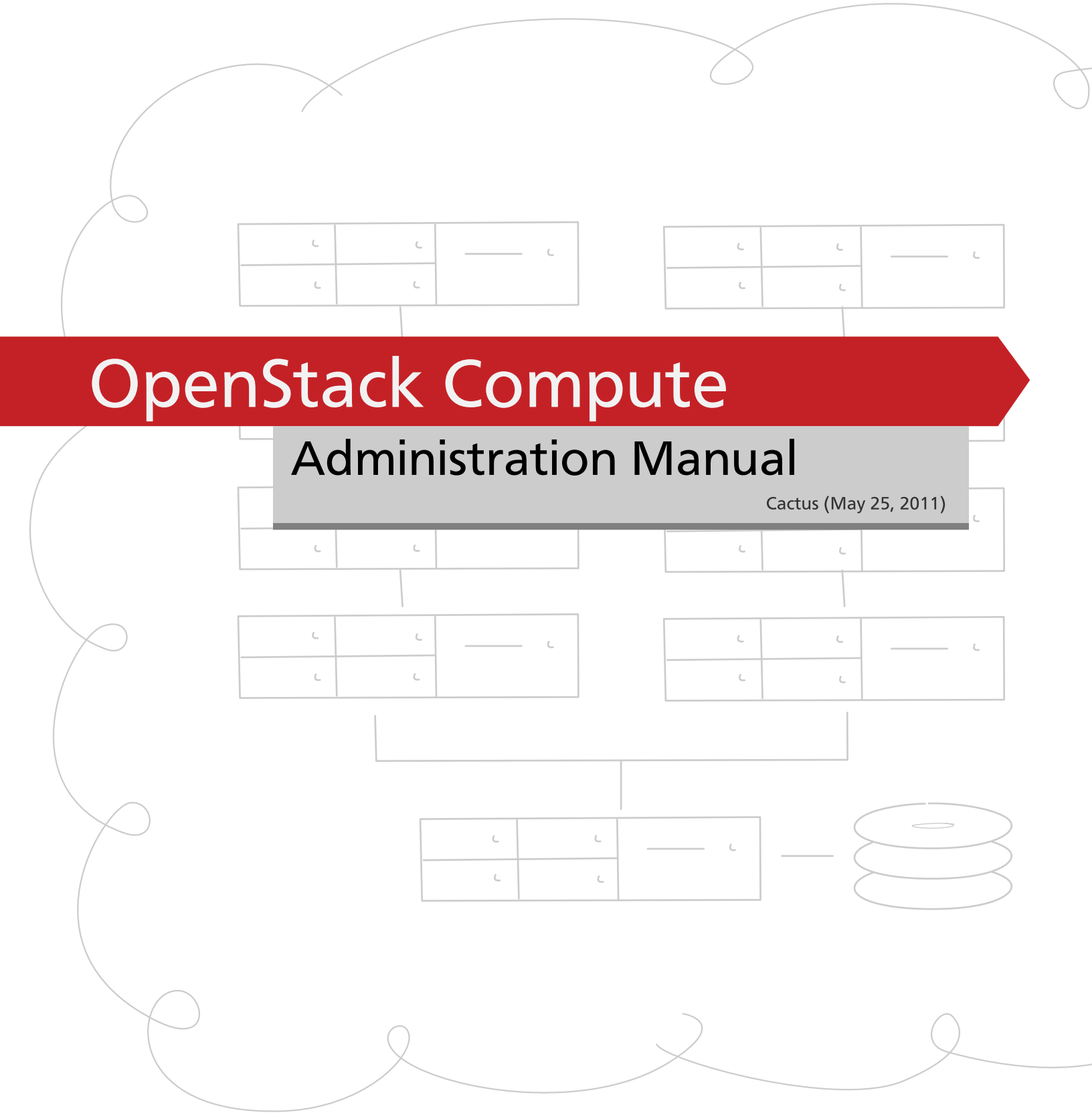


OpenStack Compute

Administration Manual

Cactus (May 25, 2011)

openstack™

docs.openstack.org

OpenStack Compute Administration Manual

Cactus (2011-05-25)

OpenStack Compute offers open source software for cloud administration and management for any organization. This manual provides guidance for installing, managing, and understanding the software that runs OpenStack Compute.

List of Tables

1. Getting Started with OpenStack

Table of Contents

OpenStack is a collection of open source technology that provides massively scalable open source cloud computing software. Currently OpenStack develops two related projects: OpenStack Compute, which offers computing power through virtual machine and network management, and OpenStack Object Storage which is software for redundant, scalable object storage capacity. Closely related to the OpenStack Compute project is the Image Service project, named Glance. OpenStack can be used by corporations, service providers, VARS, SMBs, researchers, and global data centers looking to deploy large-scale cloud deployments for private or public clouds.

1.1. What is OpenStack?

OpenStack offers open source software to build public and private clouds. OpenStack is a community and a project as well as open source software to help organizations run clouds for virtual computing or storage. OpenStack contains a collection of open source projects that are community-maintained including OpenStack Compute (code-named Nova), OpenStack Object Storage (code-named Swift), and OpenStack Image Service (code-named Glance). OpenStack provides an operating platform, or toolkit, for orchestrating clouds.

OpenStack is more easily defined once the concepts of cloud computing become apparent, but we are on a mission: to provide scalable, elastic cloud computing for both public and private clouds, large and small. At the heart of our mission is a pair of basic requirements: clouds must be simple to implement and massively scalable.

If you are new to OpenStack, you will undoubtedly have questions about installation, deployment, and usage. It can seem overwhelming at first. But don't fear, there are places to get information to guide you and to help resolve any issues you may run into during the on-ramp process. Because the project is so new and constantly changing, be aware of the revision time for all information. If you are reading a document that is a few months old and you feel that it isn't entirely accurate, then please let us know through the mailing list at https://launchpad.net/~openstack so it can be updated or removed.

1.2. Components of OpenStack

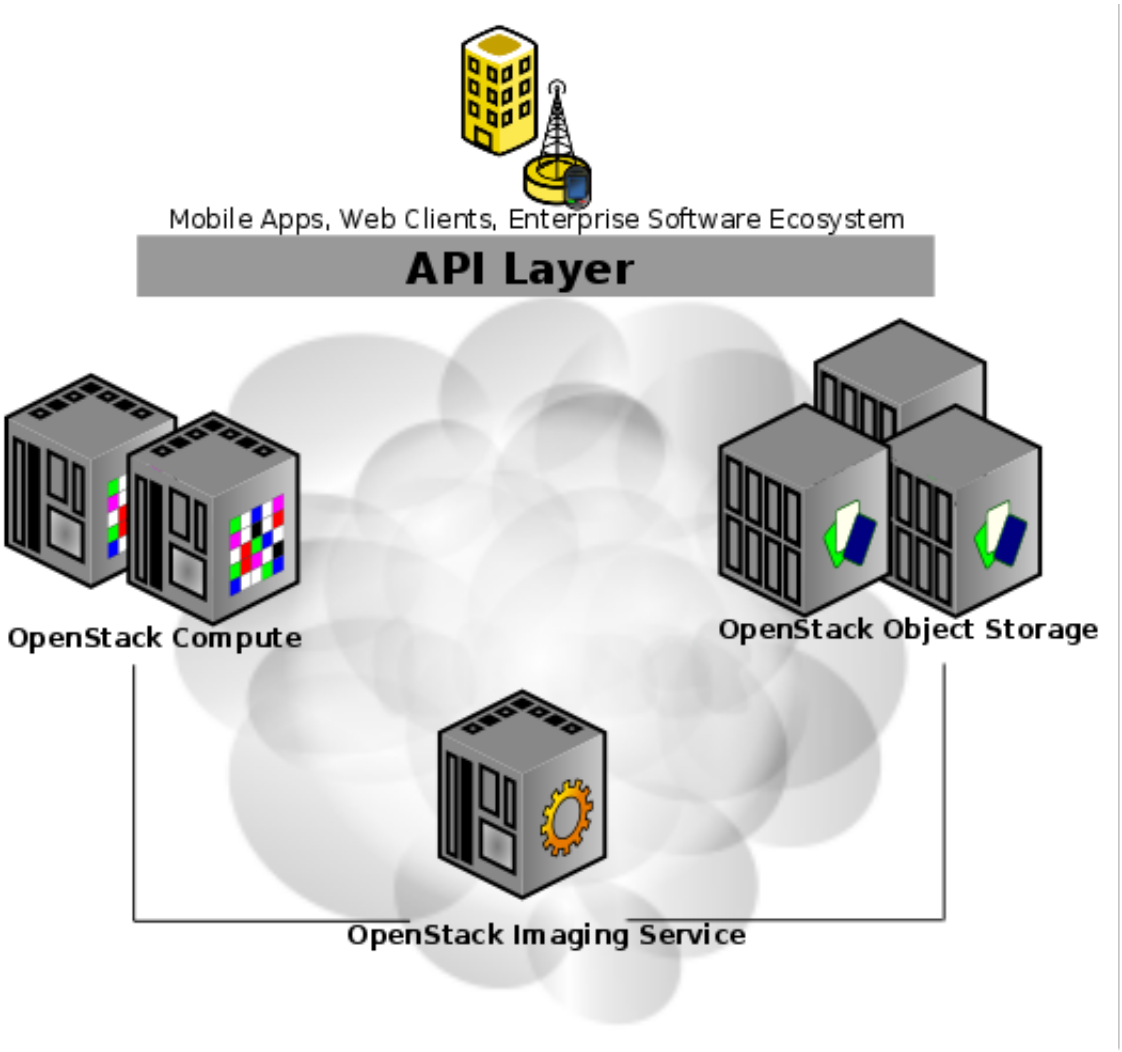
There are currently three main components of OpenStack: Compute, Object Storage, and Image Service. Let's look at each in turn.

OpenStack Compute is a cloud fabric controller, used to start up virtual instances for either a user or a group. It's also used to configure networking for each instance or project that contains multiple instances for a particular project.

OpenStack Object Storage is a system to store objects in a massively scalable large capacity system with built-in redundancy and failover. Object Storage has a variety of applications, such as backing up or archiving data, serving graphics or videos (streaming data to a user's browser), serving content with a Content Delivery Network (CDN), storing secondary or tertiary static data, developing new applications with data storage integration, storing data when predicting storage capacity is difficult, and creating the elasticity and flexibility of cloud-based storage for your web applications.

OpenStack Image Service is a lookup and retrieval system for virtual machine images. It can be configured in three ways: using OpenStack Object Store to store images; using Amazon's Simple Storage Solution (S3) storage directly; or using S3 storage with Object Store as the intermediate for S3 access.

The following diagram shows the basic relationships between the projects, how they relate to each other, and how they can fulfill the goals of open source cloud computing.



1.3. Why Cloud?

In data centers today, many computers suffer the same underutilization in computing power and networking bandwidth. For example, projects may need a large amount of computing capacity to complete a computation, but no longer need the computing power after completing the computation. You want cloud computing when you want a service that's available on-demand with the flexibility to bring it up or down through automation or with little intervention. The phrase "cloud computing" is often represented with a diagram that contains a cloud-like shape indicating a layer where responsibility for service goes from user to provider. The cloud in these types of diagrams contains the services that afford computing power harnessed to get work done. Much like the electrical power we receive each day, cloud computing provides subscribers or users with access to a shared collection of computing resources: networks for transfer, servers for storage, and applications or services for completing tasks.

These are the compelling features of a cloud:

- On-demand self-service: Users can provision servers and networks with little human intervention.
- Network access: Any computing capabilities are available over the network. Many different devices are allowed access through standardized mechanisms.
- Resource pooling: Multiple users can access clouds that serve other consumers according to demand.
- Elasticity: Provisioning is rapid and scales out or in based on need.
- Metered or measured service: Just like utilities that are paid for by the hour, clouds should optimize resource use and control it for the level of service or type of servers such as storage or processing.

Cloud computing offers different service models depending on the capabilities a consumer may require.

- SaaS: Software as a Service. Provides the consumer the ability to use the software in a cloud environment, such as web-based email for example.

- PaaS: Platform as a Service. Provides the consumer the ability to deploy applications through a programming language or tools supported by the cloud platform provider. An example of platform as a service is an Eclipse/Java programming platform provided with no downloads required.

- IaaS: Infrastructure as a Service. Provides infrastructure such as computer instances, network connections, and storage so that people can run any software or operating system.

When you hear terms such as public cloud or private cloud, these refer to the deployment model for the cloud. A private cloud operates for a single organization, but can be managed on-premise or off-premise. A public cloud has an infrastructure that is available to the general public or a large industry group and is likely owned by a cloud services company. The NIST also defines community cloud as shared by several organizations supporting a specific community with shared concerns.

Clouds can also be described as hybrid. A hybrid cloud can be a deployment model, as a composition of both public and private clouds, or a hybrid model for cloud computing may involve both virtual and physical servers.

What have people done with cloud computing? Cloud computing can help with large-scale computing needs or can lead consolidation efforts by virtualizing servers to make more use of existing hardware and potentially release old hardware from service. People also use cloud computing for collaboration because of its high availability through networked computers. Productivity suites for word processing, number crunching, and email communications, and more are also available through cloud computing. Cloud computing also avails additional storage to the cloud user, avoiding the need for additional hard drives on each users's desktop and enabling access to huge data storage capacity online in the cloud.

For a more detailed discussion of cloud computing's essential characteristics and its models of service and deployment, see http://csrc.nist.gov/groups/SNS/cloud-computing/, published by the US National Institute of Standards and Technology.

2. Introduction to OpenStack Compute

Table of Contents

OpenStack Compute gives you a tool to orchestrate a cloud, including running instances, managing networks, and controlling access to the cloud through users and projects. The underlying open source project's name is Nova, and it provides the software that can control an Infrastructure as a Service (IaaS) cloud computing platform. It is similar in scope to Amazon EC2 and Rackspace Cloud Servers. OpenStack Compute does not include any virtualization software; rather it defines drivers that interact with underlying virtualization mechanisms that run on your host operating system, and exposes functionality over a web-based API.

2.1. Hypervisors

OpenStack Compute requires a hypervisor and Compute controls the hypervisors through an API server. The process for selecting a hypervisor usually means prioritizing and making decisions based on budget and resource constraints as well as the inevitable list of supported features and required technical specifications. With OpenStack Compute, you can orchestrate clouds using multiple hypervisors in different zones. The types of virtualization standards that may be used with Compute include:

- Hyper-V 2008
- KVM - Kernel-based Virtual Machine
- QEMU
- User Mode Linux
- VMWare - ESX/ESXi 4.1 update 1
- Xen - XenServer 5.5

2.2. Users and Projects

The OpenStack Compute system is designed to be used by many different cloud computing consumers or customers, using role-based access assignments. Roles control the actions that a user is allowed to perform. For example, a user cannot allocate a public IP without the netadmin or admin role. There are both global roles and per-project role assignments. A user's access to particular images is limited by project, but the access key and secret key are

assigned per user. Key pairs granting access to an instance are enabled per user, but quotas to control resource consumption across available hardware resources are per project.

OpenStack Compute uses a rights management system that employs a Role-Based Access Control (RBAC) model and supports the following five roles:

- Cloud Administrator (admin): Global role. Users of this class enjoy complete system access.
- IT Security (itsec): Global role. This role is limited to IT security personnel. It permits role holders to quarantine instances on any project.
- Project Manager (projectmanager): Project role. The default for project owners, this role affords users the ability to add other users to a project, interact with project images, and launch and terminate instances.
- Network Administrator (netadmin): Project role. Users with this role are permitted to allocate and assign publicly accessible IP addresses as well as create and modify firewall rules.
- Developer (developer): Project role. This is a general purpose role that is assigned to users by default.

While the original EC2 API supports users, OpenStack Compute adds the concept of projects. Projects are isolated resource containers forming the principal organizational structure within Nova. They consist of a separate VLAN, volumes, instances, images, keys, and users. A user can specify which project he or she wishes to use by appending :project_id to his or her access key. If no project is specified in the API request, Compute attempts to use a project with the same id as the user.

For projects, quota controls are available to limit the:

- Number of volumes which may be created
- Total size of all volumes within a project as measured in GB
- Number of instances which may be launched
- Number of processor cores which may be allocated
- Publicly accessible IP addresses

2.3. Images and Instances

An image is a file containing information about a virtual disk that completely replicates all information about a working computer at a point in time including operating system information and file system information. Compute can use certificate management for decrypting bundled images. For now, Compute relies on using the euca2ools command-line tools distributed by the Eucalyptus Team for adding, bundling, and deleting images.

