HPC Cloud Computing with OpenNebula

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- What is Cloud Computing?
- What is OpenNebula?
- HPC and Science Cloud Computing
- HPC Cloud Computing at SARA and BiG Grid
# What is Cloud Computing?

Cloud computing is the delivery of computing services over the internet. These services can be software services (Software as a Service - SaaS) or infrastructure services (Infrastructure as a Service - IaaS).

## Types of Cloud Services for Provision of IT Capabilities as a Service

<table>
<thead>
<tr>
<th>What</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-demand access to any application</td>
<td>End-user (does not care about hw or sw)</td>
</tr>
<tr>
<td></td>
<td><img src="skype.png" alt="skype" /> <img src="gmail.png" alt="gmail" /> <img src="facebook.png" alt="facebook" /></td>
</tr>
<tr>
<td>Platform for building and delivering web applications</td>
<td>Developer (no managing of the underlying hw &amp; sw layers)</td>
</tr>
<tr>
<td></td>
<td><img src="windows-azure.png" alt="windows-azure" /> <img src="force.com.png" alt="force.com" /></td>
</tr>
<tr>
<td>Raw computer infrastructure</td>
<td>System Administrator (complete management of the computer infrastructure)</td>
</tr>
<tr>
<td></td>
<td><img src="gocgrid.png" alt="gocgrid" /> <img src="rackspace.png" alt="rackspace" /> <img src="flexiscale.png" alt="flexiscale" /> <img src="amazon.png" alt="amazon" /></td>
</tr>
</tbody>
</table>

Software as a Service

Platform as a Service

Infrastructure as a Service

Physical Infrastructure
What is Cloud Computing?

Provision of Virtualized Resources as a Service

• Management Console
  • Simple REST API’s

• Raw infrastructure resources

• Pay-as-you-go & elastic capacity

Manage Instances
What is OpenNebula?

IaaS Cloud Computing Tool for Managing a Data Center's Virtual Infrastructure

Adaptable
- Customizable and Extensible

Proven
- Many Massive Scale Production Deployments

Powerful and Innovative
- Advanced Enterprise-class Functionality

No Lock-in
- Platform Independent and Interoperable

Interoperable
- Popular cloud APIs and standard based

Openness
- Fully open-source
- Apache license

HPC Cloud Computing with OpenNebula
What is OpenNebula?

Building the Industry Standard Open Source Cloud Computing Tool

- Develop & innovate
- Support the community
- Collaborate

OpenNebula.org

- Third party scalability tests: 16000 VMs
- Commercial Support
  C12G LABS


TP v1.0 v1.2 v1.4 v2.0 v2.2 V3.0

dsa group doing research...

Ubuntu Debian openSUSE

4,000 downloads/month

European Funding

HPC Cloud Computing with OpenNebula
What is OpenNebula?

Organizations Building Clouds and Innovative Projects

Organizations Building Clouds for Development, Testing and Production

Projects Building an Open Cloud Ecosystem Around OpenNebula

HPC Cloud Computing with OpenNebula
## What is OpenNebula?

### Different Models of Deployment

<table>
<thead>
<tr>
<th>Model</th>
<th>Definition</th>
<th>Cloud Cases</th>
</tr>
</thead>
</table>
| 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**  
  (Government Clouds, University Clouds...) |
| Public        | Infrastructure is owned by a single organization and made available to other organizations over the Internet | • **Commercial cloud providers**, mostly hosting providers to offer low cost solutions with limited control/configuration and security/reliability good enough  
• **Science public clouds** to enable scientific and educational projects or to experiment with cloud computing |
| Virtual Private | Infrastructure is owned by a single organization and made available to other organization over a dedicated private network | • **Telecom cloud providers** to offer premium solutions with additional control/configuration and security/reliability |
Deployment Scenarios

- **Private clouds as infrastructure tool** for hosting virtualized computing environments (job managers or pre-defined scientific platforms)
- **Public clouds as provisioning tool** for providing users with “HPC cluster as a service” resource provisioning using cloud interfaces
HPC and Science Cloud Computing

OpenNebula as an Infrastructure Tool

Access

Grid Middleware

Middlewares

LRMS (LSF, PBS, SGE...)

Service

Virtual Worker Nodes

Provision

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- Common interfaces
- Grid integration

- Custom environments
- Dynamic elasticity

- Consolidation of WNs
- Simplified management
- Physical – Virtual WNs
- Dynamic capacity partitioning
- Faster upgrades
HPC and Science Cloud Computing

OpenNebula as an Provisioning Tool

- Simple Provisioning Interface
- Raw/Appliance VMs
- Dynamic scalable computing
- Custom access to capacity
- Not only batch workloads
- Not only scientific workloads
- Improve utilization
- Reduced service management
- Cost efficiency
HPC Cloud Computing at SARA and BiG Grid

BiG Grid and SARA as Leaders in HPC Cloud Computing Services

Pioneers in Design and Deployment of HPC Clouds

- OpenNebula is only one of the components
- Deployment and integration are very complex tasks
- There is a lot of complexity behind this portal to make your life easier

A Mutually Beneficial Collaboration

- Early adopters of the software contributed to beta testing of the code
- Authors of the well-known OpenNebula Management Console
Questions?

We Will Be Happy to Answer Any Question

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