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OpenNebula
The Open-Source Toolkit for Cloud Computing

Eduardo Huedo
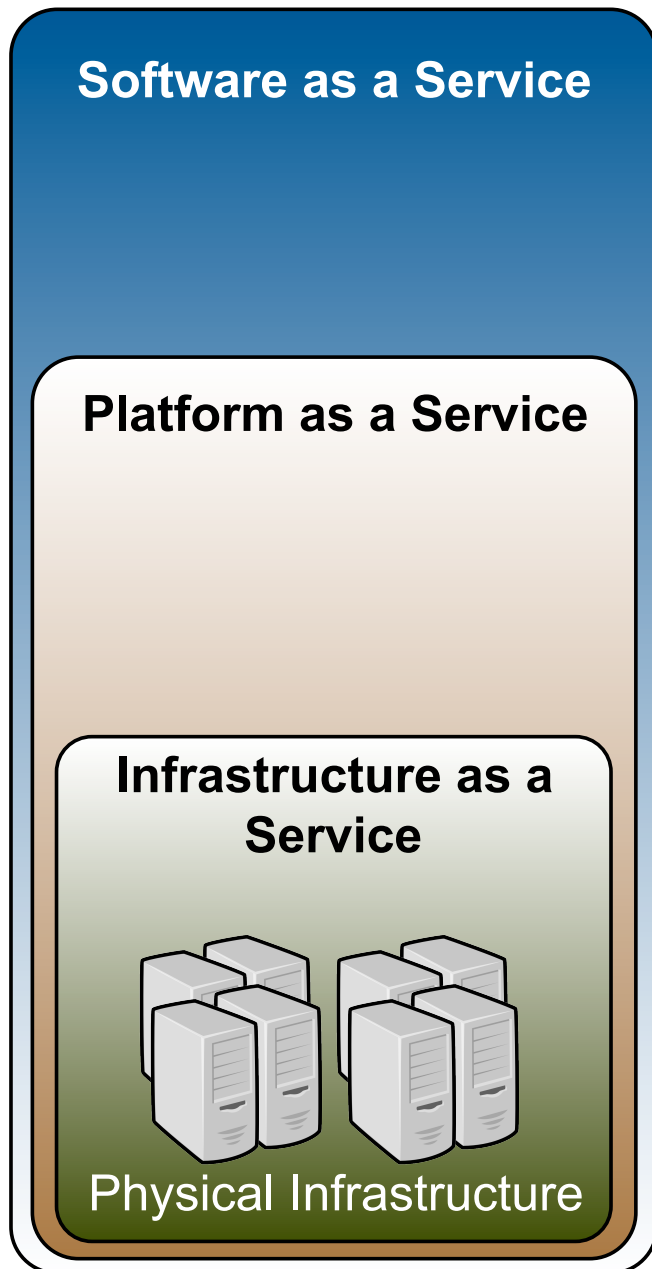
DSA-Research.org
Distributed Systems Architecture Research Group
Universidad Complutense de Madrid

- IaaS Cloud Computing

- The OpenNebula Open-source Toolkit

- Who is Using OpenNebula?

- Get Involved in the OpenNebula Community!

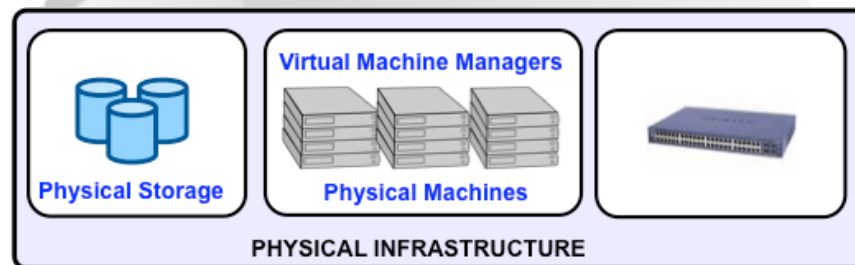|	What	Who
Software as a Service	**On-demand access to any application**	End-user **(does not care about hw or sw)**
Platform as a Service	**Platform for building and delivering web applications**	Developer **(no managing of the underlying hw & swlayers)**
Infrastructure as a Service	*Raw* **computer infrastructure**	System Administrator **(complete management of the computer infrastructure)**
Physical Infrastructure		