There are two methods for managing images. Images can be served through the OpenStack Image Service, a project that is named Glance, or use the nova-objectstore service. With an OpenStack Image Service server in place, the Image Service fetches the

image on to the host machine and then OpenStack Compute boots the image from the host machine. To place images into the service, you would use a ReST interface to stream them, and the service, in turn, streams that into a back end which could be S3, OpenStack Object Storage (which can use an S3), or the local file system on the server where OpenStack Image Service is installed.

An instance is a running virtual machine within the cloud. An instance has a life cycle that is controlled by OpenStack Compute. Compute creates the instances and it is responsible for building a disk image, launching it, reporting the state, attaching persistent storage, and terminating it.

2.4. System Architecture

OpenStack Compute consists of several main components. A "cloud controller" contains many of these components, and it represents the global state and interacts with all other components. An API Server acts as the web services front end for the cloud controller. The compute controller provides compute server resources and typically contains the compute service, The Object Store component optionally provides storage services. An auth manager provides authentication and authorization services. A volume controller provides fast and permanent block-level storage for the compute servers. A network controller provides virtual networks to enable compute servers to interact with each other and with the public network. A scheduler selects the most suitable compute controller to host an instance.

OpenStack Compute is built on a shared-nothing, messaging-based architecture. You can run all of the major components on multiple servers including a compute controller, volume controller, network controller, and object store. A cloud controller communicates with the internal object store via HTTP (Hyper Text Transfer Protocol), but it communicates with a scheduler, network controller, and volume controller via AMQP (Advanced Message Queue Protocol). To avoid blocking each component while waiting for a response, OpenStack Compute uses asynchronous calls, with a call-back that gets triggered when a response is received.

To achieve the shared-nothing property with multiple copies of the same component, OpenStack Compute keeps all the cloud system state in a distributed data store. Updates to system state are written into this store, using atomic transactions when required. Requests for system state are read out of this store. In limited cases, the read results are cached within controllers for short periods of time (for example, the current list of system users.)

2.5. Storage and OpenStack Compute

A ‘volume’ is a detachable block storage device. You can think of it as a USB hard drive. It can only be attached to one instance at a time, so it does not work like a SAN. If you wish to expose the same volume to multiple instances, you will have to use an NFS or SAMBA share from an existing instance.

Every instance larger than m1.tiny starts with some local storage (up to 160GB for m1.xlarge). This storage is currently the second partition on the root drive.

3. Installing OpenStack Compute

Table of Contents

The OpenStack system has several key projects that are separate installations but can work together depending on your cloud needs: OpenStack Compute, OpenStack Object Storage, and OpenStack Image Store. You can install any of these projects separately and then configure them either as standalone or connected entities.

3.1. System Requirements

Hardware: OpenStack components are intended to run on standard hardware.

Operating System: OpenStack currently runs on Ubuntu and the large scale deployments running OpenStack run on Ubuntu 10.04 LTS, so deployment-level considerations tend to be Ubuntu-centric. You can install OpenStack on Red Hat Enterprise Linux version 6 using packages from a specific repository.

Networking: 1000 Mbps are suggested. For OpenStack Compute, networking is configured on multi-node installations between the physical machines on a single subnet. For networking between virtual machine instances, three network options are available: flat, DHCP, and VLAN.

Database: For OpenStack Compute, you need access to either a PostgreSQL or MySQL database, or you can install it as part of the OpenStack Compute installation process.

Permissions: You can install OpenStack Compute either as root or as a user with sudo permissions if you configure the sudoers file to enable all the permissions.

3.2. Example Installation Architectures

OpenStack Compute uses a shared-nothing, messaging-based architecture. While very flexible, the fact that you can install each nova- service on an independent server

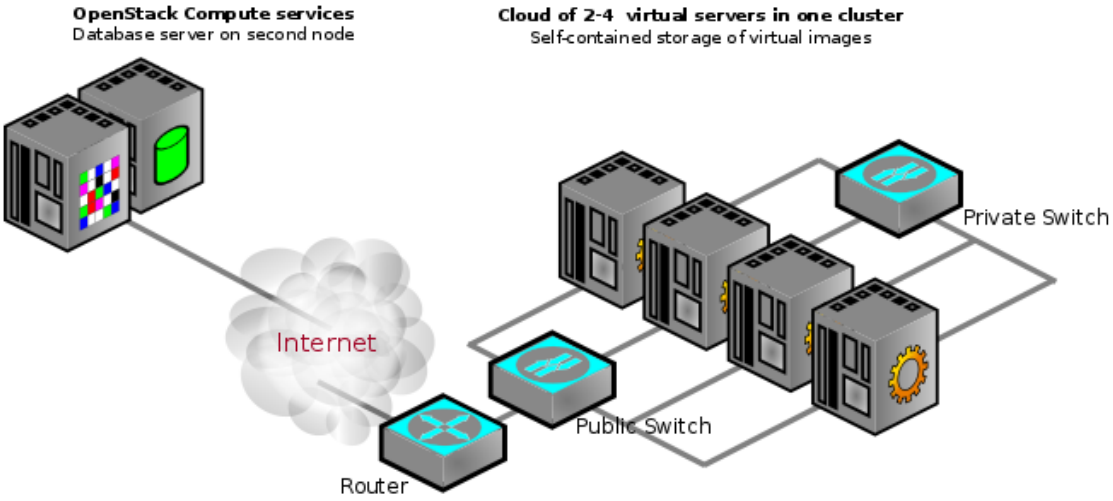
means there are many possible methods for installing OpenStack Compute. The only co-dependency between possible multi-node installations is that the Dashboard must be installed nova-api server. Here are the types of installation architectures:

- Single node: Only one server runs all nova- services and also drives all the virtual instances. Use this configuration only for trying out OpenStack Compute, or for development purposes.

- Two nodes: A cloud controller node runs the nova- services except for nova-compute, and a compute node runs nova-compute. A client computer is likely needed to bundle images and interfacing to the servers, but a client is not required. Use this configuration for proof of concepts or development environments.

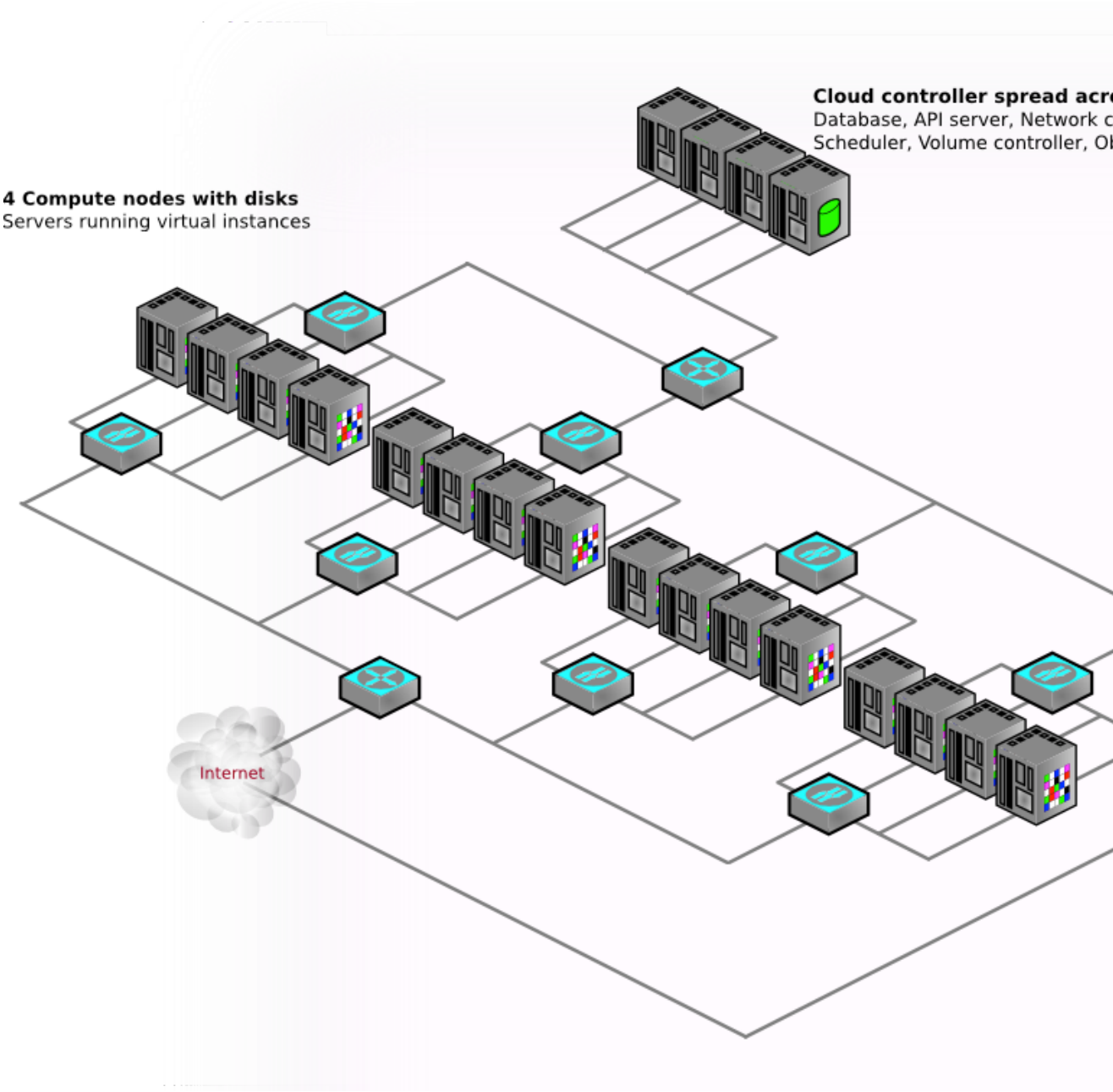
- Multiple nodes: You can add more compute nodes to the two node installation by simply installing nova-compute on an additional server and copying a nova.conf file to the added node. This would result in a multiple node installation. You can also add a volume controller and a network controller as additional nodes in a more complex multiple node installation. A minimum of 4 nodes is best for running multiple virtual instances that require a lot of processing power.

This is an illustration of one possible multiple server installation of OpenStack Compute; virtual server networking in the cluster may vary.



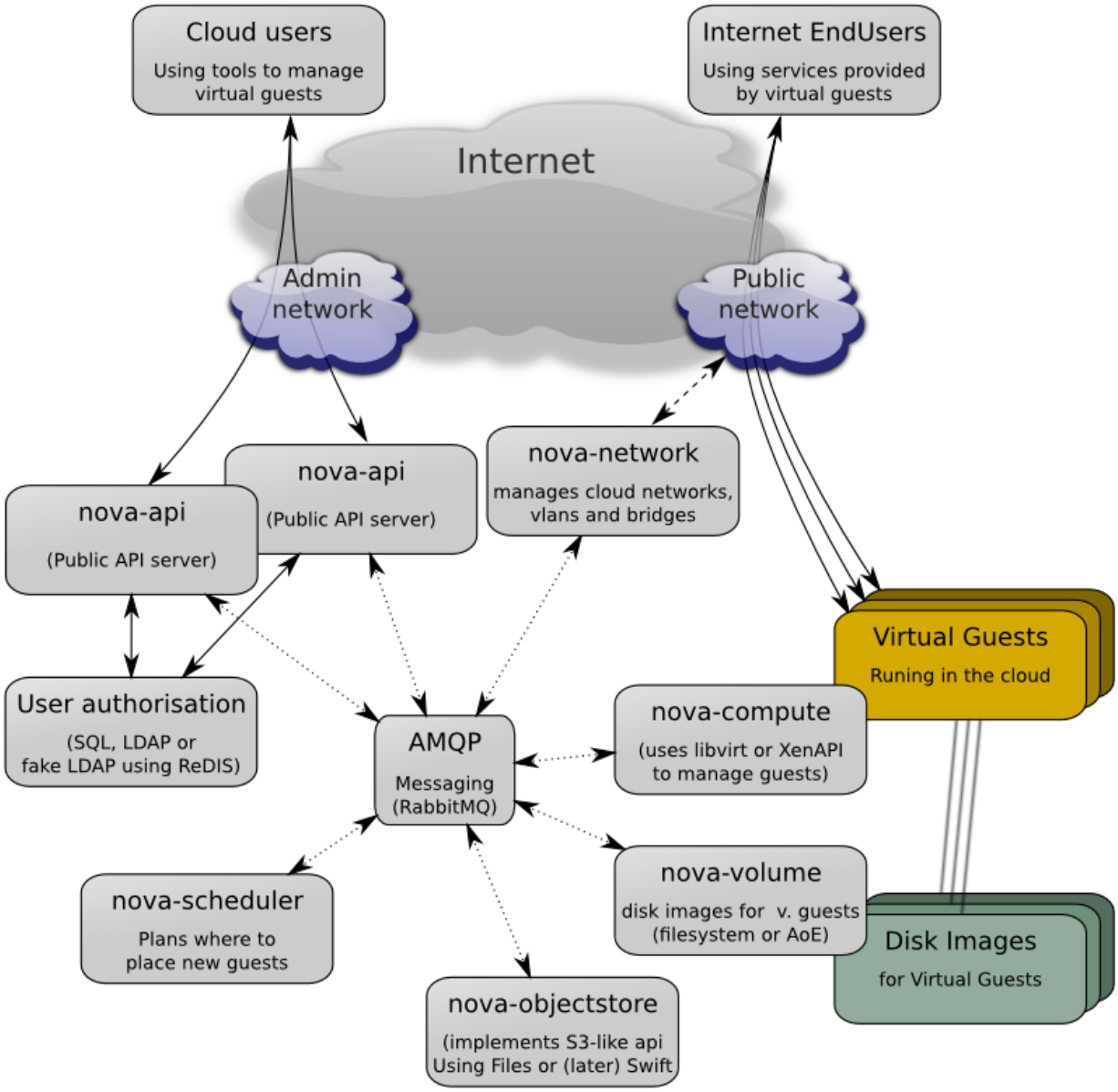
An alternative architecture would be to add more messaging servers if you notice a lot of back up in the messaging queue causing performance problems. In that case you would add an additional RabbitMQ server in addition to or instead of scaling up the database server. Your installation can run any nova- service on any server as long as the nova.conf is configured to point to the RabbitMQ server and the server can send messages to the server.

Multiple installation architectures are possible, here is another example illustration.



3.3. Service Architecture

Because Compute has multiple services and many configurations are possible, here is a diagram showing the overall service architecture and communication systems between the services.



3.4. Installing OpenStack Compute on Ubuntu

How you go about installing OpenStack Compute depends on your goals for the installation.

3.4.1. ISO Distribution Installation

You can download and use an ISO image that is based on a Ubuntu Linux Server 10.04 LTS distribution containing only the components needed to run OpenStack Compute. See http://sourceforge.net/projects/stackops/files/ for download files and information, license information, and a README file.

3.4.2. Scripted Installation

You can download a script from GitHub at https://github.com/elasticdog/OpenStack-NOVA-Installer-Script/raw/master/nova-install.

Copy the file to the servers where you want to install OpenStack Compute services - with multiple servers, you could install a compute node and multiple cloud controller nodes. The compute node manages all the virtual machines through the nova-compute service. The cloud controller node contains all other nova- services.

Ensure you can execute the script by modifying the permissions on the script file.

```
wget --no-check-certificate https://github.com/elasticdog/OpenStack-NOVA-
Installer-Script/raw/master/nova-install
sudo chmod 755 nova-install
```

You must run the script with root permissions.

```
sudo bash nova-install -t cloud
```

The way this script is designed, you can have multiple servers for the cloud controller, the messaging service, and the database server, or run it all on one server. The -t or -type parameter has two options: `nova-install -t cloud` installs the cloud controller and `nova-install -t compute` installs a compute node for an existing cloud controller.

These are the parameters you enter using the script:

- Enter the Cloud Controller Host IP address.
- Enter the S3 IP, or use the default address as the current server's IP address.
- Enter the RabbitMQ Host IP. Again, you can use the default to install it to the local server. RabbitMQ will be installed.
- Enter the MySQL host IP address.
- Enter the MySQL root password and verify it.
- Enter a network range for all projects in CIDR format.

The script uses all these values entered for the configuration information to create the nova.conf configuration file. The script also walks you through creating a user and project. Enter a user name and project name when prompted. It also generates credentials.

After configuring OpenStack Compute using the script, be sure to source the novarc credential file.

```
source /root/creds/novarc
```

Now all the necessary nova services are started up and you can begin to issue nova-manage commands. If you configured it to all run from one server, you're done. If you have a second server that you intend to use as a compute node (a node that does not contain the database), install the nova services on the second node using the -t compute parameters using the same nova-install script.

To run from two or more servers, copy the nova.conf from the cloud controller node to the compute node.

3.4.3. Manual Installation

The manual installation involves installing from packages on Ubuntu 10.04 or 10.10 as a user with root permission. Depending on your environment, you may need to prefix these commands with sudo.

