Crash Course in Open Source Cloud Computing

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- NOT Mark Hinkle
- Community guy for Cloudstack
- Fedora Project Board member (along with docs writer, packager, infrastructure sysadmin, and a host of other roles)
- Organizer of the Southeast Linuxfest
- Recovering sysadmin
- Contributor to a lesser degree for other F/LOSS projects (Zenoss, Sahana, Cobbler, Sheepdog)
- Author for a number of magazines and websites. (namely Linux Pro Magazine and Opensource.com)
Slides Can be Viewed and Downloaded at:

http://www.slideshare.net/socializedsoftware/
Agenda

1. Cloud Computing Trends
2. Quick Cloud Computing Overview
3. Open Source Building Blocks for Cloud Computing
4. Open Source Tools for Cloud Management
5. Questions
Cloud Computing: Cloud Computing Trends

Recent Study on **Cloud Computing Preferences**
Top Reasons For Cloud Computing Adoption

- Hardware savings: 68%
- Faster deployment of infrastructure: 66%
- Reduce systems management burden: 57%
Open Source Usage

- Use whenever possible: 69%
- Sparingly: 15%
- Only when commercial support is available: 14%
- Don’t use at all: 3%
Cloud Service Model Usage

Services Models Consumed by Cloud Computing Users in 2011

- **Compute**: 59%
- **Storage**: 51%
- **Platform as a service**: 47%
Why Open Source?

- Typically User-Driven to solve real problems
- Larger user base, users helping users
- Lower barrier to participation
- Aggressive release cycles – stay current with the state of the art
- Try before you “buy”, no Brochure-ware, no Powerpoint software
- Open data, Open standards, Open APIs
Quick Cloud Computing Overview: *Or* the Obligatory “What is the Cloud?” Slides
Five Characteristics of Clouds

1. On-Demand Self-Service
2. Broad Network Access
3. Resource Pooling
4. Rapid Elasticity
5. Measured Service
Cloud Computing Service Models

**USER CLOUD a.k.a. SOFTWARE AS A SERVICE**

Single application, multi-tenancy, network-based, one-to-many delivery of applications, all users have same access to features.

*Examples: Salesforce.com, Google Docs, Red Hat Network/RHEL*

**DEVELOPMENT CLOUD a.k.a. PLATFORM-AS-A-SERVICE**

Application developer model, Application deployed to an elastic service that autoscales, low administrative overhead. No concept of virtual machines or operating system. Code it and deploy it.

*Examples: Google AppEngine, Windows Azure, Rackspace Site, Red Hat Makara*

**SYSTEMS CLOUD a.k.a INFRASCTURE-AS-A-SERVICE**

Servers and storage are made available in a scalable way over a network.

*Examples: EC2, Rackspace CloudFiles, OpenStack, CloudStack, Eucalyptus, Ubuntu Enterprise Cloud, OpenNebula*
Deployment Models
Public, Private & Hybrid Clouds
Building Compute Clouds with Open Source Software
Cloud Still Requires Architectural Design

• Cloud Computing isn’t a “magical solution”
• Need to design your architecture with the end in mind
• As you build it make your infrastructure easily replicable
Open Source Hypervisors

**Open Source**
- Xen, Xen Cloud Platform (XCP)
- KVM – Kernel-based Virtualization
- VirtualBox - Oracle supported Virtualization Solutions
- OpenVZ - Container-based, Similar to Solaris Containers or Zones
- LXC – Userspace chrooted installs

**Proprietary**
- VMware
- Citrix Xenserver
- Microsoft Hyper-V
- Oracle VM
## Open Source Compute Clouds

<table>
<thead>
<tr>
<th></th>
<th>Year Started</th>
<th>License</th>
<th>Hypervisors Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>cloud.com</td>
<td>2010 (Development Since 2008)</td>
<td>GPLv3+</td>
<td>Xenserver, XCP, VMware, KVM</td>
</tr>
<tr>
<td>Eucalyptus Systems</td>
<td>2008</td>
<td>GPLv3</td>
<td>Xen, KVM, VMware</td>
</tr>
<tr>
<td>openstack</td>
<td>2010 (Developed by NASA by Anso Labs previously)</td>
<td>Apache</td>
<td>Xen, KVM, Hyper-V</td>
</tr>
<tr>
<td>Ubuntu Enterprise Cloud</td>
<td>2009 (Karmic Koala)</td>
<td>GPLv3</td>
<td>Xen, KVM</td>
</tr>
<tr>
<td>abiquoo</td>
<td>2009 (Development 2006)</td>
<td>LGPLv3</td>
<td>VMware ESX and ESXi, Microsoft Hyper-V, Xen, KVM and Virtual Box</td>
</tr>
</tbody>
</table>
### Open Source Platform-as-a-Service

<table>
<thead>
<tr>
<th>Year Started</th>
<th>Sponsors</th>
<th>Platforms Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>VMware</td>
<td>Spring, Rails, Sinatra, Node.js</td>
</tr>
<tr>
<td>2011</td>
<td>Red Hat</td>
<td>Express – Ruby, PHP Python Flex – JBoss, Java EE6</td>
</tr>
<tr>
<td>2009</td>
<td>WSO2</td>
<td>Tomcat, JBoss, Java EE6</td>
</tr>
</tbody>
</table>
Open Source Cloud Computing Storage

• **GlusterFS** – Scale Out NAS system aggregating storage over Ethernet or Infiniband
• **CloudFS** – GlusterFS, with multi-tenant, encryption, additional management support
• **CEPH** – Highly capable distributed file storage system
• **OpenStack Object Storage (SWIFT)** – Long-term storage object storage system
• **Sheepdog** – Distributed storage for KVM hypervisors
• **NFS** – Old standby, tried and true, not designed for cloud scale or performance
Cloud APIs Aren’t Created Equal
Open Source Abstractions

- jclouds
- libcloud
- deltacloud
- fog
Managing Clouds with Open Source Tools
Automation Unlocks the Potential of the Cloud

- MeatCloud, Can’t Keep up with Cloud Computing
- Devops & Agile IT Philosophy
- Script Repetitive Tasks
- Automate, Automate, Automate

cloud.com
Open Source Cloud Computing Software
Why Open Source Tools?

