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The OpenNebula Cloud Toolkit

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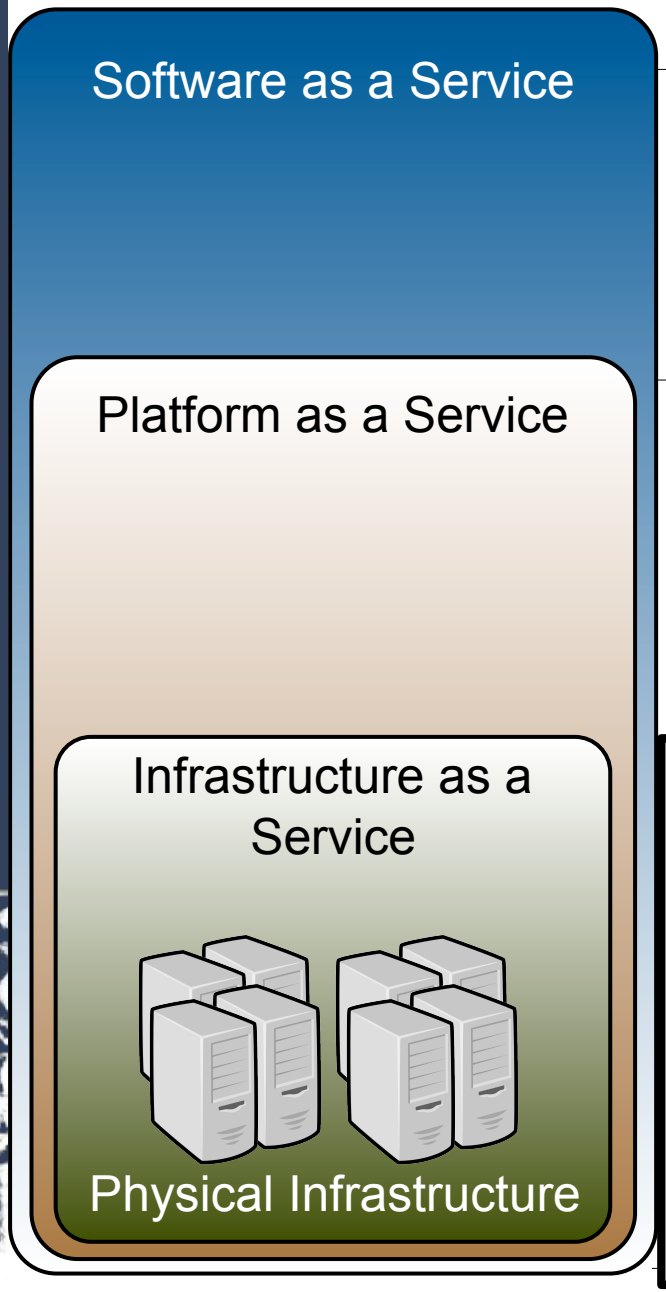
Position in the Cloud Ecosystem

The OpenNebula Cloud Toolkit



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 configure your own IT resources into a IaaS cloud

Transforming your IT Infrastructure into a Cloud

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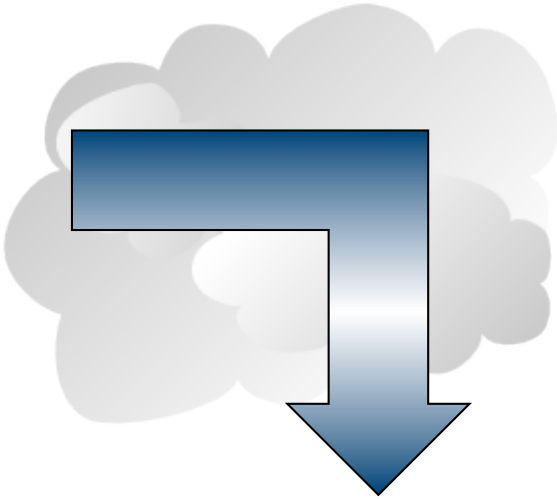
Commercial Cloud Provider

- **Flexible** and **elastic capacity** to meet dynamic demands of service
- **Ubiquitous network access**
- **Pay per use** and on-demand access