This installation process walks through installing a cloud controller node and a compute node. The cloud controller node contains all the nova- services including the API server and the database server. The compute node needs to run only the nova-compute service. You only need one nova-network service running in a multi-node install. You cannot install nova-objectstore on a different machine from nova-compute (production-style deployments will use a Glance server for virtual images).

3.4.3.1. Installing the Cloud Controller

First, set up pre-requisites to use the Nova PPA (Personal Packages Archive) provided through https://launchpad.net/~nova-core/+archive/trunk. The 'python-software-properties' package is a pre-requisite for setting up the nova package repository. You can also use the release package by adding the ppa:nova-core/release repository.

```
sudo apt-get install python-software-properties
```

```
sudo add-apt-repository ppa:nova-core/trunk
```

Run update with `sudo apt-get update`.

Install the messaging queue server, RabbitMQ.

```
sudo apt-get install -y rabbitmq-server
```

Now, install the Python dependencies.

```
sudo apt-get install -y python-greenlet python-mysqldb
```

Install the required nova- packages, and dependencies should be automatically installed.

```
sudo apt-get install -y nova-common nova-doc python-nova nova-api
                        nova-network nova-objectstore nova-scheduler nova-
compute
```

Install the supplemental tools such as euca2ools and unzip.

```
sudo apt-get install -y euca2ools unzip
```

3.4.3.1.1. Setting up the SQL Database (MySQL) on the Cloud Controller

You must use a SQLAlchemy-compatible database, such as MySQL or PostgreSQL. This example shows MySQL.

First you can set environments with a "pre-seed" line to bypass all the installation prompts, running this as root:

```
bash
```

```
MYSQL_PASS=nova
NOVA_PASS=notnova
cat <<MYSQL_PRESEED | debconf-set-selections
mysql-server-5.1 mysql-server/root_password password $MYSQL_PASS
mysql-server-5.1 mysql-server/root_password_again password $MYSQL_PASS
mysql-server-5.1 mysql-server/start_on_boot boolean true
MYSQL_PRESEED
```

Next, install MySQL with: `sudo apt-get install -y mysql-server`

Edit /etc/mysql/my.cnf to change 'bind-address' from localhost (127.0.0.1) to any (0.0.0.0) and restart the mysql service:

```
sudo sed -i 's/127.0.0.1/0.0.0.0/g' /etc/mysql/my.cnf
sudo service mysql restart
```

To configure the MySQL database, create the nova database:

```
sudo mysql -uroot -p$MYSQL_PASS -e 'CREATE DATABASE nova;'
```

Update the DB to give user 'nova'@'%' full control of the nova database:

```
sudo mysql -uroot -p$MYSQL_PASS -e "GRANT ALL PRIVILEGES ON *.* TO
                            'nova'@'%' WITH GRANT OPTION;"
```

Set MySQL password for 'nova'@'%':

```
sudo mysql -uroot -p$MYSQL_PASS -e "SET PASSWORD FOR 'nova'@'%' =
                           PASSWORD('$NOVA_PASS');"
```

3.4.3.2. Installing the Compute Node

There are many different ways to perform a multinode install of Compute. In this case, you can install all the nova- packages and dependencies as you did for the Cloud Controller node, or just install nova-network and nova-compute. Your installation can run any nova- services anywhere, so long as the service can access nova.conf so it knows where the rabbitmq server is installed.

The Compute Node is where you configure the Compute network, the networking between your instances. There are three options: flat, flatDHCP, and VLAN.

If you use FlatManager as your network manager, there are some additional networking changes to ensure connectivity between your nodes and VMs. If you chose VlanManager or FlatDHCP, you may skip this section because they are set up for you automatically.

Compute defaults to a bridge device named 'br100'. This needs to be created and somehow integrated into your network. To keep things as simple as possible, have all the VM guests on the same network as the VM hosts (the compute nodes). To do so, set the compute node's external IP address to be on the bridge and add eth0 to that bridge. To do this, edit your network interfaces configuration to look like the following example:

```
< begin /etc/network/interfaces >
# The loopback network interface
auto lo
iface lo inet loopback
```

```
# Networking for OpenStack Compute
auto br100

iface br100 inet dhcp
bridge_ports        eth0
bridge_stp           off
bridge_maxwait   0
bridge_fd            0
< end /etc/network/interfaces >
```

Next, restart networking to apply the changes:

```
sudo /etc/init.d/networking restart
```

If you use flat networking, you must manually insert the IP address into the 'fixed_ips' table in the nova database. Also ensure that the database lists the bridge name correctly that matches the network configuration you are working within. Flat networking should insert this automatically but you may need to check it.

3.4.3.3. Restart All Relevant Services on the Compute Node

On both nodes, restart all six services in total, just to cover the entire spectrum:

```
restart libvirt-bin; restart nova-network; restart nova-compute;
restart nova-api; restart nova-objectstore; restart nova-scheduler
```

3.5. Installing OpenStack Compute on Red Hat Enterprise Linux 6

This section documents a multi-node installation using RHEL 6. RPM repos for the Bexar release, the Cactus release, and also per-commit trunk builds for OpenStack Nova are available at http://yum.griddynamics.net.

Known limitations for RHEL version 6 installations:

- iSCSI LUN not supported due to tgtadm vs ietadm differences
- Only KVM hypervisor has been tested with this installation

To install Nova on RHEL v.6 you need access to two repositories, one available on the yum.griddynamics.net website and the RHEL DVD image connected as repo.

First, install RHEL 6.0, preferrably with a minimal set of packages.

Disable SELinux in /etc/sysconfig/selinux and then reboot.

Connect the RHEL 3. 6.0 x86_64 DVD as a repository in YUM.

```
sudo mount /dev/cdrom /mnt/cdrom
cat /etc/yum.repos.d/rhel.repo
[rhel]
name=RHEL 6.0
baseurl=file:///mnt/cdrom/Server
enabled=1
gpgcheck=0
```

Download and install repo config and key.

```
wget http://yum.griddynamics.net/openstack-repo-2011.1-2.noarch.rpm
sudo rpm -i openstack-repo-2011.1-2.noarch.rpm
```

Install the libvirt package (these instructions are tested only on KVM).

```
sudo yum install libvirt
sudo chkconfig libvirtd on
sudo service libvirtd start
```

Repeat the basic installation steps to put the pre-requisites on all cloud controller and compute nodes. Nova has many different possible configurations. You can install Nova services on separate servers as needed but these are the basic pre-reqs.

These are the basic packages to install for a cloud controller node:

```
sudo yum install euca2ools openstack-nova-
{api,compute,network,objectstore,scheduler,volume} openstack-nova-cc-config
 openstack-glance
```

These are the basic packages to install compute nodes. Repeat for each compute node (the node that runs the VMs) that you want to install.

```
sudo yum install openstack-nova-compute openstack-nova-compute-config
```

On the cloud controller node, create a MySQL database named nova.

```
sudo service mysqld start
sudo chkconfig mysqld on
sudo service rabbitmq-server start
sudo chkconfig rabbitmq-server on
mysqladmin -uroot password nova
```

You can use this script to create the database.

```
#!/bin/bash

DB_NAME=nova
DB_USER=nova
DB_PASS=nova
PWD=nova

CC_HOST="A.B.C.D" # IPv4 address
HOSTS='node1 node2 node3' # compute nodes list

mysqladmin -uroot -p$PWD -f drop nova
mysqladmin -uroot -p$PWD create nova

for h in $HOSTS localhost; do
        echo "GRANT ALL PRIVILEGES ON $DB_NAME.* TO '$DB_USER'@'$h' IDENTIFIED
 BY '$DB_PASS';" | mysql -uroot -p$DB_PASS mysql
done
echo "GRANT ALL PRIVILEGES ON $DB_NAME.* TO $DB_USER IDENTIFIED BY
 '$DB_PASS';" | mysql -uroot -p$DB_PASS mysql
echo "GRANT ALL PRIVILEGES ON $DB_NAME.* TO root IDENTIFIED BY '$DB_PASS';" |
 mysql -uroot -p$DB_PASS mysql
```

Now, ensure the database version matches the version of nova that you are installing:

```
nova-manage db sync
```

On each node, set up the configuration file in /etc/nova/nova.conf.

Start the Nova services after configuring and you then are running an OpenStack cloud!

```
for n in api compute network objectstore scheduler volume; do sudo service
 openstack-nova-$n start; done
sudo service openstack-glance start
for n in node1 node2 node3; do ssh $n sudo service openstack-nova-compute
 start; done
```

3.6. Post-Installation Configuration for OpenStack Compute

Configuring your Compute installation involves nova-manage commands plus editing the nova.conf file to ensure the correct flags are set. This section contains the basics for a simple multi-node installation, but Compute can be configured many ways. You can find networking options and hypervisor options described in separate chapters, and you will read about additional configuration information in a separate chapter as well.

3.6.1. Setting Flags in the nova.conf File

The configuration file nova.conf is installed in /etc/nova by default. You only need to do these steps when installing manually, the scripted installation above does this configuration during the installation. A default set of options are already configured in nova.conf when you install manually. The defaults are as follows:

```
--daemonize=1
--dhcpbridge_flagfile=/etc/nova/nova.conf
--dhcpbridge=/usr/bin/nova-dhcpbridge
--logdir=/var/log/nova
--state_path=/var/lib/nova
```

Starting with the default file, you must define the following required items in /etc/nova/nova.conf. The flag variables are described below. You cannot place comments in the nova.conf file. To see a listing of all possible flag settings, see the output of running /bin/nova-api –help.

Table 3.1. Description of nova.conf flags (not comprehensive)

Flag	Description
–sql_connection	IP address; Location of OpenStack Compute SQL database
–s3_host	IP address; Location where OpenStack Compute is hosting the objectstore service, which will contain the virtual machine images and buckets
–rabbit_host	IP address; Location of OpenStack Compute SQL database
–ec2_api	IP address; Location where the nova-api service runs
–verbose	Set to 1 to turn on; Optional but helpful during initial setup
–ec2_url	HTTP URL; Location to interface nova-api. Example: http://184.106.239.134:8773/services/Cloud

Flag	Description
–network_manager	Configures how your controller will communicate with additional OpenStack Compute nodes and virtual machines. Options: • nova.network.manager.FlatManager Simple, non-VLAN networking • nova.network.manager.FlatDHCPManager Flat networking with DHCP • nova.network.manager.VlanManager VLAN networking with DHCP; This is the Default if no network manager is defined here in nova.conf.
–fixed_range	IP address/range; Network prefix for the IP network that all the projects for future VM guests reside on. Example: 192.168.0.0/12
–network_size	Number value; Number of IP addresses to use for VM guests across all projects.

Here is a simple example nova.conf file for a small private cloud, with all the cloud controller services, database server, and messaging server on the same server.

```
--dhcpbridge_flagfile=/etc/nova/nova.conf
--dhcpbridge=/usr/bin/nova-dhcpbridge
--logdir=/var/log/nova
--state_path=/var/lib/nova
--verbose
--s3_host=184.106.239.134
--rabbit_host=184.106.239.134
--ec2_api=184.106.239.134
--ec2_url=http://184.106.239.134:8773/services/Cloud
--fixed_range=192.168.0.0/12
--network_size=8
--routing_source_ip=184.106.239.134
--sql_connection=mysql://nova:notnova@184.106.239.134/nova
```

Create a “nova” group, so you can set permissions on the configuration file:

```
sudo addgroup nova
```

The nova.config file should have its owner set to root:nova, and mode set to 0640, since the file contains your MySQL server’s username and password.

```
chown -R root:nova /etc/nova
chmod 640 /etc/nova/nova.conf
```

3.6.2. Setting Up OpenStack Compute Environment on the Compute Node

These are the commands you run to ensure the database schema is current, and then set up a user and project:

```
/usr/bin/nova-manage db sync
/usr/bin/nova-manage user admin <user_name>
/usr/bin/nova-manage project create <project_name> <user_name>
```

```
/usr/bin/nova-manage network create <project-network> <number-of-networks-in-project> <addresses-in-each-network>
```

Here is an example of what this looks like with real values entered:

```
/usr/bin/nova-manage db sync
/usr/bin/nova-manage user admin dub
/usr/bin/nova-manage project create dubproject dub
/usr/bin/nova-manage network create 192.168.0.0/24 1 256
```

For this example, the number of IPs is /24 since that falls inside the /12 range that was set in 'fixed-range' in nova.conf. Currently, there can only be one network, and this set up would use the max IPs available in a /24. You can choose values that let you use any valid amount that you would like.

The nova-manage service assumes that the first IP address is your network (like 192.168.0.0), that the 2nd IP is your gateway (192.168.0.1), and that the broadcast is the very last IP in the range you defined (192.168.0.255). If this is not the case you will need to manually edit the sql db 'networks' table.o.

When you run the `nova-manage network create` command, entries are made in the 'networks' and 'fixed_ips' table. However, one of the networks listed in the 'networks' table needs to be marked as bridge in order for the code to know that a bridge exists. The network in the Nova networks table is marked as bridged automatically for Flat Manager.

3.6.3. Creating Certifications

Generate the certifications as a zip file. These are the certs you will use to launch instances, bundle images, and all the other assorted API functions.

```
mkdir –p /root/creds
/usr/bin/python /usr/bin/nova-manage project zipfile $NOVA_PROJECT
 $NOVA_PROJECT_USER /root/creds/novacreds.zip
```

If you are using one of the Flat modes for networking, you may see a Warning message "No vpn data for project <project_name>" which you can safely ignore.

Unzip them in your home directory, and add them to your environment.

```
unzip /root/creds/novacreds.zip -d /root/creds/
cat /root/creds/novarc >> ~/.bashrc
source ~/.bashrc
```

3.6.4. Enabling Access to VMs on the Compute Node

One of the most commonly missed configuration areas is not allowing the proper access to VMs. Use the 'euca-authorize' command to enable access. Below, you will find the commands to allow 'ping' and 'ssh' to your VMs:

```
euca-authorize -P icmp -t -1:-1 default
euca-authorize -P tcp -p 22 default
```

Another common issue is you cannot ping or SSH your instances after issuing the 'euca-authorize' commands. Something to look at is the amount of 'dnsmasq' processes that are running. If you have a running instance, check to see that TWO 'dnsmasq' processes are running. If not, perform the following:

```
killall dnsmasq
service nova-network restart
```

3.6.5. Configuring Multiple Compute Nodes

If your goal is to split your VM load across more than one server, you can connect an additional nova-compute node to a cloud controller node. This configuring can be reproduced on multiple compute servers to start building a true multi-node OpenStack Compute cluster.

To build out and scale the Compute platform, you spread out services amongst many servers. While there are additional ways to accomplish the build-out, this section describes adding compute nodes, and the service we are scaling out is called 'nova-compute.'