Commercial Cloud Provider

- **Flexible elastic capacity** to meet dynamic demands of service
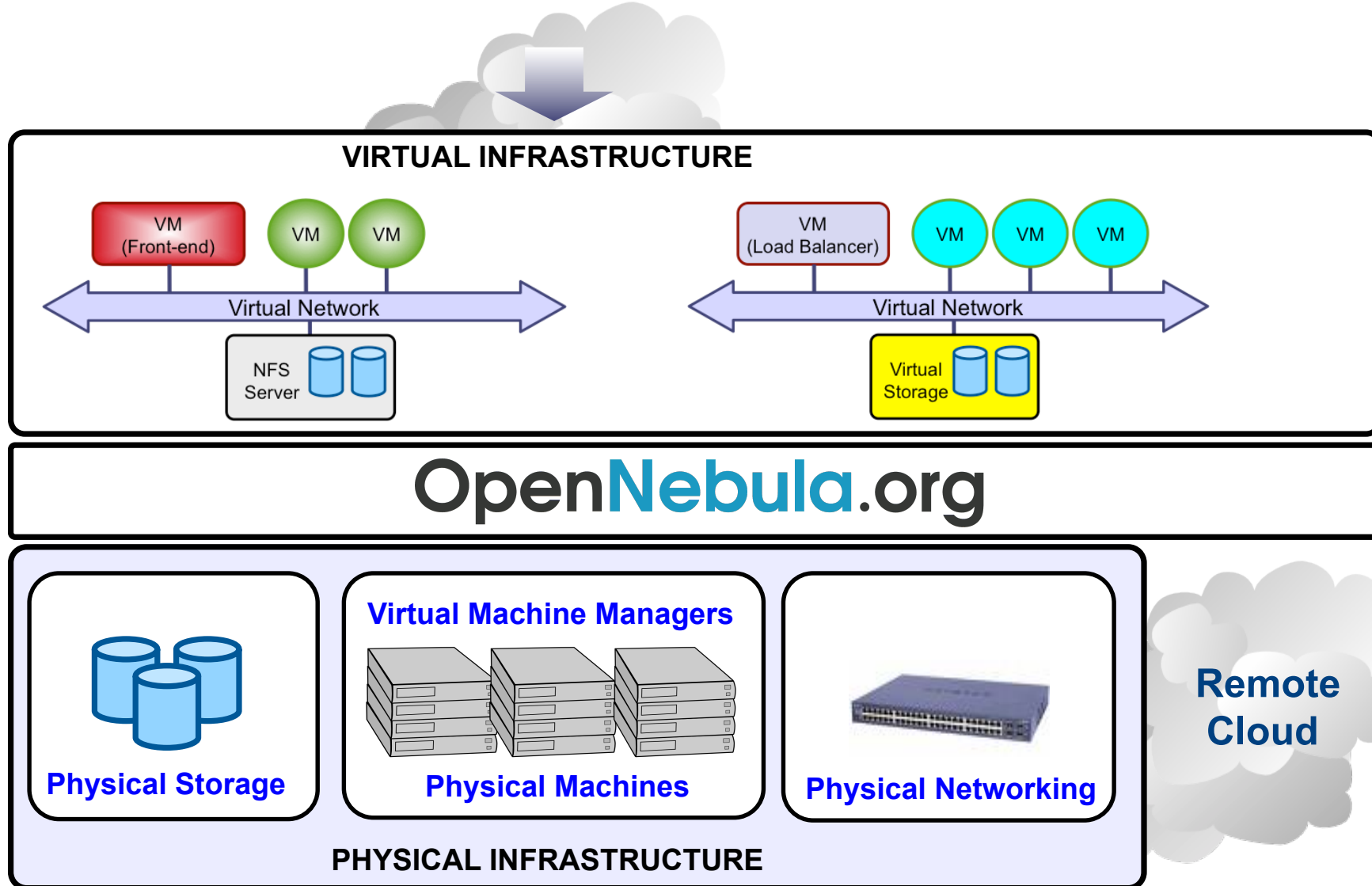- **Ubiquitous network access**
- **Pay per use**
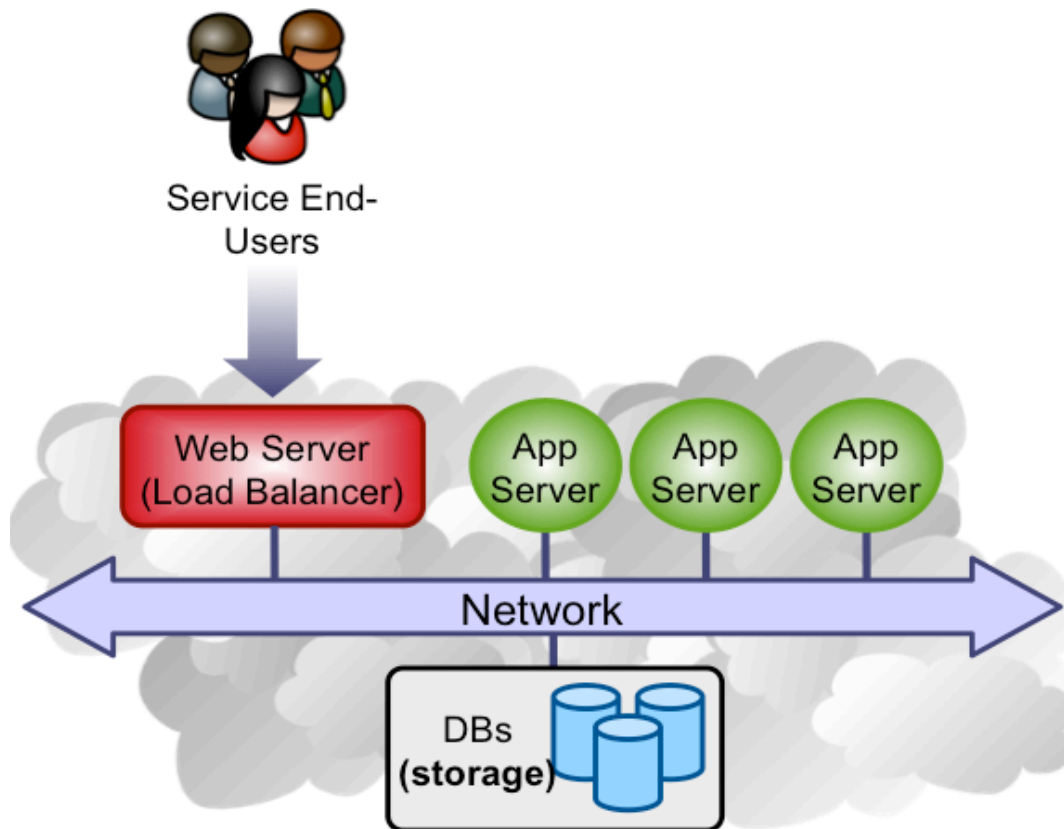
Building your Own Cloud

- **Build your Private Cloud** to 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

- **Build your Hybrid Cloud** to lower infrastructure expenses with combination of local and remote Cloud resources

- **Build your Public Cloud** to support new IT, scientific, or business Cloud services