Building your Own Cloud

- **Optimize and Simplify Internal Operations**
  - **Centralized management** of all servers and services with dynamic resizing of infrastructure and dynamic allocation of capacity
  - **Higher utilization** and **operational saving** of existing resources with server consolidation and removal of application silos
  - **Lower infrastructure expenses** with combination of local and remote Cloud resources
- **Support new IT, scientific, or business Cloud services**

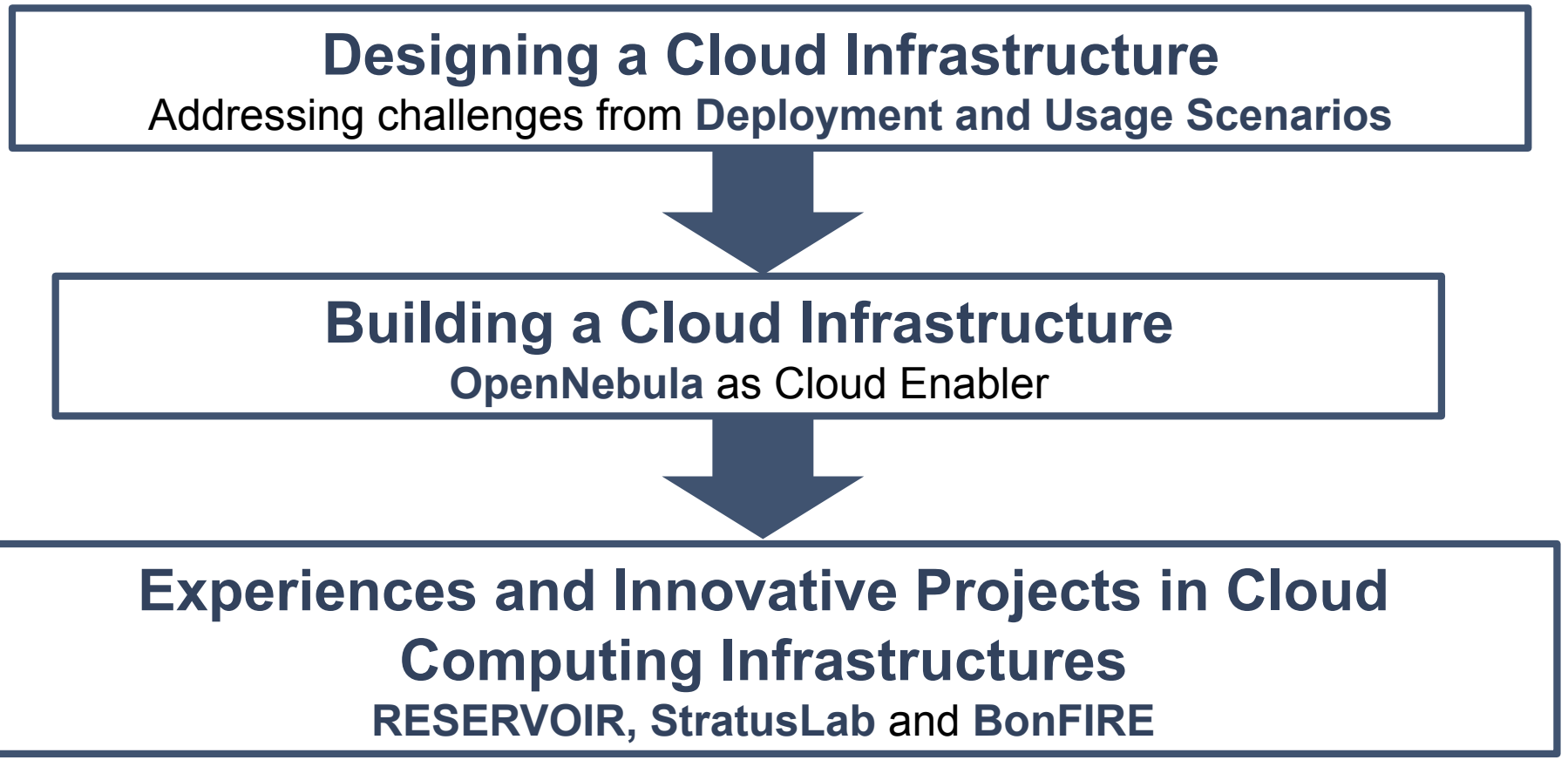
Deployment Models

The OpenNebula Cloud Toolkit

Model	Definition	Examples of Deployment
Private	Infrastructure is owned by a single organization and made available only to the organization	• Optimize and simplify **internal operation** • **SaaS**/**PaaS** support • IT consolidation within **large organizations** (Goverment Clouds, University Clouds…)
Public	Infrastructure is owned by a single organization and made available to other organizations	• **Commercial cloud providers** • **Community public clouds** by ICT service centers to enable scientific and educational projects to experiment with cloud computing • **Special purpose clouds** with dedicated capabilities (Science Clouds, HPC Clouds..) • **Regional clouds** to address regulatory or latency issues