With the Bexar release we have two configuration files: nova-api.conf and nova.conf. For a multi-node install you only make changes to nova.conf and copy it to additional compute nodes. Ensure each nova.conf file points to the correct IP addresses for the respective services. Customize the nova.config example below to match your environment. The CC_ADDR is the Cloud Controller IP Address.

```
                --dhcpbridge_flagfile=/etc/nova/nova.conf
                --dhcpbridge=/usr/bin/nova-dhcpbridge
                --logdir=/var/log/nova
                --state_path=/var/lib/nova
                --verbose
                --sql_connection=mysql://root:nova@CC_ADDR/nova
                --s3_host=CC_ADDR
                --rabbit_host=CC_ADDR
                --ec2_api=CC_ADDR
                --ec2_url=http://CC_ADDR:8773/services/Cloud
                --network_manager=nova.network.manager.FlatManager
                --fixed_range= network/CIDR
                --network_size=number of addresses
```

By default, Nova sets 'br100' as the bridge device, and this is what needs to be done next. Edit /etc/network/interfaces with the following template, updated with your IP information.

```
           # The loopback network interface
           auto lo
           iface lo inet loopback

           # The primary network interface
           auto br100
           iface br100 inet static
           bridge_ports    eth0
           bridge_stp      off
           bridge_maxwait  0
           bridge_fd       0
           address xxx.xxx.xxx.xxx
           netmask xxx.xxx.xxx.xxx
           network xxx.xxx.xxx.xxx
           broadcast xxx.xxx.xxx.xxx
           gateway xxx.xxx.xxx.xxx
           # dns-* options are implemented by the resolvconf package, if
installed
```

```
            dns-nameservers xxx.xxx.xxx.xxx
```

Restart networking:

```
/etc/init.d/networking restart
```

With nova.conf updated and networking set, configuration is nearly complete. First, lets bounce the relevant services to take the latest updates:

```
restart libvirt-bin; service nova-compute restart
```

To avoid issues with KVM and permissions with Nova, run the following commands to ensure we have VM's that are running optimally:

```
chgrp kvm /dev/kvm
chmod g+rw /dev/kvm
```

If you want to use the 10.04 Ubuntu Enterprise Cloud images that are readily available at http://uec-images.ubuntu.com/releases/10.04/release/, you may run into delays with booting. Any server that does not have nova-api running on it needs this iptables entry so that UEC images can get metadata info. On compute nodes, configure the iptables with this next step:

```
 # iptables -t nat -A PREROUTING -d 169.254.169.254/32 -p tcp -m tcp --dport
 80 -j DNAT --to-destination $NOVA_API_IP:8773
```

Lastly, confirm that your compute node is talking to your cloud controller. From the cloud controller, run this database query:

```
mysql -u$MYSQL_USER -p$MYSQL_PASS nova -e 'select * from services;'
```

In return, you should see something similar to this:

```
            +---------------------+---------------------+------------
+---------+----+----------+----------------+-----------+--------------
+----------+-------------------+
            | created_at          | updated_at          | deleted_at | deleted
 | id | host     | binary         | topic     | report_count | disabled |
 availability_zone |
            +---------------------+---------------------+------------
+---------+----+----------+----------------+-----------+--------------
+----------+-------------------+
            | 2011-01-28 22:52:46 | 2011-02-03 06:55:48 | NULL       |       0
 |  1 | osdemo02 | nova-network   | network   |        46064 |        0 | nova
              |
            | 2011-01-28 22:52:48 | 2011-02-03 06:55:57 | NULL       |       0
 |  2 | osdemo02 | nova-compute   | compute   |        46056 |        0 | nova
              |
            | 2011-01-28 22:52:52 | 2011-02-03 06:55:50 | NULL       |       0
 |  3 | osdemo02 | nova-scheduler | scheduler |        46065 |        0 | nova
              |
            | 2011-01-29 23:49:29 | 2011-02-03 06:54:26 | NULL       |       0
 |  4 | osdemo01 | nova-compute   | compute   |        37050 |        0 | nova
              |
            | 2011-01-30 23:42:24 | 2011-02-03 06:55:44 | NULL       |       0
 |  9 | osdemo04 | nova-compute   | compute   |        28484 |        0 | nova
              |
            | 2011-01-30 21:27:28 | 2011-02-03 06:54:23 | NULL       |       0
 |  8 | osdemo05 | nova-compute   | compute   |        29284 |        0 | nova
              |
```

```
            +--------------------+--------------------+------------
+---------+----+----------+---------------+-----------+-------------
+----------+------------------+
```

You can see that 'osdemo0{1,2,4,5} are all running 'nova-compute.' When you start spinning up instances, they will allocate on any node that is running nova-compute from this list.

3.6.6. Migrating from Bexar to Cactus

If you have an installation already installed and running, to migrate to Cactus you must update the installation first, then your database, then perhaps your images if you were already running images on Bexar in the nova-objectstore. If you were running images through Glance, your images should work automatically after an upgrade. Here are the overall steps.

If your installation already pointed to ppa:nova-core/release, the release package has been updated from Bexar to Cactus so you can simply run:

```
apt-get update
apt-get upgrade
```

Next, update the database schema.

```
nova-manage db sync
```

Restart all the nova- services.

Make sure that you can launch images. You can convert images that were previously stored in the nova object store using this command:

```
nova-manage image convert /var/lib/nova/images
```

4. Configuring OpenStack Compute

Table of Contents

The OpenStack system has several key projects that are separate installations but can work together depending on your cloud needs: OpenStack Compute, OpenStack Object Storage, and OpenStack Image Store. You can install any of these projects separately and then configure them either as standalone or connected entities.

4.1. General Compute Configuration Overview

Most configuration information is available in the nova.conf flag file. Here are some general purpose flags that you can use to learn more about the flag file and the node. The configuration file nova.conf is typically stored in /etc/nova/nova.conf.

You can use a particular flag file by using the –flagfile (nova.conf) parameter when running one of the nova- services. This inserts flag definitions from the given configuration file name, which may be useful for debugging or performance tuning. Here are some general purpose flags.

Table 4.1. Description of general purpose nova.conf flags

Flag	Default	Description
–my_ip	None	IP address; Calculated to contain the host IP address.
–host	None	String value; Calculated to contain the name of the node where the cloud controller is hosted
-?, –[no]help	None	Show this help.
–[no]helpshort	None	Show usage only for this module.
–[no]helpxml	None	Show this help, but with XML output instead of text

If you want to maintain the state of all the services, you can use the –state_path flag to indicate a top-level directory for storing data related to the state of Compute including images if you are using the Compute object store. Here are additional flags that apply to all nova- services.

Table 4.2. Description of nova.conf flags for all services

Flag	Default	Description
–state_path	'/Users/username/p/nova/nova/../'	Directory path; Top-level directory for maintaining nova's state.
–periodic_interval	default: '60'	Integer value; Seconds between running periodic tasks.
–report_interval	default: '10'	Integer value; Seconds between nodes reporting state to the data store.

4.2. Configuring Logging

You can use nova.conf flags to indicate where Compute will log events, the level of logging, and customize log formats.

Table 4.3. Description of nova.conf flags for logging

Flag	Default	Description
–logdir	'/var/logs/nova'	Directory path; Output to a per-service log file in the named directory.
–logfile	default: ''	File name; Output to named file.
–[no]use_syslog	default: 'false'	Output to syslog using their file naming system.
–default_log_levels	default: 'amqplib=WARN,sqlalchemy=WARN,eventlet=WARN';	Pair of named loggers and level of messages to be logged; List of logger=LEVEL pairs
–verbose	default: 'false'	Set to 1 or true to turn on; Shows debug output - optional but helpful during initial setup.

To customize log formats for OpenStack Compute, use these flag settings.

Table 4.4. Description of nova.conf flags for customized log formats

Flag	Default	Description
–logging_context_format_string	default: '%(asctime)s %(levelname)s %(name)s [%(request_id)s %(user)s %(project)s] %(message)s'	The format string to use for log messages with additional context.
–logging_debug_format_suffix	default: 'from %(processName)s (pid=%(process)d) %(funcName)s %(pathname)s:%(lineno)d'	The data to append to the log format when level is DEBUG
–logging_default_format_string	default: '%(asctime)s %(levelname)s %(name)s [-] %(message)s'	The format string to use for log messages without context.
–logging_exception_prefix	default: '(%(name)s): TRACE: '	String value; Prefix each line of exception output with this format.

4.3. Configuring Hypervisors

OpenStack Compute requires a hypervisor and supports several hypervisors and virtualization standards. Configuring and running OpenStack Compute to use a particular hypervisor takes several installation and configuration steps.

4.4. Configuring Compute to use IPv6 Addresses

You can configure Compute to use both IPv4 and IPv6 addresses for communication by putting it into a IPv4/IPv6 dual stack mode. In IPv4/IPv6 dual stack mode, instances can acquire their IPv6 global unicast address by stateless address autoconfiguration mechanism [RFC 4862/2462]. IPv4/IPv6 dual stack mode works with VlanManager and FlatDHCPManager networking modes, though floating IPs are not supported in the Bexar release. In VlanManager, different 64bit global routing prefix is used for each project. In FlatDHCPManager, one 64bit global routing prefix is used for all instances. The Cactus release includes support for the FlatManager networking mode with a required database migration.

This configuration has been tested on Ubuntu 10.04 with VM images that have IPv6 stateless address autoconfiguration capability (must use EUI-64 address for stateless address autoconfiguration), a requirement for any VM you want to run with an IPv6 address. Each node that executes a nova- service must have python-netaddr and radvd installed.

On all nova-nodes, install python-netaddr:

```
sudo apt-get install -y python-netaddr
```

On all nova-network nodes install radvd and configure IPv6 networking:

```
sudo apt-get install -y radvd
sudo bash -c "echo 1 > /proc/sys/net/ipv6/conf/all/forwarding"
sudo bash -c "echo 0 > /proc/sys/net/ipv6/conf/all/accept_ra"
```

Edit the nova.conf file on all nodes to set the –use_ipv6 flag to True. Restart all nova-services.

When using the command 'nova-manage network create' you can now add a fixed range for IPv6 addresses.

```
nova-manage network create fixed_range num_networks network_size [vlan_start]
 [vpn_start] [fixed_range_v6]
```

You can set IPv6 global routing prefix by using the fixed_range_v6 parameter. The default is: fd00::/48. When you use FlatDHCPManager, the command uses the original value of fixed_range_v6. When you use VlanManager, the command creates prefixes of subnet by incrementing subnet id. Guest VMs uses this prefix for generating their IPv6 global unicast address.

Here is a usage example for VlanManager:

```
nova-manage network create 10.0.1.0/24 3 32 100 1000 fd00:1::/48
```

Here is a usage example for FlatDHCPManager:

```
nova-manage network create 10.0.2.0/24 3 32 0 0 fd00:1::/48
```

Note that [vlan_start] and [vpn_start] parameters are not used by FlatDHCPManager.

Table 4.5. Description of nova.conf flags for configuring IPv6

Flag	Default	Description
–use_ipv6	default: 'false'	Set to 1 or true to turn on; Determines whether to use IPv6 network addresses
–flat_injected	default: 'false'	Cactus only:Indicates whether Compute (Nova) should use attempt to inject IPv6 network configuration information into the guest. It attempts to modify /etc/network/interfaces and currently only works on Debian-based systems.

4.5. Configuring Image Service and Storage for Compute

You can either use a local image storage system or install Glance for storing and retrieving images. After you have installed a Glance server, you can configure nova-compute to use Glance for image storage and retrieval. You must change the –image_service flag to 'nova.image.glance.GlanceImageService' in order to use Glance to store and retrieve images for OpenStack Compute.

Table 4.6. Description of nova.conf flags for the Glance image service and storage

Flag	Default	Description
–glance_host=GLANCE_SERVER_IP	default: '$my_ip'	IP address; Used to identify where the Glance server is installed
–image_service	default: 'nova.image.local.LocalImageService'	The service to use for retrieving and searching for images. Images must be registered using euca2ools. Options: • nova.image.s3.S3ImageService S3 backend for the Image Service. • nova.image.local.LocalImageService Image service storing images to local disk. It assumes that image_ids are integers. This is the default setting if no image manager is defined here. • **nova.image.glance.GlanceImageService** Glance back end for storing and retrieving images; See http://glance.openstack.org for more info.
–glance_host	default: '$my_ip'	IP address; IP address of OpenStack Compute Image Service server (project's name is Glance)
–glance_port	default: '9292'	Port value; Port opened for OpenStack Compute Image Service server (project's name is Glance)
–s3_dmz	default: '$my_ip'	IP address; For instances internal IP (a DMZ is shorthand for a demilitarized zone)

Flag	Default	Description
–s3_host	default: '$my_ip'	IP address: IP address of the S3 host for infrastructure. Location where OpenStack Compute is hosting the objectstore service, which will contain the virtual machine images and buckets.
–s3_port	default: '3333'	Integer value; Port where S3 host is running
–use_s3	default: 'true'	Set to 1 or true to turn on; Determines whether to get images from s3 or use a local copy

If you choose not to use Glance for the image service, you can use the object store that maintains images in a particular location, namely the state path on the server local to the nova.conf file. You can also use a set of S3 buckets to store images.

Table 4.7. Description of nova.conf flags for local image storage

Flag	Default	Description
–image_service	default: 'nova.image.local.LocalImageService'	The service to use for retrieving and searching for images. Images must be registered using euca2ools. Options: • nova.image.s3.S3ImageService S3 backend for the Image Service; In Cactus, the S3 image service wraps the other image services for use by the EC2 API. The EC2 api will always use the S3 image service by default so setting the flag is not necessary. • **nova.image.local.LocalImageService** Image service storing images to local disk. It assumes that image_ids are integers. • nova.image.glance.GlanceImageService Glance back end for storing and retrieving images; See http://glance.openstack.org for more info.
–state_path	'/Users/username/p/nova/nova/../'	Directory path; Top-level directory for maintaining nova's state.
–buckets_path	'$state_path/buckets'	Directory path; Directory established for S3-style buckets.
–images_path	'$state_path/images'	Directory path; Directory that stores images when using object store.

4.6. Configuring Live Migrations

The live migration feature is useful when you need to upgrade or installing patches to hypervisors/BIOS and you need the machines to keep running. For example, when one of HDD volumes RAID or one of bonded NICs is out of order. Also for regular periodic maintenance, you may need to migrate VM instances. When many VM instances are running on a specific physical machine, you can redistribute the high load. Sometimes when

VM instances are scattered, you can move VM instances to a physical machine to arrange them more logically.

Environments

- **OS:** Ubuntu 10.04/10.10 for both instances and host.
- **Shared storage:** NOVA-INST-DIR/instances/ has to be mounted by shared storage (tested using NFS).
- **Instances:** Instance can be migrated with ISCSI/AoE based volumes
- **Hypervisor:** KVM with libvirt
- **(NOTE1)** "NOVA-INST-DIR/instance" is expected that vm image is put on to. see "flags.instances_path" in nova.compute.manager for the default value
- **(NOTE2)** This feature is admin only, since nova-manage is necessary.

Sample Nova Installation before starting

- Prepare 3 servers at least, lets say, HostA, HostB and HostC
- nova-api/nova-network/nova-volume/nova-objectstore/ nova-scheduler(and other daemon) are running on HostA.
- nova-compute is running on both HostB and HostC.
- HostA export NOVA-INST-DIR/instances, HostB and HostC mount it.
- To avoid any confusion, NOVA-INST-DIR is same at HostA/HostB/HostC("NOVA-INST-DIR" shows top of install dir).
- HostA export NOVA-INST-DIR/instances, HostB and HostC mount it.

Pre-requisite configurations

1. Configure /etc/hosts, Make sure 3 Hosts can do name-resolution with each other. Ping with each other is better way to test.

```
# ping HostA
# ping HostB
# ping HostC
```

2. Configure NFS at HostA by adding below to /etc/exports

```
NOVA-INST-DIR/instances HostA/255.255.0.0(rw,sync,fsid=0,no_root_squash
```

Change "255.255.0.0" appropriate netmask, which should include HostB/HostC. Then restart nfs server.

```
# /etc/init.d/nfs-kernel-server restart
# /etc/init.d/idmapd restart
```

3. Configure NFS at HostB and HostC by adding below to /etc/fstab

```
HostA:/ DIR nfs4 defaults 0 0
```

Then mount, check exported directory can be mounted.

```
# mount -a -v
```

If fail, try this at any hosts.

```
# iptables -F
```

Also, check file/daemon permissions. We expect any nova daemons are running as root.

```
# ps -ef | grep nova
root 5948 5904 9 11:29 pts/4 00:00:00 python /opt/nova-2010.4//bin/nova-api
root 5952 5908 6 11:29 pts/5 00:00:00 python /opt/nova-2010.4//bin/nova-
objectstore
... (snip)
```

"NOVA-INST-DIR/instances/" directory can be seen at HostA

```
# ls -ld NOVA-INST-DIR/instances/
drwxr-xr-x 2 root root 4096 2010-12-07 14:34 nova-install-dir/instances/
```

Same check at HostB and HostC

```
# ls -ld NOVA-INST-DIR/instances/
drwxr-xr-x 2 root root 4096 2010-12-07 14:34 nova-install-dir/instances/

# df -k
Filesystem           1K-blocks      Used Available Use% Mounted on
/dev/sda1            921514972   4180880 870523828   1% /
none                  16498340      1228  16497112   1% /dev
none                  16502856         0  16502856   0% /dev/shm
none                  16502856       368  16502488   1% /var/run
none                  16502856         0  16502856   0% /var/lock
none                  16502856         0  16502856   0% /lib/init/rw
HostA:        921515008 101921792 772783104  12% /opt  ( <--- this line is
 important.)
```

4. Libvirt configurations. Modify /etc/libvirt/libvirt.conf:

```
before : #listen_tls = 0
after : listen_tls = 0

before : #listen_tcp = 1
after : listen_tcp = 1

add: auth_tcp = "none"
```

Modify /etc/init/libvirt-bin.conf

```
before : exec /usr/sbin/libvirtd -d
 after : exec /usr/sbin/libvirtd -d -l
```

Modify /etc/default/libvirt-bin

```
before :libvirtd_opts=" -d"
after :libvirtd_opts=" -d -l"
```

then, restart libvirt. Make sure libvirt is restarted.

```
# stop libvirt-bin && start libvirt-bin
# ps -ef | grep libvirt
root 1145 1 0 Nov27 ? 00:00:03 /usr/sbin/libvirtd -d -l
```

5. Flag configuration. usually, you do not have to configure any flags. Below chart is only for advanced usage.

Table 4.8. Description of nova.conf flags for live migration

Flag	Default	Description
–live_migration_retry_count	default: 30	Retry count needed in live_migration. Sleep 1sec for each retry
–live_migration_uri	default: 'qemu+tcp://%s/system'	Define protocol used by live_migration feature. If you would like to use qemu +ssh, change this as described at http://libvirt.org/.
–live_migration_bandwidth	default: 0	Define bandwidth used by live migration.
–live_migration_flag	default: 'VIR_MIGRATE_UNDEFINE_SOURCE, VIR_MIGRATE_PEER2PEER'	Define libvirt flag for live migration.

