OpenStack

Operational details of a large python project

http://www.pixelbeat.org/talks/openstack_python/

Pádraig Brady – Red Hat
Agenda

- OpenStack Overview
- Public / Private cloud description
- Development Process
- Related python projects
About Me

Open Source user for 12 years
Python user for 10 years
Gnu Coreutils co-maintainer (4 of us) for 4 years
Red Hatter for 9 months
OpenStacker for 7 months
Fedora OpenStack release manager for 4 months
What is OpenStack

- IaaS platform (like AWS)
- Open Source
  - unlike VMware, AWS, Compute Engine etc.
- Leverages lots of existing Linux technologies
- Written mainly in 2.6 <= python < 3.0
- 2 years old
- 300K lines of python
The shift to cloud

- Division of labour
- Economies of scale
- Automation of provisioning
- Increased resiliency
  - Decreased MTTR
    - Due to scale and automation
Public or Private

- Need for private
  - Leverage existing systems
  - Specific requirements
  - Large scale economies
  - Sensitive logic or data
- Amazon acknowledged in March 2012 the need for private cloud by partnering with Eucalyptus
- Traditionally separate implementations
- OpenStack aims to support both with consistent implementation and APIs
Who uses OpenStack?

- private clouds
  - mercado libre (ebay of south america)
  - Wikimedia
  - scientific community
    - NASA
    - HEPIX
      - CERN (15K servers, 300K VMs by 2015)
      - ISI.edu
- Public clouds
  - Rackspace
  - HP
Linux Kernel Similarities

- Open Source
- Released early
- OpenStack Foundation is being formed akin to the Linux Foundation
- One could consider the abstractions quite similar too:
Core Projects Overview

- Nova akin to EC2 – Controls VMs
- Swift akin to S3 – Object storage
- Glance – VM image, registration service
- Keystone – Identity/Auth
- Horizon – Self service and Admin UI
- Quantum – Advanced networking
- Volume akin to EBS – Storage service
Nova Compute Service

- Plugable components
- KVM -> XenServer or LXC, ...
- Qpid -> RabbitMQ or ØMQ
- DB can be postgres, mysql, ...
- Components can be distributed
- See wikimedia slide
Scalability notes

- Services use eventlet and greenthread to support concurrency
  - Some explicit locking required in various places
- Can scale almost everything horizontally
- There is a single AMQP/DB though per "cell"
  - Supports 500-1000 hosts
- Several "cells" (zones) can be used for further scalability
Who develops OpenStack

- A rough estimate from the Nova project:

```bash
$ curl -s https://raw.github.com/openstack/nova/master/Authors | sed -n 's/.*<.*@\(.*\)>/\1/p' | sort | uniq -c | sort -n | tail -n20 | column

<table>
<thead>
<tr>
<th>Company</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>midokura.jp</td>
<td>2</td>
</tr>
<tr>
<td>netapp.com</td>
<td>2</td>
</tr>
<tr>
<td>wikimedia.org</td>
<td>2</td>
</tr>
<tr>
<td>canonical.com</td>
<td>3</td>
</tr>
<tr>
<td>cloudscaling.com</td>
<td>3</td>
</tr>
<tr>
<td>dreamhost.com</td>
<td>3</td>
</tr>
<tr>
<td>eu.citrix.com</td>
<td>3</td>
</tr>
<tr>
<td>mirantis.com</td>
<td>3</td>
</tr>
<tr>
<td>nicira.com</td>
<td>3</td>
</tr>
<tr>
<td>lab.ntt.co.jp</td>
<td>4</td>
</tr>
<tr>
<td>ubuntu.com</td>
<td>4</td>
</tr>
<tr>
<td>pistoncloud.com</td>
<td>5</td>
</tr>
<tr>
<td>isi.edu</td>
<td>6</td>
</tr>
<tr>
<td>nttdata.co.jp</td>
<td>6</td>
</tr>
<tr>
<td>openstack.org</td>
<td>6</td>
</tr>
<tr>
<td>hp.com</td>
<td>8</td>
</tr>
<tr>
<td>redhat.com</td>
<td>9</td>
</tr>
<tr>
<td>citrix.com</td>
<td>10</td>
</tr>
<tr>
<td>rackspace.com</td>
<td>22</td>
</tr>
<tr>
<td>gmail.com</td>
<td>31</td>
</tr>
</tbody>
</table>
```
$ for proj in nova quantum glance keystone horizon; do
cat $proj/tools/pip-requires
done | sed '/ *#/d; /^ *$/d; s/[>=].*///'
| sort -f | uniq -ci | column | expand