Hybrid	Infrastructure is a composition of two or more clouds	• **Cloudbursting** to address peak demands • **Cloud Federation** to share infrastructure with partners • **Cloud Aggregation** to provide a larger resource infrastructure

Contents

The OpenNebula Cloud Toolkit



Designing a Cloud: A Design Driven by Requirements

The OpenNebula Cloud Toolkit

Requirements from Usage and Deployment Scenarios

- **Users:** Functionality exposed and workload profile
- **Managers:** Flexible, efficient and scalable management of the Cloud
- **Business:** Hybrid cloud computing and federation
- **Integrators:** Open architecture, interfaces and code

"One solution does not fit all requirements and constraints, a properly architected solution should fully align with your Cloud strategy"

Constraints from Existing Infrastructure and Processes in the Organization

Designing a Cloud: Flexible Cloud Manager

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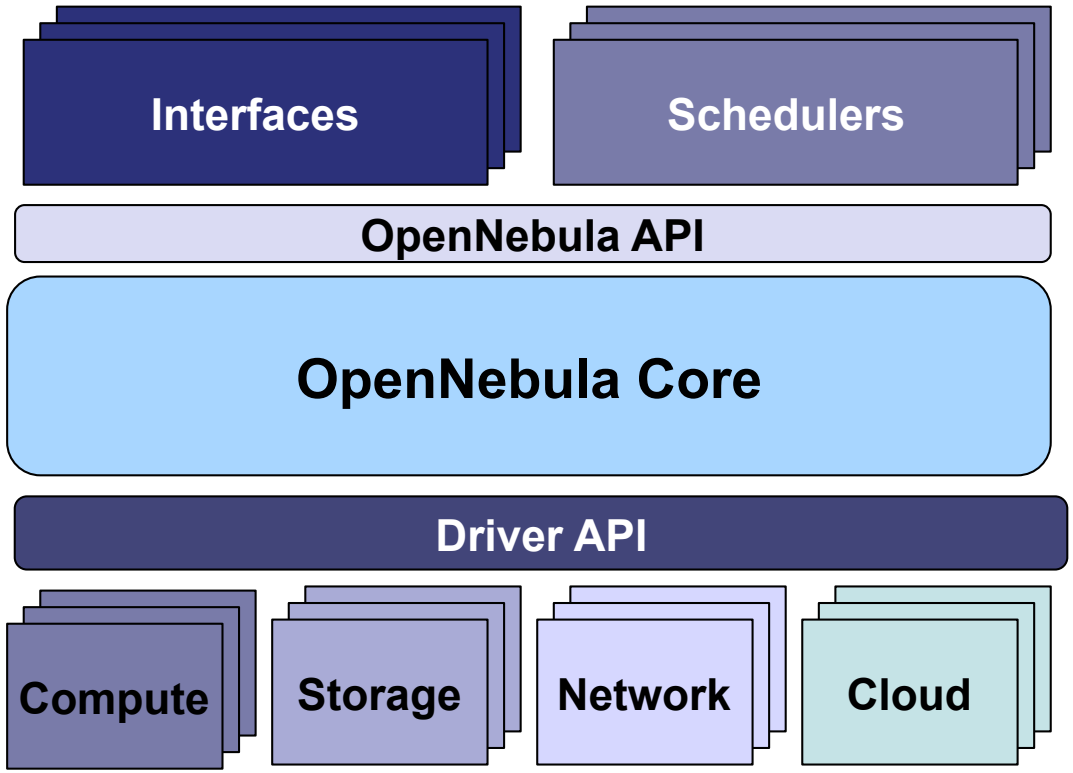
Cloud Manager as Enabler to Build Your Own Cloud

