Getting Started Hacking on OpenNebula

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Acknowledgments

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Agenda

● What is IaaS?
● What is OpenNebula?
● Demo!
● OpenNebula from the…
  ● Cloud provider perspective
  ● Cloud integrator perspective
● Advanced Deployments
● OpenNebula Apps
● How to try it out
### What is IaaS?

#### Types of Cloud Computing

<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>Platform for building and delivering web applications</td>
<td>Developer (no managing of the underlying hw &amp; sw layers)</td>
</tr>
<tr>
<td>Raw computer infrastructure</td>
<td>System Administrator (complete management of the computer infrastructure)</td>
</tr>
</tbody>
</table>

**Software as a Service**

- Skype
- Gmail
- Facebook

**Platform as a Service**

- Windows Azure
- Force.com

**Infrastructure as a Service**

- GOGOGRID
- Rackspace Hosting
- Flexiscale
- Amazon Web Services

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The OpenNebula Project
What is IaaS?

Challenges of IaaS Clouds

- How do I provision a new VM?  
  Image Management & Context
- Where do I store the disks?  
  Storage
- How do I set up networking for a multitier service?  
  Network & VLANs
- Where do I put my web server VM?  
  Monitoring & Scheduling
- How do I manage any hypervisor?  
  Virtualization
- Who has access to the Cloud’s resources?  
  User & Role Management
- How do I manage my distributed infrastructure?  
  Interfaces & APIs
What is IaaS?

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Uniform management layer that orchestrates multiple technologies
What is OpenNebula?

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

Data Center Virtualization Manager
- Open-source Apache license
- Interoperable, based on standards
- Adaptable

Private Clouds
- Virtualize your on-premise infrastructure

Public Clouds
- Expose standard cloud interfaces

Hybrid Clouds
- Extend your private cloud with resources from a remote cloud provider

Ready for end-users
- Advanced user management
- CLI and Web Interface
What is OpenNebula?

Rigorously Tested, Matured Through Vibrant Community and Many Release Cycles

OpenNebula.org

• Develop & innovate
• Support the community
• Collaborate

Third party scalability tests: 16,000 VMs

2005

TP v1.0 v1.2 v1.4 v2.0 v2.2 v3.0 v3.2 v3.4 v3.6 v3.8 v4.0

2008 2009 2010 2011 2012 2013 2014

Research Project

5,000 downloads/month
What is OpenNebula?

Widely Used to Build Enterprise Private Clouds in Medium and Large Data Centers

Reference Users

Survey Q2/Q3 2012 (2,500 users http://c12g.com/resources/survey/)

- North America, 23%
- Europe or Russia, 49%
- Africa, 1%
- Australia or South East Asia, 4%
- China, Japan or Korea, 14%
- Central or South America, 3%
- Middle East, 1%
- India or Pakistan, 4%

Industry

- Non-profit
- Academic
- Research
- Other
- Dev/testing

- Dev/testing, 58%
- Production, 42%

0% 10% 20% 30% 40% 50%
What is OpenNebula?

The OpenNebula Model

- **Adaptable**: Integration capabilities to fit into any data center
- **Enterprise-ready**: Upgrade process and commercial support
- **No Lock-in**: Infrastructure and platform independent
- **Light**: Efficient & simple
- **Proven**: Rigorously tested, mature and widely used
- **Scalable**: single instance & multi-tier architectures
- **Interoperable**: rich set of API's & Interfaces

- **Open Source**: Apache License v2
Demo Time!

A Quick Tour of OpenNebula’s Main Features

Dashboard

- **Storage**
  - 2 Images
  - 2GB Used

- **Users**
  - 4 Users
  - 2 Groups

- **Network**
  - 3 VNets
  - 7 Used IPs

**Hosts**

- 1 Total
- 1 On
- 0 Off
- 0 Error

**CPU**

**Memory**

**Virtual Machines**

- 99 Total
- 17 Active
- 82 Pending
- 0 Failed

NET DOWNLOAD SPEED

NET UPLOAD SPEED
What are the Main Components to Build a Cloud Infrastructure?

**VM Instance Networks**
- Public and private networks

**Front-end**
- Authentication
- Authorization
- ACLs, roles, groups...
- Accounting
- Logging
- Resource quotas

**Service Networks**
- Monitoring, control...
- Live migration...
- Storage access...

**Hosts**
- No need to install any software
- Multiple hypervisors
- Up to 500 hosts
- Automatic failover and HA
- Resource pools
- Automatic resource allocation

**Datastores**
- VM image storage
- Multiple datastores
- Heterogeneous configurations
- Shared or non-shared

**Internet**
The Cloud Provider Perspective

Broad Commodity and Enterprise Platform Support

VM Instance Networks
- VLAN per user (layer2)
- Open vSwitch, 802.1q
- Ebtables

Front-end
- X509, LDAP, ssh keys
- ACLs, permissions, groups

Internet

Hosts
- VMware
- Xen
- KVM

Service Networks
- SSH, Ganglia/Nagios
- Additional monitor agents

Datastores
- DFS: NFS, Ceph, Gluster, GlusterFS...
- SAN: Fibre Channel, iSCSI, LVM...
- SSH
The Cloud Integrator Perspective