1 amqplib             2 iso8601              1 python-cloudfiles
2 anyjson             1 jsonschema           1 python-daemon
1 argparse            2 kombu                1 python-dateutil
1 Babel               1 lockfile             2 python-gflags
2 boto                4 lxml                 1 python-novaclient
1 carrot              1 netaddr              4 routes
1 Cheetah             1 pam                  4 sqlalchemy
1 Django              1 paramiko             3 sqlalchemy-migrate
4 eventlet            2 passlib
1 feedparser          4 paste
1 glance              4 PasteDeploy
3 greenlet            2 pycrypto
1 httplib2             1 pysendfile
1 python-libvirt
Project Packaging

• Given the number of parts and options there is a large gain with consuming through distros

• Distro package dependencies are a good way to get overall position and leverage of a project

    yum install rpmorphan graphviz
    for pkg in nova glance dashboard keystone quantum quantum-openvswitch;
    do
        rpmdep -dot $pkg.dot openstack-$pkg
        dot -Tsvg $pkg.dot -o $pkg.svg
    done
Release History

- 6 monthly, design summit after each, monthly milestones
  - Austin Oct 2010
    - Nova + Swift
  - Cactus Apr 2011
    - Glance
  - Diablo Sep 2011
    - First “production ready” release
  - Essex Apr 2012
    - Horizon + Keystone
  - Folsom Sep 2012
    - Quantum + Melange + Volume
Development

- Development done on always open trunk
- Releases done to a stable branch
- Standardized tools across all projects
- Git
- Gerrit
  - Standalone patch review server
  - Created by Google for Android development
- Jenkins
  - Continuous integration
  - Gates commits on unit tests
Commit process