- Management of network, computing, remote cloud and storage capacity
- Management of virtual network, machine and storage life-cycles
- Workload placement and management of VM images
- Management of information, accounting and security
- **Interfacing with any infrastructure service**



Building a Cloud: OpenNebula as Cloud Enabler

The OpenNebula Cloud Toolkit

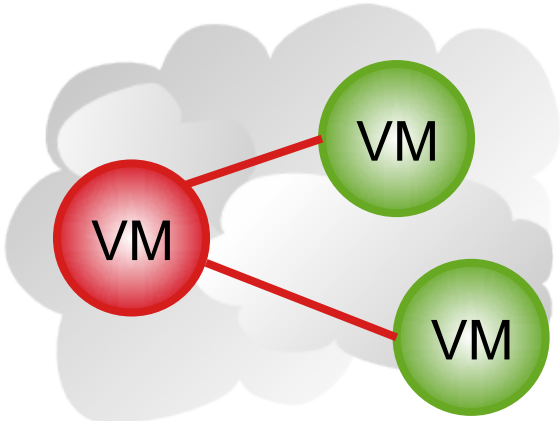
RESERVOIR

Innovations

Technology **challenges** in cloud computing management from **business use cases**

Open-source Toolkit

OpenNebula v1.4

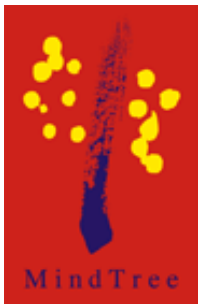


- **Open and flexible tool** to fit into any datacenter and integrate with any ecosystem component
- **Open-source** released under Apache v2.0, and distributed in Ubuntu
- **Most advanced solution** to build private, public, federated and hybrid clouds
- Based on **standards** avoid vendor lock-in and to enable interoperability
- **Efficient and scalable management** of the cloud

Building a Cloud: Experiences

The OpenNebula Cloud Toolkit

Different Levels of Use: From Experimental to Production



Building a Cloud: Experiences

The OpenNebula Cloud Toolkit

Deployment Cases

- A team at Clemson University and CERN has used OpenNebula to deploy thousands of VMs on 400 hosts (3,200 cores) running Xen
- OpenNebula was integrated in internal network and configuration management
- Contributed drivers for using LVM based disk images

- The Dgrid Resource Center Ruhr (DGRZR) has used OpenNebula to manage 248 Blades with a total of 1,984 cores.
- OpenNebula is used to support the execution of a virtualized Grid site in D-Grid and EGEE

- SARA High Performance Computing Center uses OpenNebula in its new HPC Cloud service on 128 cores across 16servers with KVM
- OpenNebula is used to support the execution of virtual clusters and HPC applications
- Authors of the OpenNebula Management Console

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Building a Cloud: OpenNebula Ecosystem

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Open Community for Cloud Computing

- **Haizea Lease Manager (University of Chicago):** Advance reservation of capacity and queuing of best effort requests
- **Cloud Management Console (SARA Computing and Networking Services):** Web interface for OpenNebula
- **Virtual Cluster Tool (CRS4 Distributed Computing Group):** Atomic virtual cluster management with versioning and multiple transport protocols.
- **DeltaCloud Driver (DSA-Research@UCM)**
- **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 (DSA-Research@UCM):** Periodic re-placement of VMs for server consolidation and suspension/resume of physical resources
- **Claudia (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,…

Building a Cloud: Innovative Projects

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European Projects on Cloud Computing Infrastructures

EU grant agreement 215605
Service and Sw Architectures and Infrastructures
(2008-2011)

Resources and Services Virtualization without Barriers
•Open source technology to enable deployment and management of complex IT services across different administrative domains

Proposal in negotiation
e-Infrastructure
(2010-2012)

Enhancing Grid Infrastructures with Cloud Computing
•Simplify and optimize its use and operation, providing a more flexible, dynamic computing environment for scientists.
•Enhance existing computing infrastructures with “IaaS” paradigms

Proposal in negotiation
New Infrastructure Paradigms and Experimental Facilities
(2010-2013)

Building Service Testbeds on FIRE
•Design, build and operate a multi-site cloud-based facility to support research across applications, services and systems targeting services research community on Future Internet

