud Computing and Federation

- ***Cloudbursting* at infrastructure layer**, fully transparent to users
- **Scale-out decisions are taken by infrastructure administrators** according to business policies



Two levels of Collaboration

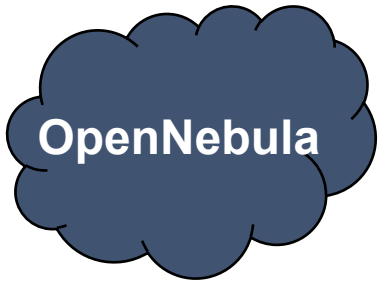
- Extend the private cloud using both **partner and commercial clouds**
- Create a **federation of clouds**

The Innovations: System Integrator View

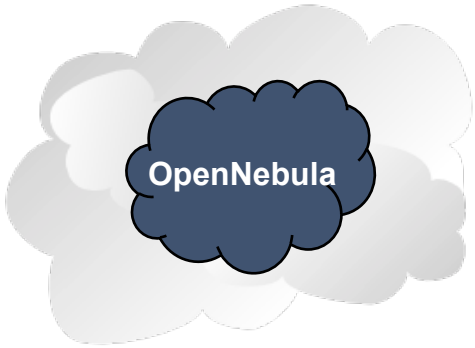
Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR

Open Architecture, Interfaces and Code

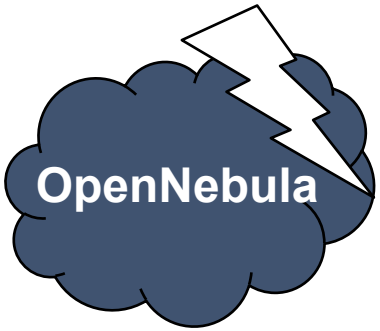
- **Integration with any product and service** in the virtualization/cloud ecosystem such as cloud providers, hypervisors, virtual image managers, service managers, management tools, schedulers…
- Support to **build any type of deployment**: private, public, hybrid and community clouds
- **Easy to enhance** to support new functionality
- **Easy to embed** into other Cloud applications and platforms
- **Liberal open-source license**