• Aggressively Developed, Keep Pace with State of the Art
• User-Developed and Instrumented
• Easy to Assemble into Automated Toolchains
4 Types of Management Tools

**Provisioning**
Installation of operating systems and other software

**Configuration Management**
Sets the parameters for servers, can specify installation parameters

**Orchestration/Automation**
Automate tasks across systems

**Monitoring**
Records errors and health of IT infrastructure
Management Toolchains

Toolchain (n):
A set of tools where the output of one tool becomes the input of another tool
# Open Source Provisioning Tools

<table>
<thead>
<tr>
<th>Year Started</th>
<th>Language</th>
<th>License</th>
<th>Installation Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cobbler (Plus koan for PXE boot of VMs)</td>
<td>2007</td>
<td>Python</td>
<td>GPL</td>
</tr>
<tr>
<td>Kickstart</td>
<td>?</td>
<td>Python</td>
<td>GPL</td>
</tr>
<tr>
<td>Spacewalk</td>
<td>2008</td>
<td>Perl, Python, Java</td>
<td>GPL</td>
</tr>
<tr>
<td>Crowbar</td>
<td>2011</td>
<td>Ruby</td>
<td>Apache</td>
</tr>
</tbody>
</table>
# Open Source Configuration Management Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Year Started</th>
<th>Language</th>
<th>License</th>
<th>Client/Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bcfg2</td>
<td>2003</td>
<td>Python</td>
<td>BSD</td>
<td>Yes</td>
</tr>
<tr>
<td>Cfengine</td>
<td>1993</td>
<td>C</td>
<td>Apache</td>
<td>Yes</td>
</tr>
<tr>
<td>Chef</td>
<td>2009</td>
<td>Ruby</td>
<td>Apache</td>
<td>Chef Solo – No Chef Server - Yes</td>
</tr>
<tr>
<td>Puppet</td>
<td>2004</td>
<td>Ruby</td>
<td>GPL</td>
<td>Yes</td>
</tr>
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# Open Source Monitoring Tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Year Started</th>
<th>License</th>
<th>Language</th>
<th>Type of Monitoring</th>
<th>Collection Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cacti</td>
<td>2001</td>
<td>GPL</td>
<td>PHP</td>
<td>Performance</td>
<td>SNMP, syslog</td>
</tr>
<tr>
<td>Nagios</td>
<td>1999</td>
<td>GPL</td>
<td>C/PHP</td>
<td>Availability</td>
<td>SNMP,TCP, ICMP, IPMI, syslog</td>
</tr>
<tr>
<td>OpenNMS</td>
<td>2000</td>
<td>GPL</td>
<td>Java</td>
<td>Availability/Performance</td>
<td>SNMP,</td>
</tr>
<tr>
<td>Zabbix</td>
<td>2001</td>
<td>GPL</td>
<td>C/PHP</td>
<td>Availability/Performance and more</td>
<td>SNMP, TCP/ICMP, IPMI, Synthetic Transactions</td>
</tr>
<tr>
<td>Zenoss</td>
<td>2005</td>
<td>GPL</td>
<td>Python</td>
<td>Availability, Performance, Event Management</td>
<td>SNMP, ICMP, SSH, syslog, WMI</td>
</tr>
<tr>
<td>Open Source Automation/Orchestration Tools</td>
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<thead>
<tr>
<th>AutomateIT</th>
<th>2009</th>
<th>Ruby</th>
<th>GPL</th>
<th>No</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capistrano</td>
<td>2006</td>
<td>Ruby</td>
<td>MIT</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>RunDeck</td>
<td>2010</td>
<td>Java</td>
<td>Apache</td>
<td>Yes</td>
<td>DTO Solutions</td>
</tr>
<tr>
<td>Func</td>
<td>2007</td>
<td>Python</td>
<td>GPL</td>
<td>Yes</td>
<td>Fedora Project</td>
</tr>
<tr>
<td>MCollective</td>
<td>2009</td>
<td>Ruby</td>
<td>Apache</td>
<td>Yes</td>
<td>PuppetLabs</td>
</tr>
</tbody>
</table>

cloud.com
Open Source Cloud Computing Software
Automated Toolchain

Command and Control

Configuration

Bootstrapping

Application Service Orchestration

System Configuration

Cloud Image Launch

OS Install

Provisioning Activity

Cloud:
- Eucalyptus
- OpenStack
- CloudStack
- Abiquo

OS Install:
- Kickstart
- Cobbler
- Spacewalk

OS:
- Kickstart
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- Spacewalk

OS Install:
- Kickstart
- Cobbler
- Spacewalk

Command and Control

Capistrano
- RunDeck
- Fabric
- Func

BCFG2
- Cfengine
- Chef
- Puppet

Configuration

Bootstrapping

OS Install

Cloud Image Launch

Open Source Cloud Computing Software
Questions?
Contact Me

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