Innovative Projects: The Enabling Software Artefacts

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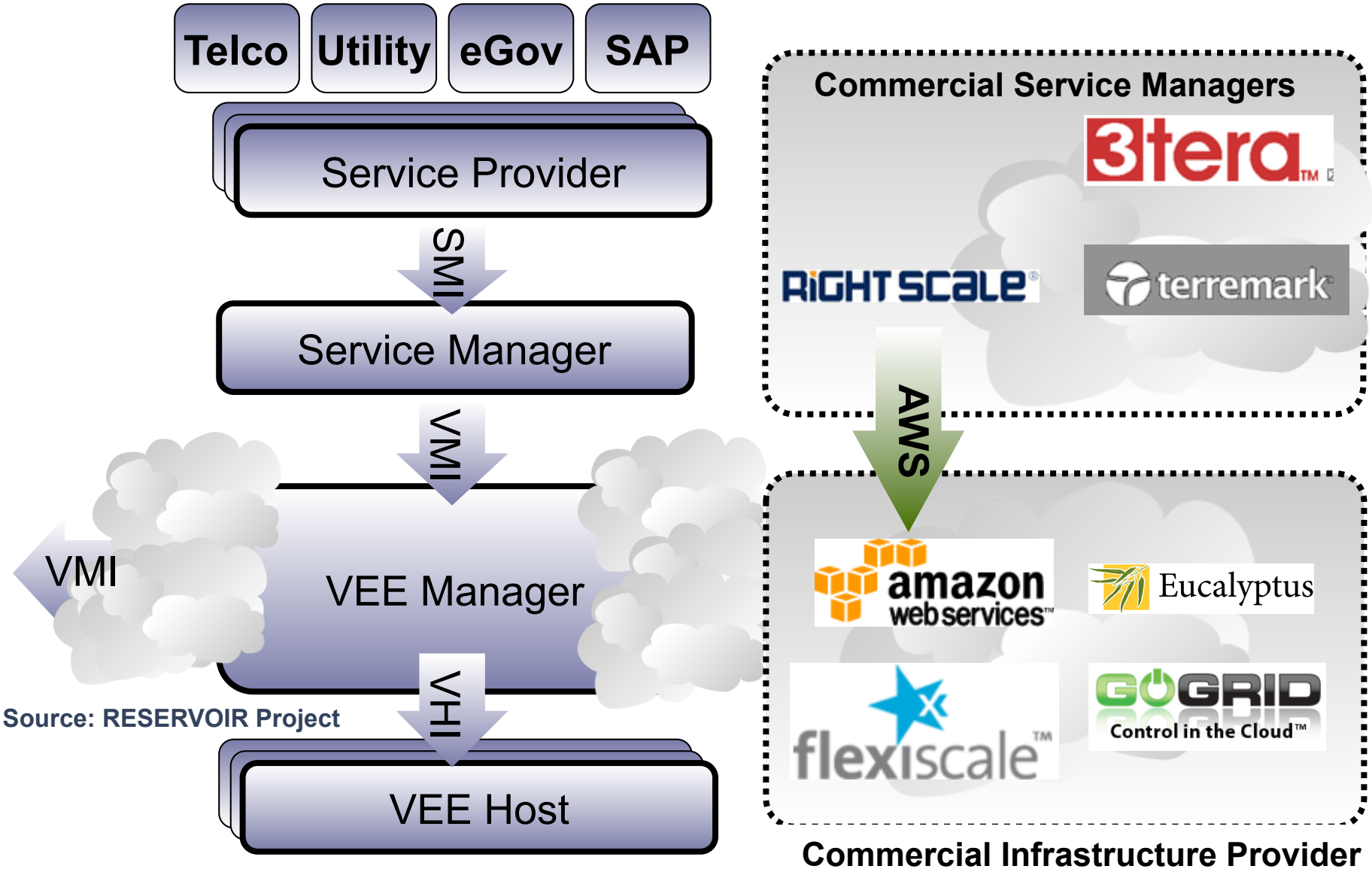
RESERVOIR **www.reservoir-fp7.eu**