4.7. Configuring Database Connections

You can configure OpenStack Compute to use any SQLAlchemy-compatible database. The database name is 'nova' and entries to it are mostly written by the nova-scheduler service, although all the services need to be able to update entries in the database. Use these settings to configure the connection string for the nova database.

Table 4.9. Description of nova.conf flags for database access

Flag	Default	Description
–sql_connection	default: 'sqlite:///$state_path/nova.sqlite'	IP address; Location of OpenStack Compute SQL database
–sql_idle_timeout	default: '3600'	
–sql_max_retries	default: '12'	Integer value; Number of attempts on the SQL connection

Flag	Default	Description
–sql_retry_interval	default: '10'	Integer value; Retry interval for SQL connections
–db_backend	default: 'sqlalchemy'	The backend selected for the database connection
–db_driver	default: 'nova.db.api'	The drive to use for database access

4.8. Configuring the Compute Messaging System

OpenStack Compute uses an open standard for messaging middleware known as AMQP. RabbitMQ enables this messaging system so that nova- services can talk to each other. You can configure the messaging communication for different installation scenarios as well as tune RabbitMQ's retries and the size of the RPC thread pool.

Table 4.10. Description of nova.conf flags for Remote Procedure Calls and RabbitMQ Messaging

Flag	Default	Description
–rabbit_host	default: 'localhost'	IP address; Location of RabbitMQ installation.
–rabbit_password	default: 'guest'	String value; Password for the RabbitMQ server.
–rabbit_port	default: '5672'	Integer value; Port where RabbitMQ server is running/listening.
–rabbit_userid	default: 'guest'	String value; User ID used for Rabbit connections.
–rabbit_virtual_host	default: '/'	Location of a virtual RabbitMQ installation.

Table 4.11. Description of nova.conf flags for Tuning RabbitMQ Messaging

Flag	Default	Description
–rabbit_max_retries	default: '12'	Integer value; RabbitMQ connection attempts.
–rabbit-retry-interval	default: '10'	Integer value: RabbitMQ connection retry interval.
–rpc_thread_pool_size	default: '1024'	Integer value: Size of Remote Procedure Call thread pool.

Table 4.12. Description of nova.conf flags for Customizing Exchange or Topic Names

Flag	Default	Description
–control_exchange	default:nova	String value; Name of the main exchange to connect to
–ajax_console_proxy_topic	default: 'ajax_proxy'	String value; Topic that the ajax proxy nodes listen on
–console_topic	default: 'console'	String value; The topic console proxy nodes listen on
–network_topic	default: 'network'	String value; The topic network nodes listen on.
–scheduler_topic	default: 'scheduler'	String value; The topic scheduler nodes listen on.

Flag	Default	Description
–volume_topic	default: 'volume'	String value; Name of the topic that volume nodes listen on

4.9. Configuring Authentication and Authorization

OpenStack Compute uses an implementation of an authentication system structured like having an Active Directory or other federated LDAP user store that backends to an identity manager or other SAML Policy Controller that then maps to groups. You can also customize roles for projects. Credentials for API calls are stored in the project zip file. Certificate authority is also customzed in nova.conf.

Table 4.13. Description of nova.conf flag for Authentication

Flag	Default	Description
–auth_driver	default:'nova.auth.dbdriver.DbDriver'	String value; Name of the driver for authentication • nova.auth.dbdriver.DbDriver - Default setting. • nova.auth.ldapdriver.FakeLdapDriver - create a replacement for this driver supporting other backends by creating another class that exposes the same public methods .

Table 4.14. Description of nova.conf flags for customizing roles

Flag	Default	Description
–allowed_roles	default: 'cloudadmin,itsec,sysadmin,netadmin,developer')	Comma separated list; Allowed roles for project
–global_roles	default: 'cloudadmin,itsec')	Comma separated list; Roles that apply to all projects
–superuser_roles	default: 'cloudadmin')	Comma separated list; Roles that ignore authorization checking completely

Table 4.15. Description of nova.conf flags for credentials

Flag	Default	Description
–credentials_template	default: '/Users/termie/p/nova/nova/auth/novarc.template')	Directory; Template for creating users' RC file
–credential_rc_file	default: '%src')	File name; File name of rc in credentials zip
–credential_cert_file	default: 'cert.pem')	File name; File name of certificate in credentials zip
–credential_key_file	default: 'pk.pem')	File name; File name of rc in credentials zip
–vpn_client_template	default: 'nova/cloudpipe/client/ovpn.template')	Directory; Refers to where the template lives for creating users vpn file

Flag	Default	Description
–credential_vpn_file	default: 'nova-vpn.conf')	File name; Filename of certificate in credentials.zip

Table 4.16. Description of nova.conf flags for CA (Certificate Authority)

Flag	Default	Description
–keys_path	default: '$state_path/keys')	Directory; Where Nova keeps the keys
–ca_file	default: 'cacert.pem')	File name; File name of root CA
–crl_file	default: 'crl.pem')	File name; File name of Certificate Revocation List
–key_file	default: 'private/cakey.pem')	File name; File name of private key
–use_project_ca	default: 'false')	True or false; Indicates whether to use a CA for each project; false means CA is not used for each project
–project_cert_subject	default: '/C=US/ST=California/ L=MountainView/O=AnsoLabs/ OU=NovaDev/CN=proje ct-ca-%s-%s')	String; Subject for certificate for projects, %s for project, timestamp
–user_cert_subject	default: '/C=US/ST=California/ L=MountainView/O=AnsoLabs/ OU=NovaDev/CN=%s-%s-%s')	String; Subject for certificate for users, %s for project, users, timestamp
–vpn_cert_subject	default: '/C=US/ST=California/ L=MountainView/O=AnsoLabs/ OU=NovaDev/CN=project-vpn-%s-%s')	String; Subject for certificate for vpns, %s for project, timestamp

5. OpenStack Compute Automated Installations

Table of Contents

In a large-scale cloud deployment, automated installations are a requirement for successful, efficient, repeatable installations. Automation for installation also helps with continuous integration and testing. This chapter offers some tested methods for deploying OpenStack Compute with either Puppet (an infrastructure management platform) or Chef (an infrastructure management framework) paired with Vagrant (a tool for building and distributing virtualized development environments).

5.1. Deployment Tool for OpenStack using Puppet

Thanks to a new project available that couples Puppet automation with a configuration file and deployment tool, you can install many servers automatically by simply editing the configuration file (deploy.conf) and running the deployment tool (deploy.py in the nova-deployment-tool project in Launchpad).

Prerequisites

- Networking: The servers must be connected to a subnet.
- Networking: Ensure that the puppet server can access nova component servers by name. The command examples in this document identify the user as “nii”. You should change the name but you need to create the same users on all Nova component servers in ~/DeploymentTool/conf/deploy.conf (ssh_user='user').
- Permissions: You must have root user permission for installation and service provision.
- Software: You must configure the installation server to access the Puppet server by name. (Puppet 0.25 or higher)
- Software: You must configure LVM if you do not change the default setting of the VolumeManager in the nova-volume service.
- Software: Python 2.6 or higher
- Software: Because of the current Nova implementation architecture, the binaries for nova-api, nova-objectstore, and euca2ools must have been loaded in one server.
- Operating system: Ubuntu 10.04 or 10.10

The tool does not support system configurations other than those listed above. If you want to use other configurations, you have to change the configuration after running the deployment tool or modify the deployment tool.

This deployment tool has been tested under the following configurations.

- Nova-compute components are installed on multiple servers.
- OS: Ubuntu10.04 or Ubuntu10.10
- Multiple network modes (VLAN Mode, Flat Mode)

Although we conducted extensive tests, we were unable to test every configuration. Please let us know any problems that occur in your environment by contacting us at https://answers.launchpad.net/nova-deployment-tool. We will try to resolve any problem you send us and make the tool better for Stackers.

Note

The configurations, which are not described on this document, are Nova default settings. Note also that, although we have not done so ourselves, you should be able to change the network mode to flat DHCP mode and hypervisor to Xen if you follow the instructions in the Notes section below.

Overview of Deployment Tool Steps

You can install/test/uninstall Nova with the Nova deployment tool as follows, which is simply an overview. The detailed steps are in the sections that follow.

Deploy.py takes care of the details using puppet. Puppet is an automation tool with standardized scripts that manage a machine's configuration. See an Introduction to Puppet on the PuppetLabs site.

Install by typing the following command.

```
python deploy.py install
```

Confirm that the installation succeeded by typing the following command.

```
python deploy.py test
```

Uninstall Nova components by typing the following command.

```
python deploy.py uninstall
python deploy.py all = python deploy.py uninstall; python deploy.py
 install; python deploy.py test
```

Installing the Deployment Tool

Type or copy/paste the following command to use the OpenStack Compute PPA on all nova component servers.

```
        sudo apt-get update
```

```
        sudo apt-get install python-software-properties -y
        sudo add-apt-repository ppa:nova-core/release
        sudo apt-get update
```

Set permissions to the deployment 'user'

Edit sudoers file to give the correct permissions to the 'user' running all the components. Type or copy/paste the visudo command to set ‘user’ (= nii in this document) as a sudouer on all nova component servers.

```
sudo visudo
```

Append the following lines to the visudo file, and then save the file.

```
nii      ALL=(ALL) NOPASSWD:ALL
nova     ALL=(ALL) NOPASSWD:ALL
```

Configure SSH

Next, we'll configure the system so that SSH works by generating public and private key pairs that provide credentials without a password intervention.

The Nova deployment tool needs to connect to all nova component servers without having the operator enter a password for any of the servers.

Type or copy/paste the following command to generate public and private key pairs on the server running the Nova deployment tool.

```
ssh-keygen -t rsa -N '' -f ~/.ssh/id_rsa
```

Copy this generated public key to all nova component servers.

Next, type or copy/paste the following commands to register the public keys on all nova component servers.

```
ssh-copy-id nii@(each nova component server name)
```

Download the code for the deployment tool next, and extract the contents of the compressed file.

```
wget http://launchpad.net/nova-deployment-tool/trunk/bexar/+download/nova-
deployment-tool.tgz
                tar xzvf nova-deployment-tool.tgz
```

Configuring the Deployment Tool

You must change the configuration file in order to execute the Nova deployment tool according to your environment and configuration design. In the unzipped files, edit conf/deploy.conf to change the settings according to your environment and desired installation (single or multiple servers, for example).

Here are the definitions of the values which are used in deploy.conf.

- nova_api Name of server in which the nava-api component is installed

- nova_objectstore Name of server in which the nova-objectstore component is installed
- nova_compute Name of server in which the nova-compute component is installed
- nova_scheduler Name of server in which the nova-scheduler component is installed
- nova_network Name of server in which the nova-network component is installed
- nova_volume Name of server in which the nova-volume component is installed
- euca2ools Name of server that runs the test sequence
- mysql Name of server in which mysql is installed
- puppet_server Name of server in which the puppet server is installed
- libvirt_type Virtualization type
- network_interface Network interface that is used in the nova-compute component
- ssh_user User name that is used to SSH into a nova component

Because of the current implementation architecture, you must load nova-api, nova-objectstore and euca2ools on a single server.

The following configuration information is an example. If you want to have multiple nova-computes, you can do so by nova_compute=ubuntu3, ubuntu8, for example.

```
<begin ~/DeploymentTool/conf/deploy.conf>
nova_api=ubuntu1
nova_objectstore=ubuntu1
nova_compute=ubuntu3
nova_scheduler=ubuntu4
nova_network=ubuntu5
nova_volume=ubuntu6
euca2ools=ubuntu1

mysql=ubuntu1
puppet_server=ubuntu7

libvirt_type=kvm
network_manager=nova.network.manager.VlanManager

network_interface=eth0

ssh_user=nii
<end ~/DeploymentTool/conf/deploy.conf>
```

5.2. OpenStack Compute Installation Using VirtualBox, Vagrant, And Chef

Integration testing for distributed systems that have many dependencies can be a huge challenge. Ideally, you would have a cluster of machines that you could PXE boot to a base OS install and run a complete install of the system. Unfortunately not everyone has a bunch of extra hardware sitting around. For those of us that are a bit on the frugal side, a whole

lot of testing can be done with Virtual Machines. Read on for a simple guide to installing OpenStack Compute (Nova) with VirtualBox and Vagrant.

Installing VirtualBox

VirtualBox is virtualization software by Oracle. It runs on Mac/Linux/Windows and can be controlled from the command line. Note that we will be using VirtualBox 4.0 and the vagrant prerelease.

OSX

```
curl -O http://download.virtualbox.org/virtualbox/4.0.2/
VirtualBox-4.0.2-69518-OSX.dmg
open VirtualBox-4.0.2-69518-OSX.dmg
```

Ubuntu Maverick

```
wget -q http://download.virtualbox.org/virtualbox/debian/oracle_vbox.asc -O- |
 sudo apt-key add -
echo "deb http://download.virtualbox.org/virtualbox/debian maverick contrib" |
 sudo tee /etc/apt/sources.list.d/virtualbox.list
sudo apt-get update
sudo apt-get install -y virtualbox-4.0
```

Ubuntu Lucid

```
wget -q http://download.virtualbox.org/virtualbox/debian/oracle_vbox.asc -O- |
 sudo apt-key add -
echo "deb http://download.virtualbox.org/virtualbox/debian lucid contrib" |
 sudo tee /etc/apt/sources.list.d/virtualbox.list
sudo apt-get update
sudo apt-get install -y virtualbox-4.0
```

Get the Vagrant Pre-release

OSX

```
sudo gem update --system
sudo gem install vagrant --pre
```

Ubuntu Maverick

```
sudo gem install vagrant --pre
sudo ln -s /var/lib/gems/1.8/bin/vagrant /usr/local/bin/vagrant
```

Ubuntu Lucid

```
wget http://production.cf.rubygems.org/rubygems/rubygems-1.3.6.zip
sudo apt-get install -y unzip
unzip rubygems-1.3.6.zip
cd rubygems-1.3.6
sudo ruby setup.rb
sudo gem1.8 install vagrant --pre
```

Get the Chef Recipes

```
cd ~
```

```
git clone http://github.com/ansolabs/openstack-cookbooks.git
```

Set Up Some Directories

```
mkdir aptcache
mkdir chef
cd chef
```

Get the chef-solo Vagrant file

Provisioning for vagrant can use chef-solo, chef-server, or puppet. We're going to use chef-solo for the installation of OpenStack Compute.

```
curl -o Vagrantfile https://gist.github.com/raw/786945/solo.rb
```

Running OpenStack Compute within a Vagrant Instance

Installing and running OpenStack Compute is as simple as typing "vagrant up"

```
vagrant up
```

In 3-10 minutes, your vagrant instance should be running. NOTE: Some people report an error from vagrant complaining about MAC addresses the first time they vagrant up. Doing `vagrant up` again seems to resolve the problem.

```
vagrant ssh
```

Now you can run an instance and connect to it:

```
. /vagrant/novarc
euca-add-keypair test > test.pem
chmod 600 test.pem
euca-run-instances -t m1.tiny -k test ami-tty
# wait for boot (euca-describe-instances should report running)
ssh -i test.pem root@10.0.0.3
```

Yo, dawg, your VMs have VMs! That is, you are now running an instance inside of OpenStack Compute, which itself is running inside a VirtualBox VM.

When the you are finished, you can destroy the entire system with vagrant destroy. You will also need to remove the .pem files and the novarc if you want to run the system again.

```
vagrant destroy
rm *.pem novarc
```

6. Networking

Table of Contents

By understanding the available networking configuration options you can design the best configuration for your OpenStack Compute instances.

6.1. Networking Options

This section offers a brief overview of each concept in networking for Compute.

In Compute, users organize their cloud resources in projects. A Compute project consists of a number of VM instances created by a user. For each VM instance, Compute assigns to it a private IP address. (Currently, Nova only supports Linux bridge networking that allows the virtual interfaces to connect to the outside network through the physical interface.)

The Network Controller provides virtual networks to enable compute servers to interact with each other and with the public network.