- git branch; git commit
  - Commit hook inserts Change-Id: for gerrit tracking
- ./run_tests.sh [subset]
  - Unit tests within a virtualenv
  - Nose used to extend unittest
  - Pep8 enforced https://github.com/jcrocholl/pep8
- git-review python tool used to submit to gerrit
  - Developed for OpenStack but not specific to it
<table>
<thead>
<tr>
<th>ID</th>
<th>Subject</th>
<th>Owner</th>
<th>Project</th>
<th>Branch</th>
<th>Updated</th>
<th>V</th>
<th>R</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>199332a79</td>
<td>CVS plugin support for v2 Quantum API</td>
<td>Aaron Rosen</td>
<td>openstack/quantum</td>
<td>master (bug/1011457)</td>
<td>1:10 AM</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13bb1b83b</td>
<td>Implement IP address allocation.</td>
<td>garyk</td>
<td>openstack/quantum</td>
<td>master (bug/1009029)</td>
<td>1:03 AM</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>11d7304ca</td>
<td>Switch to common logging</td>
<td>andrewbogott</td>
<td>openstack/nova</td>
<td>master (another)</td>
<td>12:59 AM</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>15ae33389</td>
<td>Use import_object_ns for compute_driver loading</td>
<td>Swan Dague</td>
<td>openstack/nova</td>
<td>master (bp/virt-driver-clean-up)</td>
<td>12:57 AM</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>18d535cb6</td>
<td>Updated files from openstack-common</td>
<td>andrewbogott</td>
<td>openstack/nova</td>
<td>master (another)</td>
<td>12:56 AM</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1e600bf0f</td>
<td>Adds additional volume api class for Cinder</td>
<td>sleepsonthefloor</td>
<td>openstack/nova</td>
<td>master (6073)</td>
<td>12:56 AM</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1807d1af0</td>
<td>Switch CI to support underscores and dashes</td>
<td>Dan Prince</td>
<td>openstack/nova</td>
<td>master (bug/1018467)</td>
<td>12:56 AM</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>17875c58d</td>
<td>Include all tests in generated tarballs</td>
<td>Thierry Carrez</td>
<td>openstack/glance</td>
<td>master (bug/1018830)</td>
<td>12:56 AM</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1a71d9967</td>
<td>Add check for no domains in libvirt driver</td>
<td>David Shawbury</td>
<td>openstack/nova</td>
<td>master (count_domains)</td>
<td>12:22 AM</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>124f189fd</td>
<td>Add links to change pages on /zuul/status page</td>
<td>Clark Boylan</td>
<td>openstack-ci/zuul</td>
<td>master (change_links_in_html_status)</td>
<td>12:18 AM</td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>1f3c62965</td>
<td>Implement dhcp agent for quantum</td>
<td>markmcclean</td>
<td>openstack/quantum</td>
<td>master (bp/quantum-dhcp)</td>
<td>12:13 AM</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1c356dc5b</td>
<td>Add 'allocation_pools' parameter to the subnet resource in the Quantum v2 API H (WORKINPROGRESS)</td>
<td>Salvatore Orlando</td>
<td>openstack/quantum</td>
<td>master (bug/1016306)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1dd2d1009</td>
<td>Use ip instead of ipconfig. Should work on F16, F17 and Debian based system.</td>
<td>ayoung</td>
<td>openstack/dew/derstack</td>
<td>master (master)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>1b962c913</td>
<td>Additional CommandFilters to fix rootwrap on SLES</td>
<td>shafei</td>
<td>openstack/quantum</td>
<td>stable/essxi (bug/1013147)</td>
<td>Jun 29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a0e6c500</td>
<td>If no password in env or command line, try prompting.</td>
<td>Ken Thomas</td>
<td>openstack/python-openstackclient</td>
<td>master (bp/password-prompt)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>134cc9255</td>
<td>Add support for hypervisor-uptime.</td>
<td>Kevin L Mitchell</td>
<td>openstack/python-novaclient</td>
<td>master (hyper-uptime)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1e2595897</td>
<td>Get hypervisor uptime</td>
<td>Kevin L Mitchell</td>
<td>openstack/python-novaclient</td>
<td>master (hyper-uptime)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1af77b830</td>
<td>devstack support for v2 nova/quantum integration</td>
<td>Aaron Rosen</td>
<td>openstack/dew/derstack</td>
<td>master (bug/1017760)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1d43175fd</td>
<td>Add tests for volume attach and detach</td>
<td>Dan Smith</td>
<td>openstack/tempest</td>
<td>master (master)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>16586aae7</td>
<td>Redefine the domain's XML on volume attach/detach</td>
<td>Dan Smith</td>
<td>openstack/tempest</td>
<td>master (master)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1d76e6s47</td>
<td>Do not use pickle for serialization in memcache, but JSON</td>
<td>Vincent Unrtz</td>
<td>openstack/swift</td>
<td>master (bug/1005414)</td>
<td>Jun 29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16756b027</td>
<td>Change metadata_host to metadata_host_ip</td>
<td>Matt Joyce</td>
<td>openstack/nova</td>
<td>master (master)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>13853546a</td>
<td>Refactoring code to kempal DomC plugin</td>
<td>Rick Harris</td>
<td>openstack/nova</td>
<td>master (kempal_domC_plugin)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1cc6b9551c</td>
<td>Fixes bug 999920</td>
<td>rskolkov</td>
<td>openstack/nova</td>
<td>stable/essxi (bug/999920)</td>
<td>Jun 29</td>
<td></td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>1b7f9292e</td>
<td>Make git fetching in git/git-merge more robust</td>
<td>Clark Boylan</td>
<td>openstack/openstack-ci-puppet</td>
<td>master (retry_fetches)</td>
<td>Jun 29</td>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>
Change I3e5ffcc: Add compatibility for CPU model config with libvirt < 0.9.10

Add compatibility for CPU model config with libvirt < 0.9.10

Libvirt versions prior to 0.9.10 do not support the simpler 'mode' attribute for choosing CPU model. So with such libvirt releases we must explicitly construct the guest CPU model from the host capabilities info when mode=host-mode. We can not support mode=host-passthrough at all with these earlier libvirt versions.