Source: RESERVOIR Project

Innovative Projects: Enhancing Grid with Cloud

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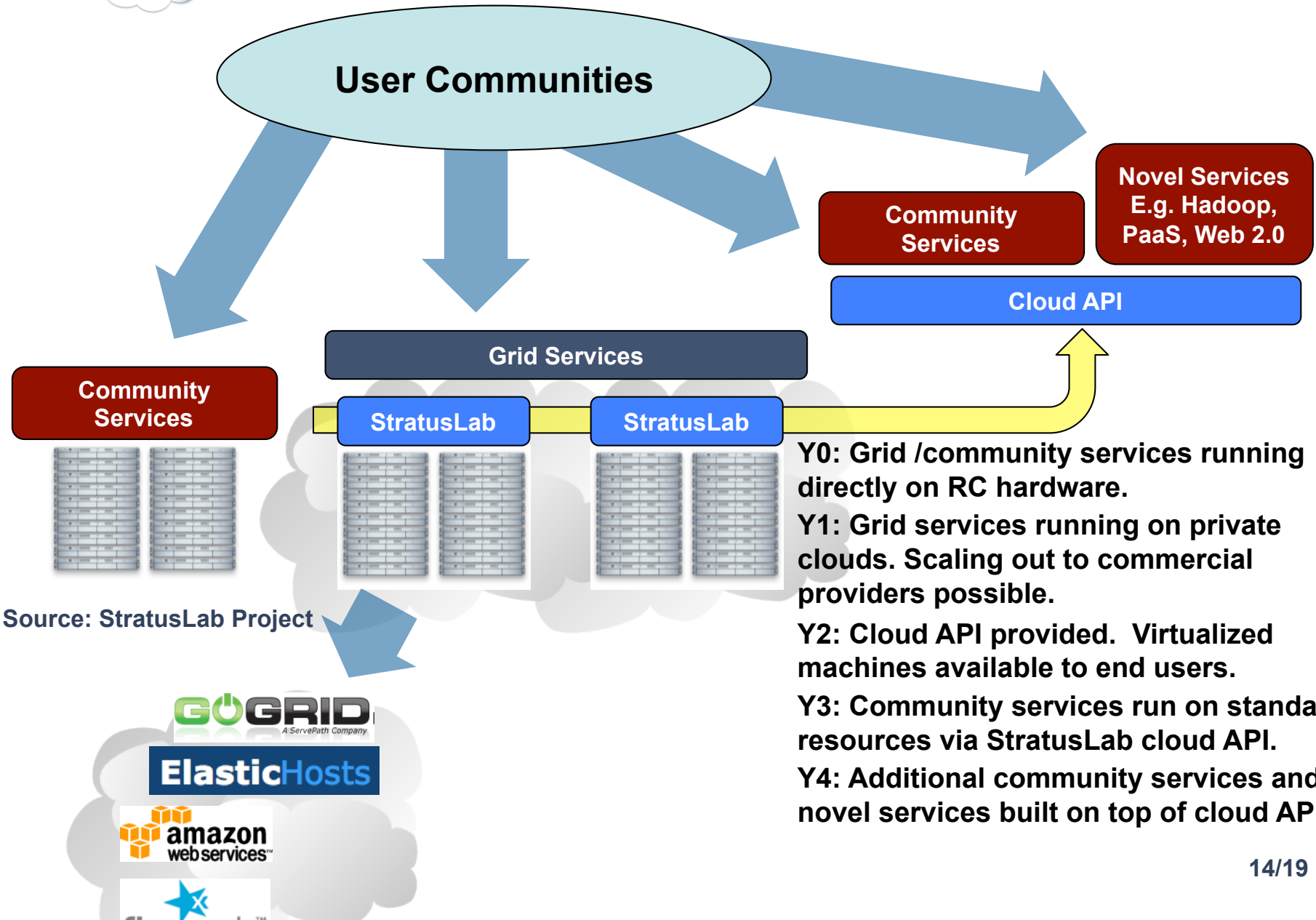
StratusLab **www.stratuslab.org**



Y0: Grid /community services running directly on RC hardware.

Y1: Grid services running on private clouds. Scaling out to commercial providers possible.

Y2: Cloud API provided. Virtualized machines available to end users.

Y3: Community services run on standard resources via StratusLab cloud API.

Y4: Additional community services and novel services built on top of cloud API.