Out-of-the-box Cloud Solution



Embedded VM Orchestrator in PaaS and SaaS Solution



Platform for Innovative Projects

The Toolkit: OpenNebula 1.4

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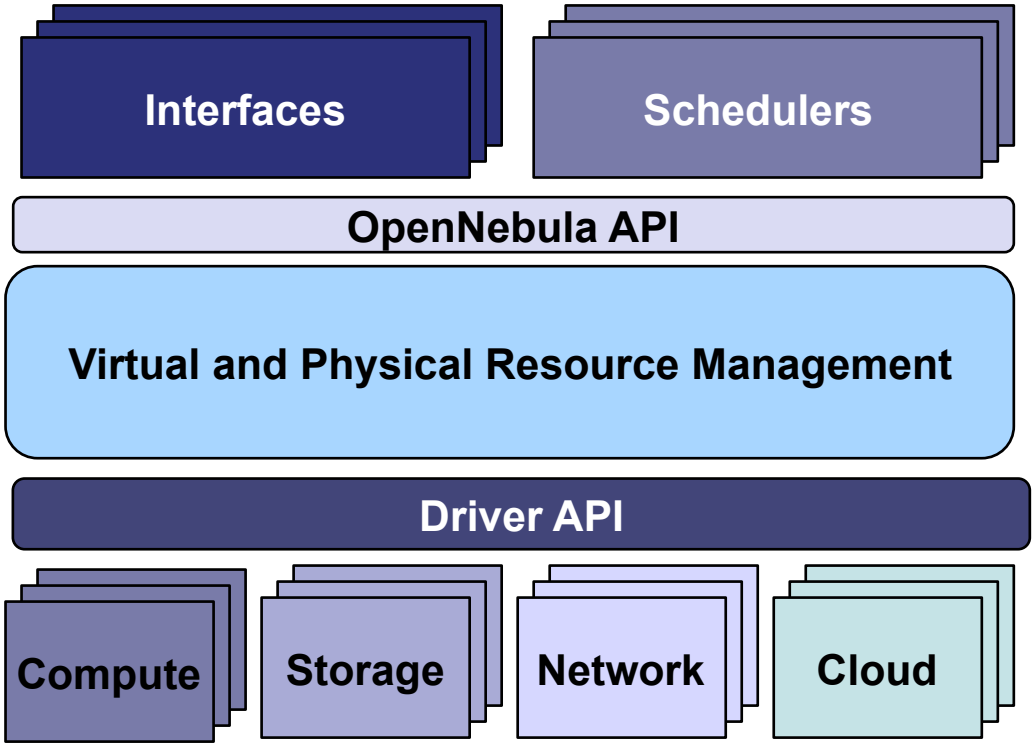
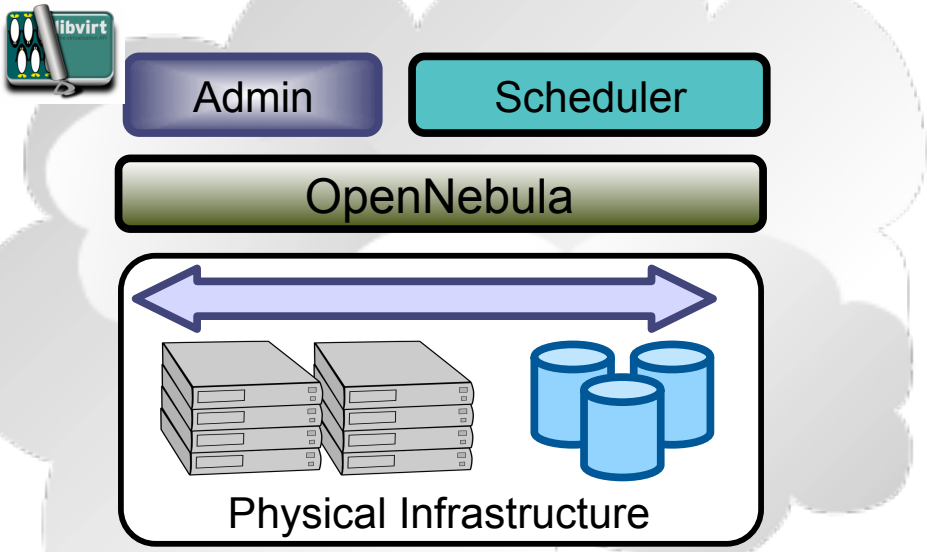
One Size does not Fit All: Tailoring the Tool to Fit your Needs

- Open, modular and extensible architecture
- Minium installation requirements (distributed in Ubuntu)
- Open Source – Apache 2



The Toolkit: Building a Private Cloud

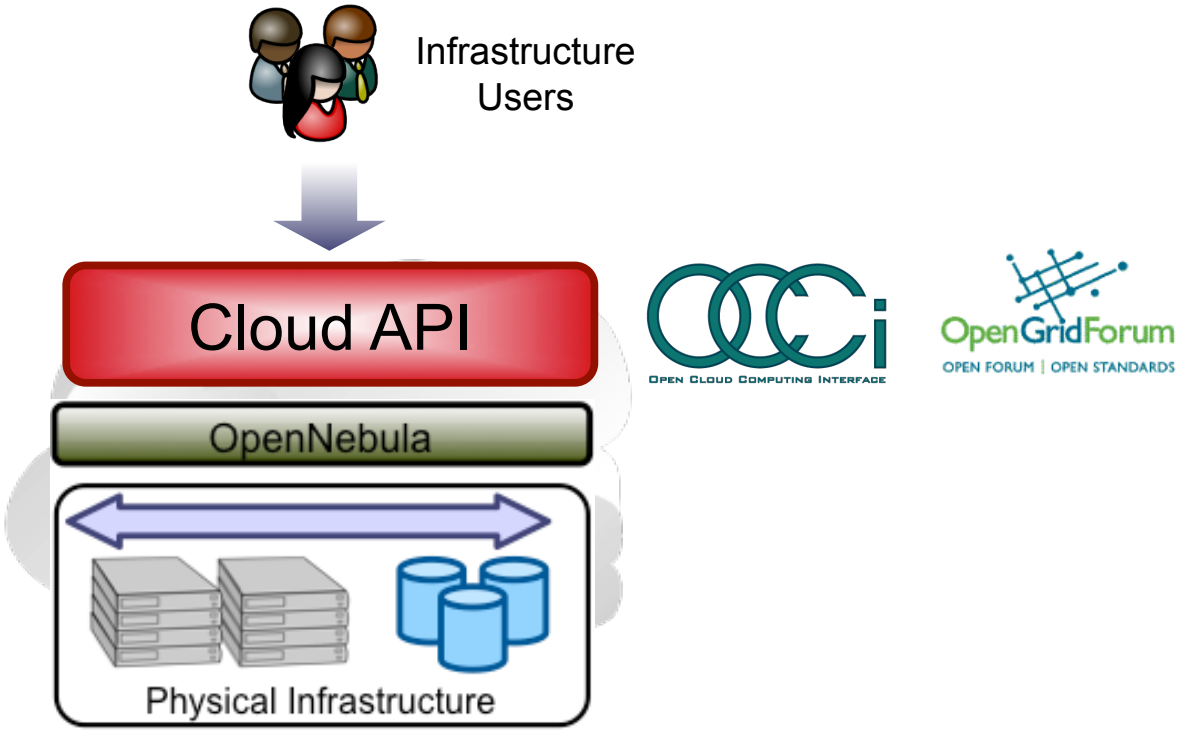
Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR



Feature	Function
Internal Interface	• Unix-like CLI for fully management of VM life-cycle and resources • XML-RPC API and libvirt virtualization API
Scheduler	• Requirement/rank matchmaker allowing the definition of workload and resource-aware allocation policies • Support for advance reservation of capacity through Haizea
Virtualization Management	• Xen, KVM, and VMware
Image Management	• General mechanisms to transfer and clone VM images
Network Management	• Definition of isolated virtual networks to interconnect VMs
Service Management and Contextualization	• Support for multi-tier services consisting of groups of inter-connected VMs, and their auto-configuration at boot time

The Toolkit: Building a Public Cloud

Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR



Feature	Function
Cloud Interfaces for Users	• Implementation of a subset of the EC2 Query API and OGF - OCCI
Flexibility	• The Cloud Service allows the implementation of new Cloud interfaces

The Toolkit: Building a Hybrid Cloud

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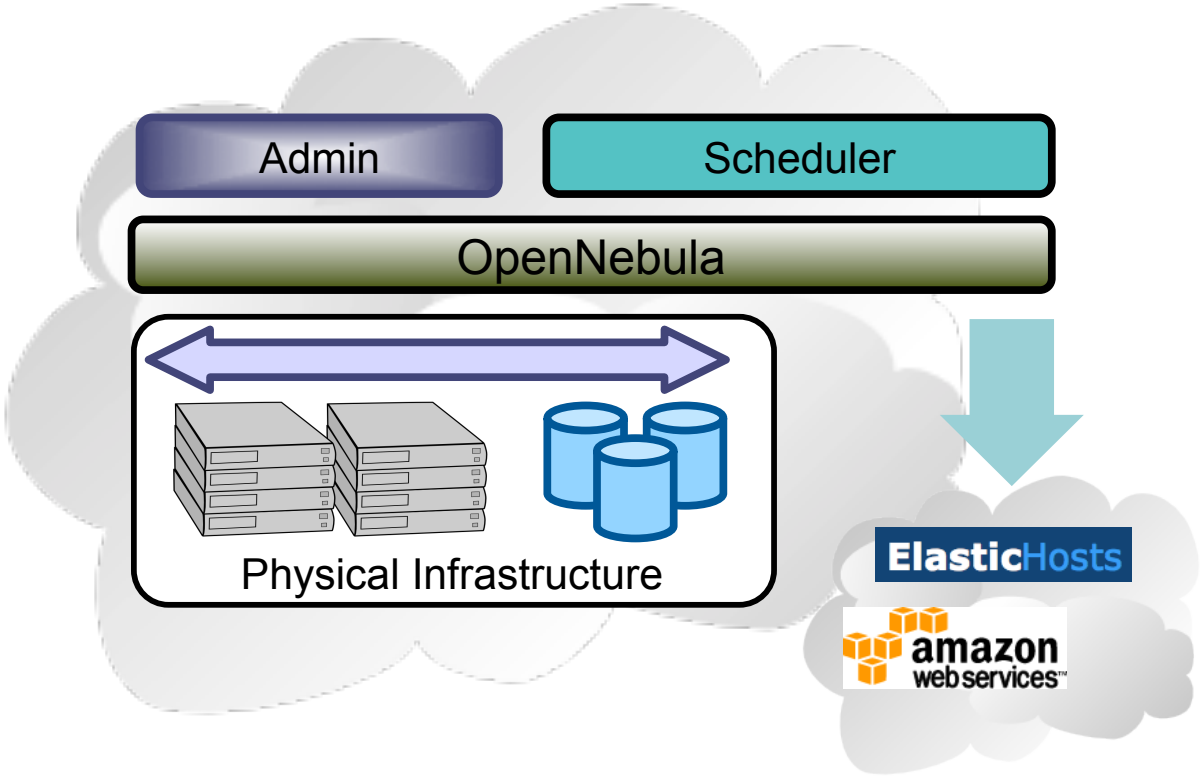