This change can be reverted in the future, if the value of the MIN_LIBVIRT_VERSION constant is increased to 0.9.10 or later.

Fixes: bug #1003373
Implements: blueprint libvirt-xml-cpu-model
Change-Id: I3e5ffccf30be18454f810efeb5c201aeb94db0
Signed-off-by: Daniel P. Berrange <berrange@redhat.com>

Reviewer | Verified | Code-Review | Approved
--- | --- | --- | ---
Daniel Berrange | | |
Jenkins | +1 | |
SmokeStack | | |
Johannes Erdfelt | | |
Mark McLoughlin | | |
Matt Dietz | | |
- Need Verified
- Need Code-Review
- Need Approved

Name or Email or Group
Add Reviewer

Dependencies

Old Version History: Base

- **Patch Set 1**
  0433fff2d3845f8a781883b65c34cd3b9f91d8f (gtweb)
- **Patch Set 2**
  7f13e99a93e3a1c7f73bcd41303fff65e308a97e5 (gtweb)
- **Patch Set 3**
  9bbbe5d01c0f118121fde7793ad0882cda08de4c (gtweb)
- **Patch Set 4**
  ba6dcb4003a0f3e879de82ba1348fb5eae065123b (gtweb)
- **Patch Set 5**
  59067af1f2bd89a396f198543cc7b57f93bcf795 (gtweb)
- **Patch Set 6**
  36c15fbd85e56599c7e9cdd64cc0c6675fc65311 (gtweb)

Author: Daniel P. Berrange <berrange@redhat.com> | Jun 19, 2012 2:42 PM
Review Process

- Gated trunk
  - Reviewers
    - Anyone can ±1
    - Only project core members can approve
  - Automated tests
    - Through Jenkins
    - Using OpenStack infrastructure itself
    - Sets up test systems and runs gerrit branch
      - Libvirt, Xen, python 2.6, python 2.7, ...
    - If OK, merges gerrit branch to trunk
    - Ancillary jobs like doc builds, pylint reports, more tests, ...
Glance activity week 10 2012

Weekly history of changes per author

- Dan Prince: 156 lines added, 69 lines removed
- Brian Lamar: 58 lines added
- Ken Pepple: 21 lines added, 13 lines removed
- Maru Newby: 14 lines added
- Chuck Short: 14 lines removed
- James E. Blair: 0 lines added, 0 lines removed

Lines added/removed

Legend: Orange = Lines added, Yellow = Lines removed
Horizon activity week 10 2012

Weekly history of changes per author

Lines added/removed

<table>
<thead>
<tr>
<th>Author</th>
<th>Lines Added</th>
<th>Lines Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gabriel Hurley</td>
<td>7,214</td>
<td>6,551</td>
</tr>
<tr>
<td>Andy Chong</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jim Yeh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>John Postlethwait</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tres Henry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiomir Trifonov</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cole Robinson</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dean Troyer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Devin Carlen</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- **Lines added**
- **Lines removed**
Keystone activity week 10 2012

Weekly history of changes per author

- Dolph Mathews: 715 lines added, 575 lines removed
- Termie: 164 lines added, 169 lines removed
- Brian Waldon: 74 lines added, 69 lines removed
- Chmouel Boudjnah: 69 lines added, 72 lines removed
- Alan Pevec: 74 lines added, 69 lines removed
- Michael Basnight: 72 lines added, 72 lines removed
- Deepak Garg: 72 lines added, 72 lines removed
- Russell Bryant: 72 lines added, 72 lines removed
- Joe Heck: 72 lines added, 72 lines removed
- Devin Carlen: 72 lines added, 72 lines removed
- Monty Taylor: 72 lines added, 72 lines removed
- Yaguang Tang: 72 lines added, 72 lines removed
- Dean Troyer: 72 lines added, 72 lines removed
- Dan Prince: 72 lines added, 72 lines removed
- Jesse Andrews: 72 lines added, 72 lines removed