Internal OpenNebula Architecture

Design Principles
- Modularity
- Lightness
- Openness

Languages

<table>
<thead>
<tr>
<th>Language</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>C++</td>
<td>39%</td>
</tr>
<tr>
<td>Ruby</td>
<td>23%</td>
</tr>
<tr>
<td>JavaScript</td>
<td>20%</td>
</tr>
<tr>
<td>shell script</td>
<td>5%</td>
</tr>
<tr>
<td>Other</td>
<td>13%</td>
</tr>
</tbody>
</table>
**The Cloud Integrator Perspective**

**Sysadmin-centric Approach**

- CLI
- GUI
- Cloud Servers
- OCA (Ruby, Java)
- XML-RPC API
- OpenNebula core
- Monitoring
- Storage
- Network
- Virtualization
- Images
- Auth
- DB
- Scheduler

**Easy to adapt**

**Easy to create new ones**

**OpenNebula drivers**

- Small script for each action, written in any language
- Simple interaction done through arguments, std/err output, exit code
- Different drivers can co-exist in heterogeneous environments
- Can be executed locally or in the remote Host
- The Host monitorization updates the remote driver directory
The Cloud Integrator Perspective

How to Develop Drivers

An example: the migrate script

- Each script performs a small, synchronous task
- Helper scripts provide commonly-used functions for log, ssh execution, error reporting, etc.
How to Interact with OpenNebula

XML-RPC

- Simple, fast
- Works in any language

OCA (OpenNebula Cloud API)

- High level bindings
- Complete functionality
- Ruby, Java, Python

OpenNebula distribution

OpenNebula

- Sunstone

Cloud APIs

- Occi
- Amazon Web Services

Community Contributions

- puppet labs
- Chef
- libcloud
- CLOUD
- jclouds
- Occi
- OCCI
- CDMI
- OVF
- DMTF
- SNIA
- Cloud Storage Initiative
How to Interact with OpenNebula

OCA Ruby Example:

Shutdown all my Virtual Machines

#!/usr/bin/env ruby

require 'OpenNebula'

CREDTENTIALS = "oneuser:onepass"
ENDPOINT = "http://localhost:2633/RPC2"

client = OpenNebula::Client.new(CREDTENTIALS, ENDPOINT)

vm_pool = VirtualMachinePool.new(client, OpenNebula::Pool::INFO_MINE)

rc = vm_pool.info
if OpenNebula.is_error?(rc)
  puts rc.message
  exit -1
end

vm_pool.each do |vm|
  rc = vm.shutdown
  if OpenNebula.is_error?(rc)
    puts "Virtual Machine #{vm.id}: #{rc.message}"
  else
    puts "Virtual Machine #{vm.id}: Shutting down"
  end
end

exit 0
Clusters

- **Pools of hosts** that share datastores and networks
- Used for **load balancing**, **high availability**, and **high performance** computing

Multiple Datastores per Cluster

- **Balance I/O operations** between storage servers
- Define different **SLA policies** (e.g. backup) and **performance features** for different VM types or users
Centralized Management of Multiple OpenNebula Instances (Zones)

- **oZones Server**
  - Portal
  - Cloud API (EC2, OCCI)
  - Global AuthN

- Federation of Clouds
  - Multi-tier architecture
  - Scalability
  - Isolation
  - Multiple-site support

Cloud Administrator/Consumer

**OpenNebula**
Virtual Private Cloud Computing

- Typical scenario in large organizations and cloud providers
- On-demand provision of fully-configurable and isolated VDC with full control and capacity to administer its users and resources
Advanced Deployments

Hybrid Cloud Computing

- Extension of the local private infrastructure with resources from remote clouds
- Cloud bursting to meet peak or fluctuating demands
OpenNebula Apps

Suite of Tools for Users and Administrators

App Flow
- Manage multi-tiered applications as single entities
- Deployment dependencies
- Elasticity rules

App Stage
- Automate the customization of VMs
- Chef recipes

App Market
- Host your own marketplace
- Centralized catalog to share and distribute virtual appliances across OpenNebula instances
Try it Out!

OpenNebula Sandboxes

- OpenNebula pre-installed in a VM: VirtualBox, KVM, VMware, Amazon
Join our growing community!

How to contribute
● Join our mailing list
● Follow the development at dev.opennebula.org

Ecosystem projects
● OpenNebula hosts an ecosystem catalog
● Promote and discuss ecosystem projects in our ecosystem mailing list

IRC Channel
● #opennebula on irc.freenode.net
Join Us in the OpenNebula Conf 2013!

OpenNebula Conf 2013
24 - 26 September in Berlin

The OpenNebula Project is proud to announce the first OpenNebula Global Conference. The Conference will serve as a meeting point for OpenNebula cloud users, developers, administrators, builders, integrators and researchers and a unique opportunity for discussion and collaboration with other projects. See you in Berlin!

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- Amazing evening event on the second day
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- Additional dinner on the first day (GOLD)

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NH Hotel Alexanderplatz

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Questions?

We Will Be Happy to Answer any Question

TL; DR: OpenNebula is awesome, go check it out!

@opennebula

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