Cloud Manager to Orchestrate the Complexity of a Datacenter

Service End-Users

VIRTUAL INFRASTRUCTURE

VM (Front-end) — VM — VM

Virtual Network

NFS Server

VM (Load Balancer) — VM — VM — VM

Virtual Network

Virtual Storage

OpenNebula.org

PHYSICAL INFRASTRUCTURE

Physical Storage

Virtual Machine Managers

Physical Machines

Physical Networking

Remote Cloud

Flagship International Projects in Cloud Computing
Result of many years of research and development in efficient and scalable management of virtual machines on large-scale distributed infrastructures.
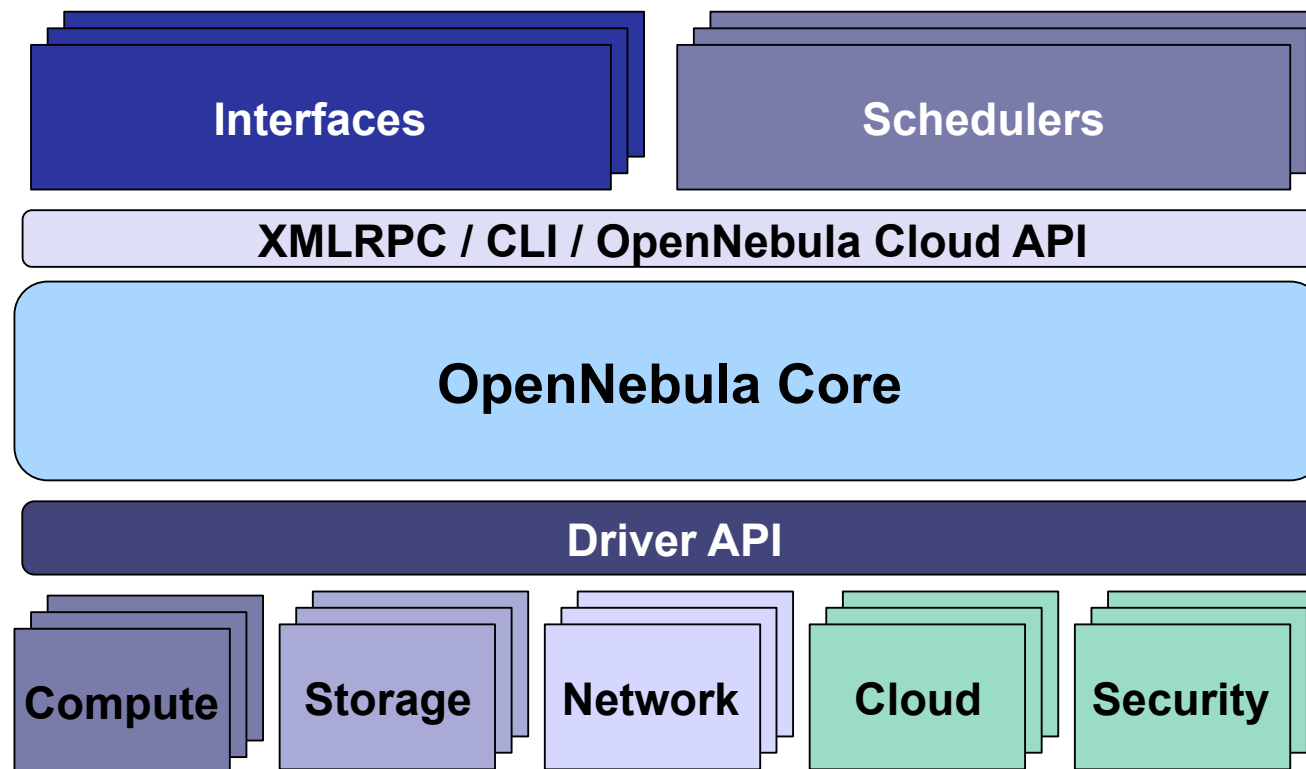
Open-source Toolkit
Open platform for innovation to research the challenges that arise in cloud management, and production-ready tool in both academia and industry
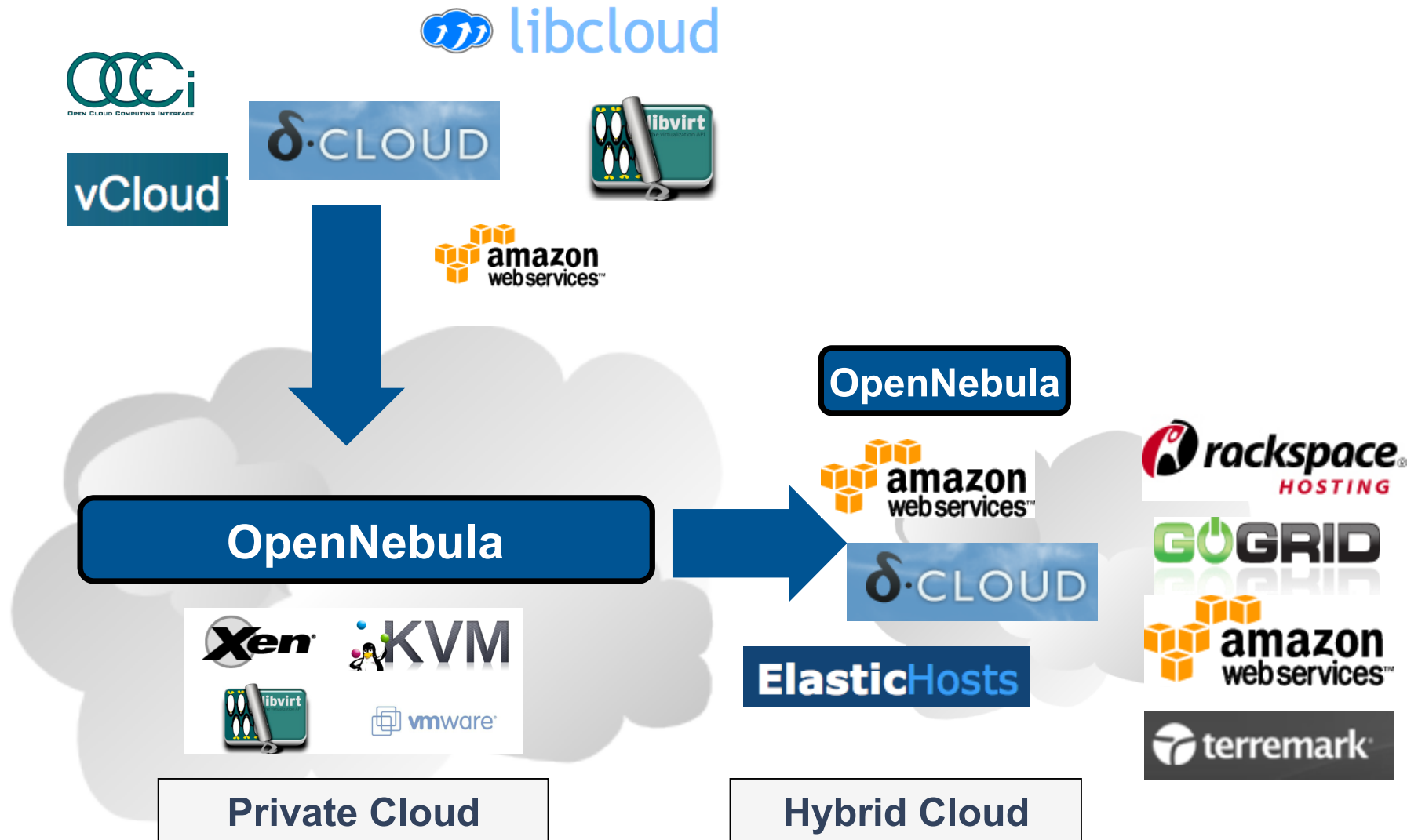
- **Started in 2005, first release in march 2008, and ONE 2.0 RC is available**