Currently, Nova supports three kinds of networks, implemented in three “Network Manager” types respectively: Flat Network Manager, Flat DHCP Network Manager, and VLAN Network Manager. The three kinds of networks can co-exist in a cloud system. However, since you can't yet select the type of network for a given project, you cannot configure more than one type of network in a given Compute installation.

Nova has a concept of Fixed IPs and Floating IPs. Fixed IPs are assigned to an instance on creation and stay the same until the instance is explicitly terminated. Floating IPs are IP addresses that can be dynamically associated with an instance. This address can be disassociated and associated with another instance at any time. A user can reserve a floating IP for their project.

In Flat Mode, a network administrator specifies a subnet. The IP addresses for VM instances are grabbed from the subnet, and then injected into the image on launch. Each instance

receives a fixed IP address from the pool of available addresses. A network administrator must configure the Linux networking bridge (named br100) both on the network controller hosting the network and on the cloud controllers hosting the instances. All instances of the system are attached to the same bridge, configured manually by the network administrator.

Note

The configuration injection currently only works on Linux-style systems that keep networking configuration in /etc/network/interfaces.

In Flat DHCP Mode, you start a DHCP server to pass out IP addresses to VM instances from the specified subnet in addition to manually configuring the networking bridge. IP addresses for VM instances are grabbed from a subnet specified by the network administrator. Like Flat Mode, all instances are attached to a single bridge on the compute node. In addition a DHCP server is running to configure instances. In this mode, Compute does a bit more configuration in that it attempts to bridge into an ethernet device (eth0 by default). It will also run dnsmasq as a dhcpserver listening on this bridge. Instances receive their fixed IPs by doing a dhcpdiscover.

In both flat modes, the network nodes do not act as a default gateway. Instances are given public IP addresses. Compute nodes have iptables/ebtables entries created per project and instance to protect against IP/MAC address spoofing and ARP poisoning.

VLAN Network Mode is the default mode for OpenStack Compute. In this mode, Compute creates a VLAN and bridge for each project. For multiple machine installation, the VLAN Network Mode requires a switch that supports host-managed VLAN tagging. The project gets a range of private IPs that are only accessible from inside the VLAN. In order for a user to access the instances in their project, a special VPN instance (code named cloudpipe) needs to be created. Compute generates a certificate and key for the user to access the VPN and starts the VPN automatically. It provides a private network segment for each project's instances that can be accessed via a dedicated VPN connection from the Internet. In this mode, each project gets its own VLAN, Linux networking bridge, and subnet. The subnets are specified by the network administrator, and are assigned dynamically to a project when required. A DHCP Server is started for each VLAN to pass out IP addresses to VM instances from the subnet assigned to the project. All instances belonging to one project are bridged into the same VLAN for that project. OpenStack Compute creates the Linux networking bridges and VLANs when required.

6.2. Cloudpipe — Per Project Vpns

Cloudpipe is a method for connecting end users to their project instances in VLAN networking mode.

The support code for cloudpipe implements admin commands (via nova-manage) to automatically create a vm for a project that allows users to vpn into the private network of their project. Access to this vpn is provided through a public port on the network host for the project. This allows users to have free access to the virtual machines in their project without exposing those machines to the public internet.

The cloudpipe image is basically just a Linux instance with openvpn installed. It needs a simple script to grab user data from the metadata server, b64 decode it into a zip file, and

run the autorun.sh script from inside the zip. The autorun script will configure and run openvpn to run using the data from nova.

It is also useful to have a cron script that will periodically redownload the metadata and copy the new crl. This will keep revoked users from connecting and will disconnect any users that are connected with revoked certificates when their connection is renegotiated (every hour).

6.2.1. Creating a Cloudpipe Image

Making a cloudpipe image is relatively easy.

- # install openvpn on a base ubuntu image.
- # set up a server.conf.template in /etc/openvpn/
- # set up.sh in /etc/openvpn/
- # set down.sh in /etc/openvpn/
- # download and run the payload on boot from /etc/rc.local
- # setup /etc/network/interfaces
- # register the image and set the image id in your flagfile:

```
--vpn_image_id=ami-xxxxxxxx
```

- # you should set a few other flags to make vpns work properly:

```
--use_project_ca
--cnt_vpn_clients=5
```

When you use nova-manage to launch a cloudpipe for a user, it goes through the following process:

1. creates a keypair called <project_id>-vpn and saves it in the keys directory
2. creates a security group <project_id>-vpn and opens up 1194 and icmp
3. creates a cert and private key for the vpn instance and saves it in the CA/projects/<project_id>/ directory
4. zips up the info and puts it b64 encoded as user data
5. launches an m1.tiny instance with the above settings using the flag-specified vpn image

6.2.2. Vpn Access

In vlan networking mode, the second IP in each private network is reserved for the cloudpipe instance. This gives a consistent IP to the instance so that nova-network can create forwarding rules for access from the outside world. The network for each project is given a specific high-numbered port on the public IP of the network host. This port is automatically forwarded to 1194 on the vpn instance.

If specific high numbered ports do not work for your users, you can always allocate and associate a public IP to the instance, and then change the vpn_public_ip and vpn_public_port in the database. (This will be turned into a nova-manage command or a flag soon.)

6.2.3. Certificates and Revocation

If the use_project_ca flag is set (required to for cloudpipes to work securely), then each project has its own ca. This ca is used to sign the certificate for the vpn, and is also passed to the user for bundling images. When a certificate is revoked using nova-manage, a new Certificate Revocation List (crl) is generated. As long as cloudpipe has an updated crl, it will block revoked users from connecting to the vpn.

The userdata for cloudpipe isn't currently updated when certs are revoked, so it is necessary to restart the cloudpipe instance if a user's credentials are revoked.

6.2.4. Restarting Cloudpipe VPN

You can reboot a cloudpipe vpn through the api if something goes wrong (using euca-reboot-instances for example), but if you generate a new crl, you will have to terminate it and start it again using nova-manage vpn run. The cloudpipe instance always gets the first ip in the subnet and it can take up to 10 minutes for the ip to be recovered. If you try to start the new vpn instance too soon, the instance will fail to start because of a NoMoreAddresses error. If you can't wait 10 minutes, you can manually update the ip with something like the following (use the right ip for the project):

```
euca-terminate-instances <instance_id>
    mysql nova -e "update fixed_ips set allocated=0, leased=0,
instance_id=NULL where fixed_ip='10.0.0.2'"
```

You also will need to terminate the dnsmasq running for the user (make sure you use the right pid file):

```
sudo kill `cat /var/lib/nova/br100.pid`
```

Now you should be able to re-run the vpn:

```
nova-manage vpn run <project_id>
```

6.2.5. Logging into Cloudpipe VPN

The keypair that was used to launch the cloudpipe instance should be in the keys/<project_id> folder. You can use this key to log into the cloudpipe instance for debugging purposes.

6.3. Configuring Networking on the Compute Node

To configure the Compute node's networking for the VM images, the overall steps are:

1. Set the –network-manager flag in nova.conf.
2. Use the `nova-manage network create CIDR n n` command to create the subnet that the VMs reside on.
3. Integrate the bridge with your network.

By default, Compute uses the VLAN Network Mode. You choose the networking mode for your virtual instances in the nova.conf file. Here are the three possible options:

- –network_manager = nova.network.manager.FlatManager

  Simple, non-VLAN networking

- –network_manager = nova.network.manager.FlatDHCPManager

  Flat networking with DHCP

- –network_manager = nova.network.manager.VlanManager

  VLAN networking with DHCP. This is the Default if no network manager is defined in nova.conf.

Also, when you issue the nova-manage network create command, it uses the settings from the nova.conf flag file. Use the "nova-manage network create 192.168.0.0/24 1 255" command to create the subnet that your VMs will run on.

6.3.1. Configuring Flat Networking

When you choose Flat networking, Nova doesn't manage networking at all. Instead, IP addresses are injected into the instance via the file system (or passed in via a guest agent). Metadata forwarding must be configured manually on the gateway if it is required within your network.

Ensure that your nova.conf file contains the line:

```
–network_manager = nova.network.manager.FlatManager
```

Compute defaults to a bridge device named 'br100' which is stored in the Nova database, so you can change the name of the bridge device by modifying the entry in the database.

Set the compute node's external IP address to be on the bridge and add eth0 to that bridge. To do this, edit your network interfaces configuration to look like the following example:

```
< begin /etc/network/interfaces >
# The loopback network interface
auto lo
iface lo inet loopback

# Networking for OpenStack Compute
auto br100
```

```
iface br100 inet dhcp
   bridge_ports       eth0
   bridge_stp         off
   bridge_maxwait   0
   bridge_fd          0
< end /etc/network/interfaces >
```

Next, restart networking to apply the changes: `sudo /etc/init.d/networking restart`

6.3.2. Configuring Flat DHCP Networking

With Flat DHCP, the host running nova-network acts as the gateway to the virtual nodes. You can run one nova-network per cluster. Set the flag –network_host on the nova.conf stored on the nova-compute node to tell it which host the nova-network is running on so it can communicate with nova-network. FlatDHCP doesn't create VLANs, it creates a bridge. This bridge works just fine on a single host, but when there are multiple hosts, traffic needs a way to get out of the bridge onto a physical interface. Be careful when setting up –flat_interface, if you specify an interface that already has an IP it will break and if this is the interface you are connecting through with SSH, you cannot fix it unless you have ipmi/console access.

If you have an unused interface on your hosts that has connectivity with no IP address, you can simply tell FlatDHCP to bridge into the interface by specifying –flat_interface=<interface> in your flagfile. The network host will automatically add the gateway ip to this bridge. You can also add the interface to br100 manually and not set flat_interface. If this is the case for you, edit your nova.conf file to contain the following lines:

```
–dhcpbridge_flagfile=/etc/nova/nova.conf
–dhcpbridge=/usr/bin/nova-dhcpbridge
–network_manager=nova.network.manager.FlatDHCPManager
–flat_network_dhcp_start=10.0.0.2
–flat_interface=eth2
–flat_injected=False
–public_interface=eth0
```

Integrate your network interfaces to match this configuration.

6.3.3. Configuring VLAN Networking

In some networking environments, you may have a large IP space which is cut up into smaller subnets. The smaller subnets are then trunked together at the switch level (dividing layer 3 by layer 2) so that all machines in the larger IP space can communicate. The purpose of this is generally to control the size of broadcast domains.

Using projects as a way to logically separate each VLAN, we can setup our cloud in this environment. Please note that you must have IP forwarding enabled for this network mode to work.

Obtain the parameters for each network. You may need to ask a network administrator for this information, including netmask, broadcast, gateway, ethernet device and VLAN ID.

You need to have networking hardware that supports VLAN tagging.

Please note that currently eth0 is hardcoded as the vlan_interface in the default flags. If you need to attach your bridges to a device other than eth0, you will need to add following flag to /etc/nova/nova.conf:

```
–vlan_interface=eth1
```

VLAN is the default networking mode for Compute, so if you have no –network_manager entry in your nova.conf file, you are set up for VLAN. To set your nova.conf file to VLAN, use this flag in /etc/nova/nova.conf:

```
–network_manager=nova.network.manager.VlanManager
```

For the purposes of this example walk-through, we will use the following settings. These are intentionally complex in an attempt to cover most situations:

- VLANs: 171, 172, 173 and 174
- IP Blocks: 10.1.171.0/24, 10.1.172.0/24, 10.1.173.0/24 and 10.1.174.0/24
- Each VLAN maps to its corresponding /24 (171 = 10.1.171.0/24, etc)
- Each VLAN will get its own bridge device, which is in the format br_$VLANID
- Each /24 has an upstream default gateway on .1
- The first 6 IPs in each /24 are reserved

First, create the networks that Compute can pull from using nova-manage commands:

```
nova-manage --flagfile=/etc/nova/nova.conf network create 10.1.171.0/24 1 256
                    nova-manage --flagfile=/etc/nova/nova.conf network create
 10.1.172.0/24 1 256
                    nova-manage --flagfile=/etc/nova/nova.conf network create
 10.1.173.0/24 1 256
                    nova-manage --flagfile=/etc/nova/nova.conf network create
 10.1.174.0/24 1 256
```

Log in to the nova database to determine the network ID assigned to each VLAN:

```
select id,cidr from networks;
```

Update the DB to match your network settings. The following script will generate SQL based on the predetermined settings for this example. *You will need to modify this database update to fit your environment.*

```
if [ -z $1 ]; then
  echo "You need to specify the vlan to modify"
fi

if [ -z $2 ]; then
  echo "You need to specify a network id number (check the DB for the network
 you want to update)"
fi
```

```
VLAN=$1
ID=$2

cat > vlan.sql << __EOF_
update networks set vlan = '$VLAN' where id = $ID;
update networks set bridge = 'br_$VLAN' where id = $ID;
update networks set gateway = '10.1.$VLAN.7' where id = $ID;
update networks set dhcp_start = '10.1.$VLAN.8' where id = $ID;
update fixed_ips set reserved = 1 where address in ('10.1.$VLAN.1','10.1.
$VLAN.2','10.1.$VLAN.3','10.1.$VLAN.4','10.1.$VLAN.5','10.1.$VLAN.6','10.1.
$VLAN.7');
__EOF_
```

After verifying that the above SQL will work for your enviornment, run it against the nova database, once for every VLAN you have in the environment.

Next, create a project manager for the Compute project:

```
nova-manage --flagfile=/etc/nova/nova.conf user admin $username
```

Then create a project and assign that user as the admin user:

```
nova-manage --flagfile=/etc/nova/nova.conf project create $projectname
 $username
```

Finally, get the credentials for the user just created, which also assigns one of the networks to this projec:)

```
nova-manage --flagfile=/etc/nova/nova.conf project zipfile $projectname
 $username
```

When you start nova-network, the bridge devices and associated VLAN tags will be created. When you create a new VM you must determine (either manually or programatically) which VLAN it should be a part of, and start the VM in the corresponding project.

In certain cases, the network manager may not properly tear down bridges and VLANs when it is stopped. If you attempt to restart the network manager and it does not start, check the logs for errors indicating that a bridge device already exists. If this is the case, you will likely need to tear down the bridge and VLAN devices manually.

```
vconfig rem vlanNNN
                        ifconfig br_NNN down
                        brctl delbr br_NNN
```

Also, if users need to access the instances in their project across a VPN, a special VPN instance (code named cloudpipe) needs to be created. You can create the cloudpipe instance. The image is basically just a Linux instance with openvpn installed. It needs a simple script to grab user data from the metadata server, b64 decode it into a zip file, and run the autorun.sh script from inside the zip. The autorun script should configure and run openvpn to run using the data from Compute.

For certificate management, it is also useful to have a cron script that will periodically download the metadata and copy the new Certificate Revocation List (CRL). This will keep revoked users from connecting and disconnects any users that are connected with revoked certificates when their connection is re-negotiated (every hour). You set the –use_project_ca flag in nova.conf for cloudpipes to work securely so that each project has its own Certificate Authority (CA).

6.3.4. Enabling Ping and SSH on VMs

Be sure you enable access to your VMs by using the 'euca-authorize' command. Below, you will find the commands to allow 'ping' and 'ssh' to your VMs:

```
euca-authorize -P icmp -t -1:-1 default
euca-authorize -P tcp -p 22 default
```

If you still cannot ping or SSH your instances after issuing the 'euca-authorize' commands, look at the number of 'dnsmasq' processes that are running. If you have a running instance, check to see that TWO 'dnsmasq' processes are running. If not, perform the following: `killall dnsmasq service nova-network restart`

6.3.5. Allocating and Associating IP Addresses with Instances

You can use Euca2ools commands to manage floating IP addresses used with Flat DHCP or VLAN networking.

To assign a reserved IP address to your project, removing it from the pool of available floating IP addresses, use `euca-allocate-address`. It'll return an IP address, assign it to the project you own, and remove it from the pool of available floating IP addresses.

To associate the floating IP to your instance, use `euca-associate-address -i [instance_id] [floating_ip]`.

When you want to return the floating IP to the pool, first use euca-disassociate-address [floating_ip] to disassociate the IP address from your instance, then use euca-deallocate-address [floating_ip] to return the IP to the pool of IPs for someone else to grab.

There are nova-manage commands that also help you manage the floating IPs.

nova-manage floating list - This command lists the floating IP addresses in the pool.

nova-manage floating create [hostname] [cidr] - This command creates specific floating IPs for a specific network host and either a single address or a subnet.

nova-manage floating destroy [hostname] [cidr] - This command removes floating IP addresses using the same parameters as the create command.

6.3.6. Associating a Public IP Address

OpenStack Compute uses NAT for public IPs. If you plan to use public IP addresses for your virtual instances, you must configure –public_interface=vlan100' in the nova.conf file so that Nova knows where to bind public IP addresses. Restart nova-network if you change nova.conf while the service is running. Also, ensure you have opened port 22 for the nova network.