Feature	Function
Cloud Plugins	• Amazon EC2 and ElasticHosts connectors
Federation	• Support for simultaneous access to several remote clouds
Flexibility	• Modular approach to develop new connectors

The Community: Users

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Users (Different Levels of Use: From Experimental to Production)

esa esac european space astronomy centre

CERN

NIKHEF

NCHC

CRS4

VSTORM the ViRtual STORM is here... are you ready?

MindTree

Telefónica Telefónica Investigación y Desarrollo

MPS CONSORZIO OPERATIVO GRUPPOMONTEPASCHI

Projects

RESERVOIR

StratusLab

eGee Enabling Grids for E-sciencE

The Community: Active Ecosystem

Components around OpenNebula

- **Haizea Lease Manager (University of Chicago):** Advance reservation of capacity and queuing of best effort requests
- **RESERVOIR Policy Engine (IBM Haifa/Elsag Datamat):** Policy-driven probabilistic admission control and dynamic placement optimization to satisfy site level management policies
- **VM Consolidation Scheduler (UCM):** Periodic re-placement of VMs for server consolidation and suspension/resume of physical resources
- **Virtual Cluster Tool (CRS4 Distributed Computing Group):** Atomic virtual cluster management with versioning and multiple transport protocols.
- **Nephele (Telefonica I+D):** SLA-driven automatic service management
- **Under Development:** SUN Cloud API, vCloud API, VirtualBox plugin, dashboard for infrastructure management, new schedulers, SLA and security framework, Grid service manager, LVM and SAN support,…
- …

The Community: Ecosystem

Haizea Lease Manager

HAIZEA http://haizea.cs.uchicago.edu/

- Haizea is a lease manager that can act as a **scheduling backend for OpenNebula**, providing advanced functionality such as:
  - Advance reservation of capacity
  - Best-effort scheduling with backfilling
  - Resource preemption (using VM suspend/resume/migrate)
  - Policy engine, allowing developers to write pluggable scheduling policies in Python
- Includes a simulation mode (useful for researchers testing scheduling algorithms)
- Open source (Apache 2)

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Vision on the Future of Cloud Computing

Innovation for Cloud Infrastructure Management in OpenNebula/RESERVOIR

IT Resources will be the Next Utility

- **Future enterprise datacenters will look like private Clouds** supporting a flexible and agile execution of virtualized services, and combining local with public Cloud-based infrastructure to enable highly scalable hosting environments
- **Growing number of domain specific and regional Cloud providers implementing a utility computing business model** by offering pay per use resources on-demand
- **Public Clouds will be supported by a network of geographically distributed datacenters** for high availability, end-user service proximity, legal and policy issues…
- **Public Clouds will be interconnected to meet fluctuating demands**
- **Grid sites will offer infrastructure cloud-like interfaces** to address the new resource access demands from the community

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The Open Source Toolkit to Build Cloud Infrastructures

More info, downloads, mailing lists at
www.OpenNebula.org

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RESERVOIR
www.reservoir-fp7.eu/

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The OpenNebula Team

- Ruben S. Montero, Rafel Moreno, Tino Vazquez, Javier Fontan and Jaime Melis