Legend:
- Lines added
- Lines removed
Quantum activity week 10 2012

Weekly history of changes per author

Lines added/removed

Sumit Naksatam: 198
Dan Wendlandt: 173
Mark McClain: 1
Maru Newby: 1

Legend: Lines added, Lines removed
Swift activity week 10 2012

Weekly history of changes per author

<table>
<thead>
<tr>
<th>Author</th>
<th>Lines added</th>
<th>Lines removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eamonn O'Toole</td>
<td>188</td>
<td></td>
</tr>
<tr>
<td>Maru Newby</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>gholter</td>
<td>1,184</td>
<td></td>
</tr>
<tr>
<td>Samuel Merritt</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Chmouel Boudjnah</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Florian Hines</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Derek Higgins</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Doug Weimer</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Julien Danjou</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>John Dickinson</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Orange: Lines added
- Yellow: Lines removed
Tempest activity week 10 2012

Weekly history of changes per author

Daryl Walleck: 234 lines added, 240 lines removed

Eoghan Glynn: 10 lines added, 0 lines removed

Legend: Lines added, Lines removed
Manuals activity week 10 2012

Weekly history of changes per author

Lines added/removed

Russell Bryant: 315
Jesse Andrews
Joe Savak
Vishvananda Ishaya
annegentie
Xiaohua Guan
Mike Pittaro
termie
Anthony Young
Tyler North
James E. Blair

Lines added: orange
Lines removed: yellow
Nova activity week 10 2012

Weekly history of changes per author

Lines added/removed

<table>
<thead>
<tr>
<th>Lines added</th>
<th>Lines removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russell</td>
<td></td>
</tr>
<tr>
<td>Amy</td>
<td></td>
</tr>
<tr>
<td>John</td>
<td></td>
</tr>
<tr>
<td>Hu</td>
<td></td>
</tr>
<tr>
<td>—you</td>
<td></td>
</tr>
<tr>
<td>etc.</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Orange: Lines added
- Yellow: Lines removed
Related python projects

- **OZ**
  - Generate guest images from install ISOs
    - Optional customization
      - Install packages, run script, ...
  - List of OZ built images from RackSpace
    - [https://github.com/rackerjoe/oz-image-build](https://github.com/rackerjoe/oz-image-build)
  - ISO -> image -> glance -> nova -> libvirt -> KVM
  - [http://aeolusproject.org/oz.html](http://aeolusproject.org/oz.html)
Related python projects

• Heat API
  • AWS Cloudformation type service
  • V4 just released
  • Provisions apps in the cloud
  • And keeps them provisioned
    • Leverages cloud attributes to provide HA
  • https://github.com/heat-api
Related python projects

- cloud-init
  - Installed in guests to configure at boot time
  - Directives for package install etc.
  - Support for many distros
  - https://launchpad.net/cloud-init/
Similar non python projects

- **oVirt** - java
  - More aligned with private datacenters
- **Eucalyptus** - C
  - Less general, Closed editions.
- **CloudStack** - java
  - Started closed (cloud.com). Closed addons.
- **OpenNebula** - C++
  - Again focusing on datacenters
Trying it out

- http://trystack.org/
  - Register to try out a test public OpenStack cloud
- http://devstack.org/
  - Script to setup simple/developer installs
- fedoraproject.org/wiki/Getting_started_with_OpenStack
  - Basic setup instructions for machine or VM
Jobs!

- Broad range of technologies
- [http://www.openstack.org/community/jobs/](http://www.openstack.org/community/jobs/)
  - Currently 90 positions listed
  - Red Hat have 8 location flexible positions there
More info

- http://docs.openstack.org/
  - The compute admin guide is a good overview
- http://ci.openstack.org/
  - OpenStack Continuous Integration info
- http://review.openstack.org/
  - OpenStack gerrit interface
- http://jenkins.openstack.org/
  - OpenStack Continuous Integration interface