You must add the IP address or block of public ip addresses to the floating IP list using the `nova-manage floating create` command. When you start a new virtual instance, associate one of the public addresses to the new instance using the euca-associate-address command.

These are the basic overall steps and checkpoints.

First, set up the public address.

```
nova-manage floating create my-hostname 68.99.26.170/31
euca-allocate-address 68.99.26.170
euca-associate-address -i i-1 68.99.26.170
```

Make sure the security groups are open.

```
root@my-hostname:~# euca-describe-groups
GROUP admin-project default default
PERMISSION admin-project default ALLOWS icmp -1 -1
FROM CIDR 0.0.0.0/0
PERMISSION admin-project default ALLOWS tcp 22 22
FROM CIDR 0.0.0.0/0
```

Ensure the NAT rules have been added to iptables.

```
-A nova-network-OUTPUT -d 68.99.26.170/32 -j DNAT --to-destination 10.0.0.3
-A nova-network-PREROUTING -d 68.99.26.170/32 -j DNAT --to-destination10.0.0.3
-A nova-network-floating-snat -s 10.0.0.3/32 -j SNAT --to-source 68.99.26.170
```

Check that the public address, in this example 68.99.26.170, has been added to your public interface. You should see the address in the listing when you enter "ip addr" at the command prompt.

```
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen
 1000
link/ether xx:xx:xx:17:4b:c2 brd ff:ff:ff:ff:ff:ff
inet 13.22.194.80/24 brd 13.22.194.255 scope global eth0
inet 68.99.26.170/32 scope global eth0
inet6 fe80::82b:2bf:fe1:4b2/64 scope link
valid_lft forever preferred_lft forever
```

Note that you cannot SSH to an instance with a public IP from within the same server as the routing configuration won't allow it.

6.4. Removing a Network from a Project

You will find that you cannot remove a network that has already been associated to a project by simply deleting it. You can disassociate the project from the network with a scrub command and the project name as the final parameter:

```
nova-manage project scrub projectname
```

7. System Administration

Table of Contents

By understanding how the different installed nodes interact with each other you can administer the OpenStack Compute installation. OpenStack Compute offers many ways to install using multiple servers but the general idea is that you can have multiple compute nodes that control the virtual servers and a cloud controller node that contains the remaining Nova services.

The OpenStack Compute cloud works via the interaction of a series of daemon processes named nova-* that reside persistently on the host machine or machines. These binaries can all run on the same machine or be spread out on multiple boxes in a large deployment. The responsibilities of Services, Managers, and Drivers, can be a bit confusing at first. Here is an outline the division of responsibilities to make understanding the system a little bit easier.

Currently, Services are nova-api, nova-objectstore (which can be replaced with Glance, the OpenStack Image Service), nova-compute, nova-volume, and nova-network. Managers and Drivers are specified by flags and loaded using utils.load_object(). Managers are responsible for a certain aspect of the system. It is a logical grouping of code relating to a portion of the system. In general other components should be using the manager to make changes to the components that it is responsible for.

For example, other components that need to deal with volumes in some way, should do so by calling methods on the VolumeManager instead of directly changing fields in the database. This allows us to keep all of the code relating to volumes in the same place.

- nova-api - The nova-api service receives xml requests and sends them to the rest of the system. It is a wsgi app that routes and authenticate requests. It supports the ec2 and openstack apis. There is a nova-api.conf file created when you install Compute.

- nova-objectstore - The nova-objectstore service is an ultra simple file-based storage system for images that replicates most of the S3 API. It can be replaced with OpenStack Image Service and a simple image manager or use OpenStack Object Storage as the virtual machine image storage facility. It must reside on the same node as nova-compute.

- nova-compute - The nova-compute service is responsible for managing virtual machines. It loads a Service object which exposes the public methods on ComputeManager via Remote Procedure Call (RPC).

- nova-volume - The nova-volume service is responsible for managing attachable block storage devices. It loads a Service object which exposes the public methods on VolumeManager via RPC.
- nova-network - The nova-network service is responsible for managing floating and fixed IPs, DHCP, bridging and VLANs. It loads a Service object which exposes the public methods on one of the subclasses of NetworkManager. Different networking strategies are available to the service by changing the network_manager flag to FlatManager, FlatDHCPManager, or VlanManager (default is VLAN if no other is specified):

```
nova-network --network_manager=nova.network.manager.FlatManager
```

7.1. Starting Images

Once you have an installation, you want to get images that you can use in your Compute cloud. We've created a basic Ubuntu image for testing your installation. First you'll download the image, then use uec-publish-tarball to publish it:

```
image="ubuntu1010-UEC-localuser-image.tar.gz"
wget http://c0179148.cdn1.cloudfiles.rackspacecloud.com/ubuntu1010-UEC-
localuser-image.tar.gz
uec-publish-tarball $image [bucket-name] [hardware-arch]
```

Here's an example of what this command looks like with data:

```
 uec-publish-tarball ubuntu1010-UEC-localuser-image.tar.gz dub-bucket x86_64
```

The command in return should output three references: emi, eri and eki. You need to use the emi value (for example, “ami-zqkyh9th") for the euca-run-instances command.

Now you can schedule, launch and connect to the instance, which you do with tools from the Euca2ools on the command line. Create the emi value from the uec-publish-tarball command, and then you can use the euca-run-instances command.

One thing to note here, once you publish the tarball, it has to untar before you can launch an image from it. Using the 'euca-describe-images' command, wait until the state turns to "available" from "untarring.":

```
euca-describe-images
```

Depending on the image that you're using, you need a public key to connect to it. Some images have built-in accounts already created. Images can be shared by many users, so it is dangerous to put passwords into the images. Nova therefore supports injecting ssh keys into instances before they are booted. This allows a user to login to the instances that he or she creates securely. Generally the first thing that a user does when using the system is create a keypair. Keypairs provide secure authentication to your instances. As part of the first boot of a virtual image, the private key of your keypair is added to root’s authorized_keys file. Nova generates a public and private key pair, and sends the private key to the user. The public key is stored so that it can be injected into instances.

Keypairs are created through the api and you use them as a parameter when launching an instance. They can be created on the command line using the euca2ools script euca-add-keypair. Refer to the man page for the available options. Example usage:

```
euca-add-keypair test > test.pem
```

```
chmod 600 test.pem
```

Now, you can run the instances:

```
euca-run-instances -k test -t m1.tiny ami-zqkyh9th
```

Here's a description of the parameters used above:

-t what type of image to create

-k name of the key to inject in to the image at launch

Optionally, you can use the -n parameter to indicate how many images of this type to launch.

The instance will go from “launching” to “running” in a short time, and you should be able to connect via SSH using the 'ubuntu' account, with the password 'ubuntu': (replace $ipaddress with the one you got from euca-describe-instances):

```
ssh ubuntu@$ipaddress
```

The 'ubuntu' user is part of the sudoers group, so you can escalate to 'root' via the following command:

```
sudo -i
```

7.2. Deleting Instances

When you are done playing with an instance, you can tear the instance down using the following command (replace $instanceid with the instance IDs from above or look it up with euca-describe-instances):

```
euca-terminate-instances $instanceid
```

7.3. Creating Custom Images

If you want to create more images, they're built in a reproducible manner. You can build more images via code at https://code.launchpad.net/~smoser/+junk/ttylinux-uec (or use bzr branch lp:~smoser/+junk/ttylinux-uec dirname). Ubuntu also provides documentation on creating images using vmbuilder at https://help.ubuntu.com/community/UEC/CreateYourImage.

7.4. Understanding the Compute Service Architecture

These basic categories describe the service architecture and what's going on within the cloud controller.

API Server

At the heart of the cloud framework is an API Server. This API Server makes command and control of the hypervisor, storage, and networking programmatically available to users in realization of the definition of cloud computing.

The API endpoints are basic http web services which handle authentication, authorization, and basic command and control functions using various API interfaces under the Amazon, Rackspace, and related models. This enables API compatibility with multiple existing tool sets created for interaction with offerings from other vendors. This broad compatibility prevents vendor lock-in.

Message Queue

A messaging queue brokers the interaction between compute nodes (processing), volumes (block storage), the networking controllers (software which controls network infrastructure), API endpoints, the scheduler (determines which physical hardware to allocate to a virtual resource), and similar components. Communication to and from the cloud controller is by HTTP requests through multiple API endpoints.

A typical message passing event begins with the API server receiving a request from a user. The API server authenticates the user and ensures that the user is permitted to issue the subject command. Availability of objects implicated in the request is evaluated and, if available, the request is routed to the queuing engine for the relevant workers. Workers continually listen to the queue based on their role, and occasionally their type hostname. When such listening produces a work request, the worker takes assignment of the task and begins its execution. Upon completion, a response is dispatched to the queue which is received by the API server and relayed to the originating user. Database entries are queried, added, or removed as necessary throughout the process.

Compute Worker

Compute workers manage computing instances on host machines. Through the API, commands are dispatched to compute workers to:

- Run instances
- Terminate instances
- Reboot instances
- Attach volumes
- Detach volumes
- Get console output

Network Controller

The Network Controller manages the networking resources on host machines. The API server dispatches commands through the message queue, which are subsequently processed by Network Controllers. Specific operations include:

- Allocate fixed IP addresses
- Configuring VLANs for projects
- Configuring networks for compute nodes

Volume Workers

Volume Workers interact with iSCSI storage to manage LVM-based instance volumes. Specific functions include:

- Create volumes
- Delete volumes
- Establish Compute volumes

Volumes may easily be transferred between instances, but may be attached to only a single instance at a time.

7.5. Managing the Cloud

There are two main tools that a system administrator will find useful to manage their cloud; the nova-manage command or the Euca2ools command line commands.

The nova-manage command may only be run by users with admin privileges. Commands for euca2ools can be used by all users, though specific commands may be restricted by Role Based Access Control.

Using the nova-manage command

The nova-manage command is used to perform many essential functions for administration and ongoing maintenance of nova, such as user creation, vpn management, and much more.

The standard pattern for executing a nova-manage command is:

```
nova-manage category command [args]
```

For example, to obtain a list of all projects: nova-manage project list

Run without arguments to see a list of available command categories: nova-manage

Command categories are: user, project, role, shell, vpn, and floating.

You can also run with a category argument such as user to see a list of all commands in that category: nova-manage user

7.6. Managing Compute Users

Access to the Euca2ools (ec2) API is controlled by an access and secret key. The user's access key needs to be included in the request, and the request must be signed with the secret key. Upon receipt of API requests, Compute will verify the signature and execute commands on behalf of the user.

In order to begin using nova, you will need to create a user. This can be easily accomplished using the user create or user admin commands in nova-manage. user create will create a

regular user, whereas user admin will create an admin user. The syntax of the command is nova-manage user create username [access] [secret]. For example:

```
nova-manage user create john my-access-key a-super-secret-key
```

If you do not specify an access or secret key, a random uuid will be created automatically.

Credentials

Nova can generate a handy set of credentials for a user. These credentials include a CA for bundling images and a file for setting environment variables to be used by euca2ools. If you don't need to bundle images, just the environment script is required. You can export one with the project environment command. The syntax of the command is nova-manage project environment project_id user_id [filename]. If you don't specify a filename, it will be exported as novarc. After generating the file, you can simply source it in bash to add the variables to your environment:

```
nova-manage project environment john_project john
. novarc
```

If you do need to bundle images, you will need to get all of the credentials using project zipfile. Note that zipfile will give you an error message if networks haven't been created yet. Otherwise zipfile has the same syntax as environment, only the default file name is nova.zip. Example usage:

```
nova-manage project zipfile john_project john
unzip nova.zip
. novarc
```

Role Based Access Control

Roles control the API actions that a user is allowed to perform. For example, a user cannot allocate a public ip without the netadmin role. It is important to remember that a users de facto permissions in a project is the intersection of user (global) roles and project (local) roles. So for john to have netadmin permissions in his project, he needs to separate roles specified. You can add roles with role add. The syntax is nova-manage role add user_id role [project_id]. Let's give john the netadmin role for his project:

```
nova-manage role add john netadmin
nova-manage role add john netadmin john_project
```

Role-based access control (RBAC) is an approach to restricting system access to authorized users based on an individual's role within an organization. Various employee functions require certain levels of system access in order to be successful. These functions are mapped to defined roles and individuals are categorized accordingly. Since users are not assigned permissions directly, but only acquire them through their role (or roles), management of individual user rights becomes a matter of assigning appropriate roles to the user. This simplifies common operations, such as adding a user, or changing a user's department.

Nova's rights management system employs the RBAC model and currently supports the following five roles:

- Cloud Administrator. (cloudadmin) Users of this class enjoy complete system access.
- IT Security. (itsec) This role is limited to IT security personnel. It permits role holders to quarantine instances.
- System Administrator. (sysadmin)The default for project owners, this role affords users the ability to add other users to a project, interact with project images, and launch and terminate instances.
- Network Administrator. (netadmin) Users with this role are permitted to allocate and assign publicly accessible IP addresses as well as create and modify firewall rules.
- Developer. This is a general purpose role that is assigned to users by default.
- Project Manager. (projectmanager) This is a role that is assigned upon project creation and can't be added or removed, but this role can do anything a sysadmin can do.

RBAC management is exposed through the dashboard for simplified user management.

7.7. Managing Volumes

Nova-volume is the service that allows you to give extra block level storage to your OpenStack Compute instances. You may recognize this as a similar offering that Amazon EC2 offers, Elastic Block Storage (EBS). However, nova-volume is not the same implementation that EC2 uses today. Nova-volume is an iSCSI solution that employs the use of Logical Volume Manager (LVM) for Linux. Note that a volume may only be attached to one instance at a time. This is not a 'shared storage' solution like a SAN which multiple servers can attach to.

For this particular walkthrough, there is one cloud controller running nova-api, nova-compute, nova-scheduler, nova-objectstore, and nova-network. There are two additional compute nodes running both nova-compute and nova-volume. The walkthrough uses a custom partitioning scheme that carves out 60GB of space and labels it as LVM. The network is a /28 .80-.95, and FlatManger is the NetworkManager setting for OpenStack Compute (Nova).

To set up Compute to use volumes, ensure that nova-volume is installed along with lvm2.

```
apt-get install lvm2 nova-volume
```

Configure Volumes for use with nova-volume

If you do not already have LVM volumes on hand, but have free drive space, you will need to create a LVM volume before proceeding.

Here is a short run down of how you would create a LVM from free drive space on your system.

Start off by issuing an fdisk command to your drive with the free space:

```
fdisk /dev/sda
```

Once in fdisk, perform the following commands:

1. Press ‘n' to create a new disk partition,
2. Press 'p' to create a primary disk partition,
3. Press '1' to denote it as 1st disk partition,
4. Either press ENTER twice to accept the default of 1st and last cylinder – to convert the remainder of hard disk to a single disk partition -OR- press ENTER once to accept the default of the 1st, and then choose how big you want the partition to be by specifying +size{K,M,G} e.g. +5G or +6700M.
5. Press 't', then select the new partition you made.
6. Press '8e' change your new partition to 8e, i.e. Linux LVM partition type.
7. Press ‘p' to display the hard disk partition setup. Please take note that the first partition is denoted as /dev/sda1 in Linux.
8. Press 'w' to write the partition table and exit fdisk upon completion.

Refresh your partition table to ensure your new partition shows up, and verify with fdisk.

```
partprobe
fdisk -l (you should see your new partition in this listing)
```

Here is how you can set up partitioning during the OS install to prepare for this nova-volume configuration:

root@osdemo03:~# fdisk -l

```
               Device Boot      Start         End      Blocks   Id  System

               /dev/sda1    *           1       12158    97280   83  Linux
               /dev/sda2           12158       24316    97655808   83  Linux

               /dev/sda3          24316       24328     97654784     83
Linux
               /dev/sda4           24328       42443   145507329    5
Extended

               /dev/sda5           24328       32352    64452608   8e  Linux
LVM
               /dev/sda6           32352       40497    65428480   8e  Linux
LVM

               /dev/sda7           40498       42443    15624192   82  Linux
swap / Solaris
```

Now that you have identified a partition has been labeled for LVM use, perform the following steps to configure LVM and prepare it as nova-volume. You must name your volume group ‘nova-volumes’ or things will not work as expected:

```
               pvcreate /dev/sda5
               vgcreate nova-volumes /dev/sda5
```

Configure iscsitarget

If you have a multinode installation of Compute, you may want nova-volume on the same node as nova-compute, although it is not required.

By default, when the 'iscsitarget' package is installed, it is not started, nor enabled by default. You need to perform the following two steps to configure the iscsitarget service in order for nova-volume to work.

```
sed -i 's/false/true/g' /etc/default/iscsitarget
service iscsitarget start
```

Configure nova.conf Flag File

Edit your nova.conf to include a new flag, –iscsi_ip_prefix=192.168. The value of this flag needs to be set to something that will differentiate the IP addresses, to ensure it uses IP addresses that are route-able, such as a prefix on the private network.