Innovative Projects: Cloud for Service Experimentation

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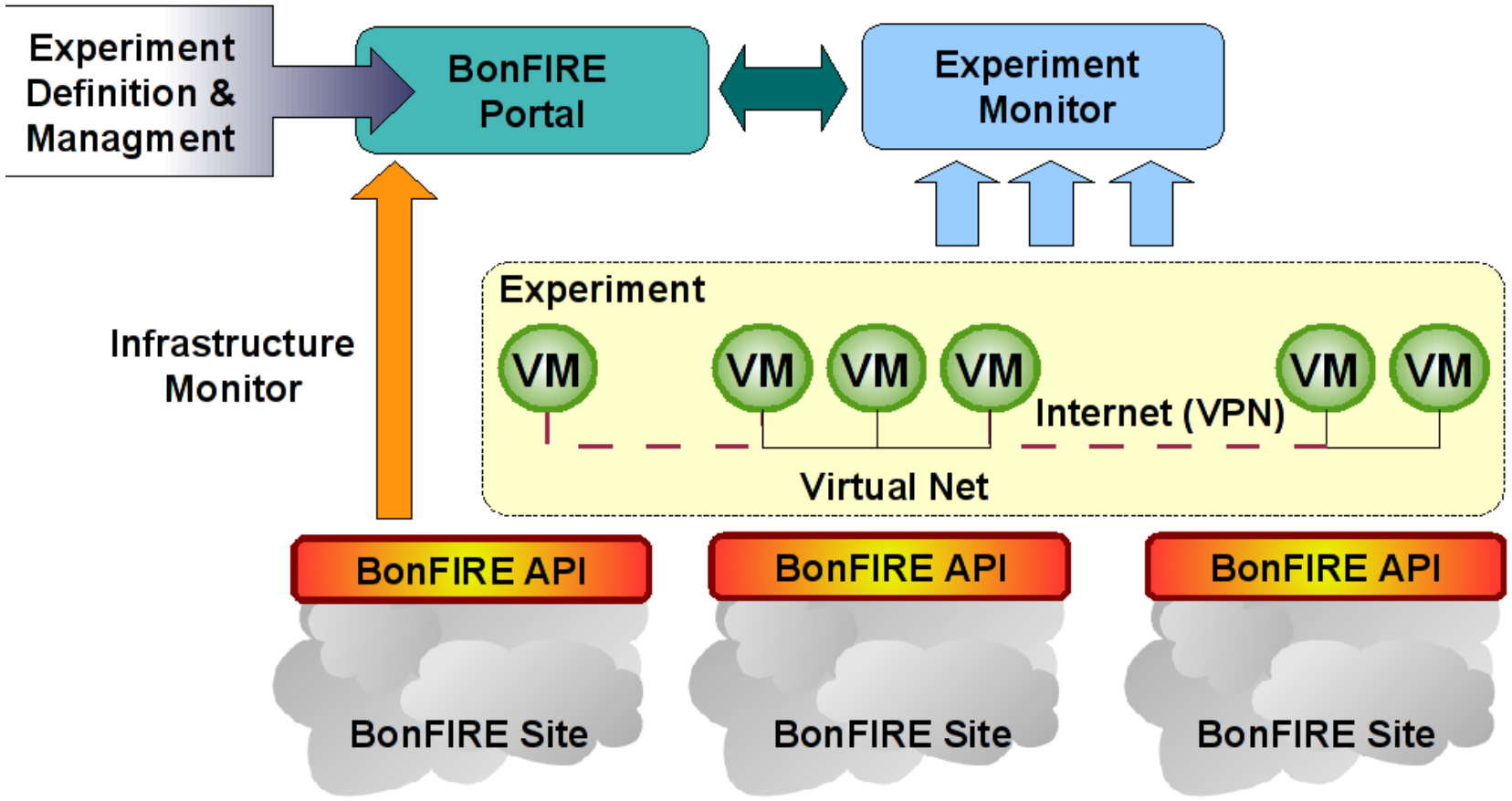
Building Service Testbeds on FIRE



Source: BonFIRE Project

Commercial Support: C12G.org

The OpenNebula Cloud Toolkit

Outlook

The OpenNebula Cloud Toolkit

About the Short-term Roadmap (2 months): v1.6

Feature	New Function
Scalability, Reliability and High Availability	• Support fro MySQL in the back-end • Unit-testing of the core • HTTP back-end
Functionality	• Image repository • Support for multiple clusters • CLI for accounting and billing support
Cloud Interfaces	• Improve compatibility with EC2 ecosystem