- **Open-source** released under Apache v2.0, packaged for main Linux distributions

- Mailing lists for **best-effort support** and **open development framework**

- Development and roadmap definition **driven by the community and projects**

- Active and engaged **open community and ecosystem**

- > **3,000 downloads/month** (not including code repository and Ubuntu)

- Used in many **production environments**, distributed in **commercial solutions** and availability of **commercial professional support**

- **Long-term sustainability** ensured by project funding and commercial sponsors

A Highly Modular Architecture to Fit into any Existing Datacenter

- One solution can not fit all data-center and user requirements and constraints

- Open, flexible and extensible architecture

- Provide basic components, but allow them to be easily replaceble by others

Interfaces	Schedulers

XMLRPC / CLI / OpenNebula Cloud API

OpenNebula Core

Driver API

Compute	Storage	Network	Cloud	Security

A Powerful Tool for Interoperability

The OpenNebula Open-Source Toolkit

Why OpenNebula?

Capabilities for Cloud Management
Most advanced open-source toolkit for building private, public and hybrid clouds, offering state-of-the-art unique features for Cloud Management to administer the complexity of large-scale distributed infrastructures

Capabilities for Integration
Open, flexible and extensible architecture, interfaces and components that fit into any existing data center; and enable its integration with any product and service in the Cloud and virtualization ecosystem, and management tool in the data center

Capabilities for Production Environments
Scalability and performance tested on very large-scale infrastructures consisting of thousands of cores, with the security and fault tolerance levels required in production

Leverage the Vibrant Cloud Ecosystems
Leverage the ecosystems being built around OpenNebula and the most common cloud interfaces, Amazon AWS, OGC OCCI and VMware vCloud

Building a Cloud to Support Computing

Who is Using OpenNebula?

As a Tool for Innovation in Cloud Computing Management

RESERVOIR

Agreement 215605 (2008-2011)
Service and Sw Architectures and Infrastructures

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

4CaaSt

Agreement 258862 (2010-2013)
Service and Sw Architectures and Infrastructures

Building the PaaS Cloud of the Future
• Create an advanced PaaS Cloud platform which supports the optimized and elastic hosting of Internet-scale multi-tier applications

StratusLab

EU grant agreement RI-261552
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; and enhance existing computing infrastructures with "IaaS" paradigms

BonFIRE

Agreement 257386 (2010-2013)
New Infrastructure Paradigms and Experimental Facilities

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

Get Involved in the OpenNebula Community!

Sponsors

dsa-research.org

- **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
- New EU Projects (StratusLab, BonFIRE, 4CaaSt) provide **funding until 2013**

C12G LABS

- **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, Borja Sotomayor…

- … and many **value community contributors** from several organizations

Your support and contribution are very much appreciated!

Get Involved in the OpenNebula Community!

Use the Technology and Give us Feedback

- Support through several mailing lists
- Report bugs and make feature requests
- Describe your use case in our blog
- Participate in the OpenNebula Technology Days

Contribute to the Development

- Open development infrastructure
- Provide patches for bug fixes or enhancements

Contribute to the Quickly Growing Ecosystem

- Submit a new tool or extension to the OpenNebula ecosystem

Sponsor the Community

- Provide funds or resources to support development or to organize workshops or tutorials

More info, downloads, mailing lists at

Research References

- B. Rochwerger, J. Caceres, R.S. Montero, D. Breitgand, E. Elmroth, A. Galis, E. Levy,I.M. Llorente, K. Nagin, Y. Wolfsthal, *"The RESERVOIR Model and Architecture for Open Federated Cloud Computing"*, **IBM Systems Journal**, Vol. 53, No. 4. (2009)
- B. Sotomayor, R. S. Montero, I. M. Llorente and I. Foster, *"Virtual Infrastructure Management in Private and Hybrid Clouds"*, **IEEE Internet Computing**, September/October 2009 (vol. 13 no. 5)