CentOS Dojo
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Cloud environment with CentOS, OpenNebula and KVM

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Agenda

- What is OpenNebula?
- Why CentOS and OpenNebula?
- Building a Cloud from scratch in 15 minutes
- Optimizing KVM
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

The OpenNebula Project
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

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


Research Project

5,000 downloads/month
**What is OpenNebula?**

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

**Reference Users**

- Fermilab
- ESA
- NASA
- IBM
- Akamai
- China Mobile

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

- Industry
  - Central or South America: 23%
  - Middle East: 19%
  - China, Japan, or Asia: 14%
  - India or Pakistan: 4%
  - Europe or Russia: 44%

- Other
  - Research
  - Academic
  - Non-profit

- Size
  - <100
  - 101-500
  - 100-500
  - >500

- Production: 47%
- Dev/test: 53%
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

The OpenNebula Project
Why CentOS and OpenNebula?

CentOS

- Long production cycles
- Mature, tested code base
- Widespread user base (Hosting, Cloud, voip, HPC...)
- Xen, xen, xen...
- Hypervisor support, ARM, automation, etc...

Disclaimer: this list has been shamelessly ripped off from Karanbir Singh’s Presentation @ OpenNebulaConf:

http://www.slideshare.net/NETWAYS/cent-os-and-opennebula-karanbir-singh
Why CentOS and OpenNebula?

- Very mature OpenNebula package
- I love opennebula-node-kvm
- I will love opennebula-node-xen
- Included in the default repos
- yum install centos-release-opennebula
- yum install opennebula-server opennebula-sunstone

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http://www.slideshare.net/NETWAYS/cent-os-and-opennebula-karanbir-singh
Building a Cloud

Our Plan

- Set-up a DHCP and TFTP server (dnsmasq)
- Get pxelinux images (syslinux)
- Write a PXE cfg file
- Mirror the **CentOS base** and **opennebula** repos
- Write a Kickstart file
- Install CentOS in a laptop in < 10 minutes
Building a Cloud

Basic OpenNebula Deployment

Monitoring, Virtualization, Storage and Network

Frontend

- ONED
- Drivers
- Images

Datastore

- Repository of VM images
- Multiple Backends (LVM, Ceph)

Worker Node 1

- SSH
- Images
- Hypervisor

Worker Node 2

- SSH
- Images
- Hypervisor

- Provides physical resources for the VMs
- **Must** have a hypervisor installed
Building a Cloud

OpenNebula Architecture - Infrastructure Agnostic and Highly Customizable

Languages

- C++: 39%
- Ruby: 23%
- JavaScript: 20%
- shell script: 5%
- Other: 13%
Demo Time!

Sunstone

OpenNebula

Dashboard

Storage

2 IMAGES 2GB USED

Users

4 USERS 2 GROUPS

Network

3 VNETS 7 USED IPs

Hosts

1 TOTAL 0 ON 0 OFF 0 ERROR

Virtual Machines

99 TOTAL 17 ACTIVE 82 PENDING 0 FAILED

CPU

MEMORY

NET DOWNLOAD SPEED

NET UPLOAD SPEED

Allocated Real Total

The OpenNebula Project
Building a Cloud

Our Plan

- Install OpenNebula and create:
  - A compute host (localhost)
  - A network
  - An image
- Create a Virtual Machine which dynamically installs apache
- Logs
- Contextualization
- Virtual Machine actions
Optimizing KVM

From the ground up

- Human beings do not understand qemu-kvm syntax (maybe Fabrice Bellard…)
- We need Libvirt
- Other tools: virt-manager, virt-install, qemu-img, virt-alignment-scan
- Drivers: **virtio**
  - Huge performance gain
  - No emulation
  - Cooperation with the hypervisor
  - Integrated into the Linux kernel
Optimizing KVM

Image Backends

- Regular file (Raw)
  - Large
- Qcow2
  - Snapshots
  - Additional layer → less performance
- LVM
  - Block Device
- Cache

Writethrough
- host page on, guest disk write cache off

Writeback
- host page on, guest disk write cache on
- Good overall I/O Performance

None
- host page off, guest disk write cache on
- Good write performance
CPU and Memory

- CGROUPS
  - Limit, account and isolate resource usage
- CPU model
  - Subset of features
  - Nested Virtualization
  - `/usr/share/libvirt/cpu_map.xml`
- Kernel Samepage Merging (KSM)
  - Combines memory private pages
  - Useful for similar VMs
  - Increases VM density
  - Enabled by default
Optimizing KVM

Networking

- MacVTap (direct)
  - Connect directly to physical interface
  - Doesn’t allow connection host ⇔ vm
  - Not recommended
- Bridged Networking
  - Plugs a VM interface to a Linux bridge
  - Disable STP
  - Kernel’s networking stack: NAT, iptables...
  - **Recommended**
- Open vSwitch
Optimizing KVM

Desktop Sharing

- VLC
  - Keymap (or you will go crazy)
- SPICE
  - QXL driver (guest OS)
  - Printers
  - USB mass-storage
  - Audio
Join our growing community!

How to contribute

- Join our mailing list (users and dev)
- Follow the development at [dev.opennebula.org](http://dev.opennebula.org)

Add-ons

Extensions (tools, interfaces or drivers) that enlarge the capabilities of OpenNebula.

You can contribute code to any of these add-ons, make a new add-on, or join the discussions in the development mailing list.

IRC Channel

- [#opennebula on irc.freenode.net](irc.freenode.net)
Questions?

We Will Be Happy to Answer any Question

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

@opennebula