About the Medium-term Roadmap

- **Projects** funding OpenNebula
- **Community**

Funding

- New European Projects ensure the development and maintenance of OpenNebula until end of 2013
- C12G Labs also contributes to the sustainability of the open-source community

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Thanks

Funding Agencies

- **European Commission**: RESERVOIR 2008-2011, EU agreement 215605
- **Ministry Science&Innovation**: HPCcloud 2010-2012, MICINN TIN2009-07146
- **Community of Madrid**: MEADIANET 2010-2013 CAM S2009/TIC-1468

Other Sponsors

- **C12G Labs** dedicates an amount of its own engineering resources to support and develop OpenNebula

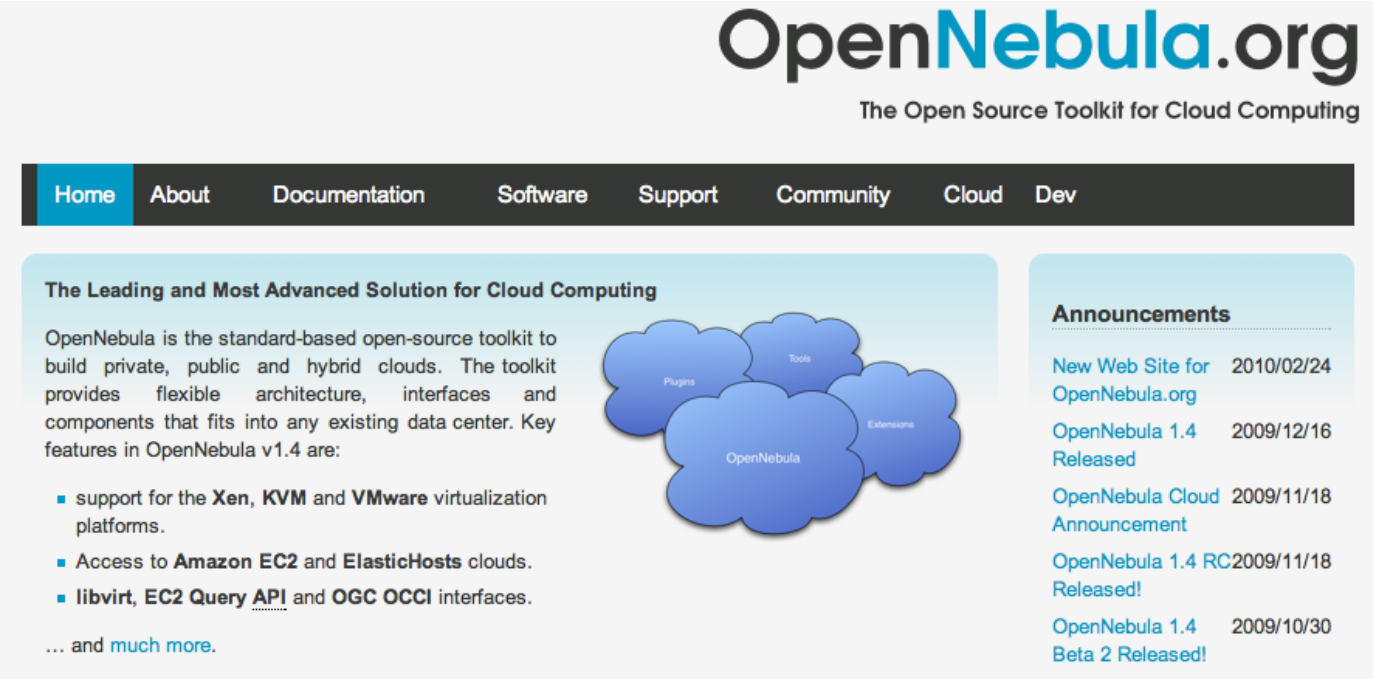
The OpenNebula Community

- **The OpenNebula Team**: Ignacio M. Llorente, Ruben S. Montero, Tino Vazquez, Javier Fontan, Jaime Melis, Carlos Martín, Rafael Moreno, Daniel Molina, and Borja Sotomayor
- … and many **value community contributors** from several organizations

Your support and contribution are very much appreciated!

More Information

More info, downloads, mailing lists at



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