Start nova-volume and Create Volumes

You are now ready to fire up nova-volume, and start creating volumes!

```
service nova-volume start
```

Once the service is started, login to your controller and ensure you've properly sourced your 'novarc' file. You will use the following commands to interface with nova-volume:

```
euca-create-volume
euca-attach-volume
euca-detach-volume
euca-delete-volume
```

One of the first things you should do is make sure that nova-volume is checking in as expected. You can do so using nova-manage:

```
nova-manage service list
```

If you see a 'nova-volume' in there, you are looking good. Now create a new volume:

```
euca-create-volume -s 7 -z nova      (-s refers to the size of the volume in
 GB, and -z is the default zone (usually nova))
```

You should get some output similar to this:

```
VOLUME  vol-0000000b    7       creating (wayne, None, None, None)
 2011-02-11 06:58:46.941818
```

You can view that status of the volumes creation using 'euca-describe-volumes'. Once that status is 'available,' it is ready to be attached to an instance:

```
euca-attach-volume vol-00000009 -i i-00000008 -d /dev/vdb
```

If you do not get any errors, it is time to login to instance 'i-00000008' and see if the new space is there. Here is the output from 'fdisk -l' from i-00000008:

```
Disk /dev/vda: 10.7 GB, 10737418240 bytes
```

```
16 heads, 63 sectors/track, 20805 cylinders
Units = cylinders of 1008 * 512 = 516096 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0×00000000
```

```
Disk /dev/vda doesn't contain a valid partition table
```

```
Disk /dev/vdb: 21.5 GB, 21474836480 bytes          <—–Here is our new volume!
16 heads, 63 sectors/track, 41610 cylinders
Units = cylinders of 1008 * 512 = 516096 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes Disk identifier: 0×00000000
```

Disk /dev/vdb doesn't contain a valid partition table

Now with the space presented, let's configure it for use:

```
fdisk /dev/vdb
```

1. Press 'n' to create a new disk partition.
2. Press 'p' to create a primary disk partition.
3. Press '1' to denote it as 1st disk partition.
4. Press ENTER twice to accept the default of 1st and last cylinder – to convert the remainder of hard disk to a single disk partition.
5. Press 't', then select the new partition you made.
6. Press '83' change your new partition to 83, i.e. Linux partition type.
7. Press 'p' to display the hard disk partition setup. Please take note that the first partition is denoted as /dev/vda1 in your instance.
8. Press 'w' to write the partition table and exit fdisk upon completion.
9. Lastly, make a file system on the partition and mount it.

```
mkfs.ext3 /dev/vdb1
mkdir /extraspace
mount /dev/vdb1 /extraspace
```

Your new volume has now been successfully mounted, and is ready for use! The 'euca' commands are pretty self-explanatory, so play around with them and create new volumes, tear them down, attach and reattach, and so on.

7.8. Using Live Migration

Before starting live migration, check "Configuring Live Migration" sections.

Live migration provides a scheme to migrate running instances from one OpenStack Compute server to another OpenStack Compute server. No visible downtime and no transaction loss is the ideal goal. This feature can be used as depicted below.

- First, make sure any instances running on a specific server.

```
# euca-describe-instances
Reservation:r-2raqmabo
RESERVATION   r-2raqmabo    admin   default
INSTANCE      i-00000003    ami-ubuntu-lucid      a.b.c.d  e.f.g.h
 running     testkey (admin, HostB)  0            m1.small     2011-02-15
 07:28:32   nova
```

In this example, i-00000003 is running on HostB.

- Second, pick up other server where instances are migrated to.

```
# nova-manage service list
HostA nova-scheduler enabled  :-) None
HostA nova-volume enabled  :-) None
HostA nova-network enabled  :-) None
HostB nova-compute enabled  :-) None
HostC nova-compute enabled  :-) None
```

In this example, HostC can be picked up because nova-compute is running onto it.

- Third, check HostC has enough resource for live migration.

```
# nova-manage service update_resource HostC
# nova-manage service describe_resource HostC
HOST             PROJECT     cpu   mem(mb) disk(gb)
HostC(total)                  16     32232     878
HostC(used)                   13     21284     442
HostC            p1            5     10240     150
HostC            p2            5     10240     150
.....
```

Remember to use update_resource first, then describe_resource. Otherwise, Host(used) is not updated.

- **cpu:**the nuber of cpu
- **mem(mb):**total amount of memory (MB)
- **disk(gb)**total amount of NOVA-INST-DIR/instances(GB)
- **1st line shows** total amount of resource physical server has.
- **2nd line shows** current used resource.
- **3rd line and under** is used resource per project.

- Finally, live migration

```
# nova-manage vm live_migration i-00000003 HostC
Migration of i-00000001 initiated. Check its progress using euca-describe-
instances.
```

Make sure instances are migrated successfully with euca-describe-instances. If instances are still running on HostB, check logfiles(src/dest nova-compute and nova-scheduler)

7.9. Reference for Flags in nova.conf

For a complete list of all available flags for each OpenStack Compute service, run bin/nova-<servicename> –help.

Table 7.1. Description of common nova.conf flags (nova-api, nova-compute)

Flag	Default	Description
–ajax_console_proxy_port	default: '8000'	Port value; port to which the ajax console proxy server binds
–ajax_console_proxy_topic	default: 'ajax_proxy'	String value; Topic that the ajax proxy nodes listen on
–ajax_console_proxy_url	default: 'http://127.0.0.1:8000'	IP address plus port value; Location of the ajax console proxy and port
–auth_token_ttl	default: '3600'	Seconds; Amount of time for auth tokens to linger, must be an integer value
–aws_access_key_id	default: 'admin'	Username; ID that accesses AWS if necessary
–aws_secret_access_key	default: 'admin'	Password key; The secret access key that pairs with the AWS ID for connecting to AWS if necessary
–compute_manager	default: 'nova.compute.manager.ComputeManager'	String value; Manager for Compute which handles remote procedure calls relating to creating instances
–compute_topic	default: 'compute'	String value; Names the topic that compute nodes listen on
–connection_type	default: 'libvirt'	String value libvirt, xenapi or fake; Virtualization driver for spawning instances
–console_manager	default: 'nova.console.manager.ConsoleProxyManager'	String value; Manager for console proxy
–console_topic	default: 'console'	String value; The topic console proxy nodes listen on
–control_exchange	default:nova	String value; Name of the main exchange to connect to
–default_image	default: 'ami-11111'	Name of an image; Names the default image to use, testing purposes only
–db_backend	default: 'sqlalchemy'	The backend selected for the database connection
–db_driver	default: 'nova.db.api'	The drive to use for database access
–default_instance_type	default: 'm1.small'	Name of an image; Names the default instance type to use, testing purposes only
–default_log_levels	default: 'amqplib=WARN,sqlalchemy=WARN,eventlet.wsgi.server=WARN'	Pair of named loggers and level of messages to be logged; List of logger=LEVEL pairs
–default_project	default: 'openstack'	Name of a project; Names the default project for openstack

Flag	Default	Description
–ec2_dmz_host	default: '$my_ip'	IP Address; Internal IP of API server (a DMZ is shorthand for a demilitarized zone)
–ec2_host	default: '$my_ip'	IP Address; External-facing IP of API server
–ec2_path	default: '/services/Cloud'	String value; Suffix for EC2-style URL where nova-api resides
–ec2_port	default: '8773'	Port value; Cloud controller port (where nova-api resides)
–ec2_scheme	default: 'http'	Protocol; Prefix for EC2-style URLs where nova-api resides
–ec2_url	none	Deprecated - HTTP URL; Location to interface nova-api. Example: http://184.106.239.134:8773/services/Cloud
–flat_injected	default: 'false'	Indicates whether Compute (Nova) should use attempt to inject IPv6 network configuration information into the guest. It attempts to modify /etc/network/interfaces and currently only works on Debian-based systems.
–fixed_ip_disassociate_timeout	default: '600'	Integer: Number of seconds after which a deallocated ip is disassociated.
–fixed_range	default: '10.0.0.0/8'	Fixed IP address block of addresses from which a set of iptables rules is created
–fixed_range_v6	default: 'fd00::/48'	Fixed IPv6 address block of addresses
–[no]flat_injected	default: 'true'	Indicates whether to attempt to inject network setup into guest; network injection only works for Debian systems
–flat_interface	default: ''	FlatDhcp will bridge into this interface if set
–flat_network_bridge	default: 'br100'	Bridge for simple network instances
–flat_network_dhcp_start	default: '10.0.0.2'	Starting IP address for the DHCP server to start handing out IP addresses when using FlatDhcp
–flat_network_dns	default: '8.8.4.4'	DNS for simple network
–floating_range	default: '4.4.4.0/24'	Floating IP address block
–[no]fake_network	default: 'false'	Indicates whether Compute (Nova) should use fake network devices and addresses
–[no]enable_new_services	default: 'true'	Services to be added to the available pool when creating services using nova-manage
–[no]fake_rabbit	default: 'false'	Indicates whether Compute (Nova) should use a fake rabbit server
–glance_host	default: '$my_ip'	IP address; IP address of OpenStack Compute Image Service server (project's name is Glance)
–glance_port	default: '9292'	Port value; Port opened for OpenStack Compute Image Service server (project's name is Glance)
-?, –[no]help		Show this help.
–[no]helpshort		Show usage only for this module.

Flag	Default	Description
–[no]helpxml		Show this help, but with XML output instead of text
–host	default: ''	String value; Name of the node where the cloud controller is hosted
–image_service	default: 'nova.image.s3.S3ImageService'	The service to use for retrieving and searching for images. Images must be registered using euca2ools. Options: • nova.image.s3.S3ImageService S3 backend for the Image Service. • nova.image.local.LocalImageService Image service storing images to local disk. It assumes that image_ids are integers. This is the default setting if no image manager is defined here. • nova.image.glance.GlanceImageService Glance back end for storing and retrieving images; See http://glance.openstack.org for more info.
–instance_name_template	default: 'instance-%08x'	Template string to be used to generate instance names.
–libvirt_type	default: kvm	String: Name of connection to a hypervisor through libvirt. Supported options are kvm, qemu, uml, and xen.
–lock_path	default: none	Directory path: Writeable path to store lock files.
–logfile	default: none	Output to named file.
–logging_context_format_string	default: '%(asctime)s %(levelname)s %(name)s [%(request_id)s %(user)s %(project)s] %(message)s'	The format string to use for log messages with additional context.
–logging_debug_format_suffix	default: 'from %(processName)s (pid=%(process)d) %(funcName)s %(pathname)s:%(lineno)d'	The data to append to the log format when level is DEBUG.
–logging_default_format_string	default: '%(asctime)s %(levelname)s %(name)s [-] %(message)s'	The format string to use for log messages without context.
–logging_exception_prefix	default: '(%(name)s): TRACE: '	String value; Prefix each line of exception output with this format.
–my_ip	default: ''	IP address; Cloud controller host IP address.
–network_manager	default: 'nova.network.manager.VlanManager'	Configures how your controller will communicate with additional OpenStack Compute nodes and virtual machines. Options: • nova.network.manager.FlatManager Simple, non-VLAN networking • nova.network.manager.FlatDHCPManager Flat networking with DHCP • nova.network.manager.VlanManager

Flag	Default	Description
		VLAN networking with DHCP; This is the Default if no network manager is defined here in nova.conf.
–network_driver	default: 'nova.network.linux_net'	String value; Driver to use for network creation.
–network_host	default: 'preciousroy.hsd1.ca.comcast.net'	String value; Network host to use for ip allocation in flat modes.
–network_size	default: '256'	Integer value; Number of addresses in each private subnet.
–num_networks	default: '1000'	Integer value; Number of networks to support.
–network_topic	default: 'network'	String value; The topic network nodes listen on.
–node_availability_zone	default: 'nova'	String value; Availability zone of this node.
–null_kernel	default: 'nokernel'	String value; Kernel image that indicates not to use a kernel, but to use a raw disk image instead.
–osapi_host	default: '$my_ip'	IP address; IP address of the API server.
–osapi_path	default: '/v1.0/'	
–osapi_port	default: '8774'	Integer value; Port open for the OpenStack API server.
–osapi_scheme	default: 'http'	Protocol; Prefix for the OpenStack API URL.
–periodic_interval	default: '60'	Integer value; Seconds between running periodic tasks.
–pidfile	default: ''	String value; Name of pid file to use for this service (such as the nova-compute service).
–rabbit_host	default: 'localhost'	IP address; Location of rabbitmq installation.
–rabbit_max_retries	default: '12'	Integer value; Rabbit connection attempts.
–rabbit_password	default: 'guest'	String value; Password for the Rabbitmq server.
–rabbit_port	default: '5672'	Integer value; Port where Rabbitmq server is running/listening.
–rabbit-retry-interval	default: '10'	Integer value: Rabbit connection retry interval.
–rabbit_userid	default: 'guest'	String value; User ID used for Rabbit connections.
–region_list	default: ''	Comma-delimited pairs; List of region = fully qualified domain name pairs separated by commas.
–report_interval	default: '10'	Integer value; Seconds between nodes reporting state to the data store.
–routing_source_ip	default: '10'	IP address; Public IP of network host. When instances without a floating IP hit the Internet, traffic is snatted to this IP address.
–s3_dmz	default: '$my_ip'	IP address; For instances internal IP (a DMZ is shorthand for a demilitarized zone)

Flag	Default	Description
–s3_host	default: '$my_ip'	IP address: IP address of the S3 host for infrastructure. Location where OpenStack Compute is hosting the objectstore service, which will contain the virtual machine images and buckets.
–s3_port	default: '3333'	Integer value; Port where S3 host is running
–scheduler_manager	default: 'nova.scheduler.manager.SchedulerManager'	Manager for the scheduler for Compute (Nova)
–scheduler_topic	default: 'scheduler'	String value; The topic scheduler nodes listen on.
–sql_connection	default: 'sqlite:///$state_path/nova.sqlite'	IP address; Location of OpenStack Compute SQL database
–sql_idle_timeout	default: '3600'	
–sql_max_retries	default: '12'	Integer value; Number of attempts on the SQL connection
–sql_retry_interval	default: '10'	Integer value; Retry interval for SQL connections
–state_path	default: '/usr/lib/pymodules/python2.6/nova/../'	Top-level directory for maintaining Nova's state
–use_ipv6	default: 'false'	Set to 1 or true to turn on; Determines whether to use IPv6 network addresses
–use_s3	default: 'true'	Set to 1 or true to turn on; Determines whether to get images from s3 or use a local copy
–verbose	default: 'false'	Set to 1 or true to turn on; Optional but helpful during initial setup
–vlan_interface	default: 'eth0'	This is the interface that VlanManager uses to bind bridges and vlans to.
–vlan_start	default: '100'	Integer; First VLAN for private networks.
–vpn_image_id	default: 'ami-cloudpipe'	AMI (Amazon Machine Image) for cloudpipe VPN server
–vpn_key_suffix	default: '-vpn'	This is the interface that VlanManager uses to bind bridges and VLANs to.

Table 7.2. Description of nova.conf flags specific to nova-volume

Flag	Default	Description
–iscsi_ip_prefix	default: ''	IP address or partial IP address; Value that differentiates the IP addresses
–volume_manager	default: 'nova.volume.manager.VolumeManager'	String value; Manager to use for nova-volume
–volume_name_template	default: 'volume-%08x'	String value; Template string to be used to generate volume names
–volume_topic	default: 'volume'	String value; Name of the topic that volume nodes listen on

8. OpenStack Image Service

Table of Contents

You can use OpenStack Image Services for discovering, registering, and retrieving virtual machine images. The service includes a RESTful API that allows users to query VM image metadata and retrieve the actual image with HTTP requests, or you can use a client class in your Python code to accomplish the same tasks.

VM images made available through OpenStack Image Service can be stored in a variety of locations from simple file systems to object-storage systems like the OpenStack Object Storage project, or even use S3 storage either on its own or through an OpenStack Object Storage S3 interface.

8.1. Overview of Architecture

There are two main parts to the Image Service's architecture:

- API server
- Registry server(s)

OpenStack Image Service is designed to be as adaptable as possible for various back-end storage and registry database solutions. There is a main API server (the ``glance-api`` program) that serves as the communications hub betweenvarious client programs, the registry of image metadata, and the storage systems that actually contain the virtual machine image data.

8.2. OpenStack Image Service API Server

The API server is the main interface for OpenStack Image Service. It routes requests from clients to registries of image metadata and to its backend stores, which are the mechanisms by which OpenStack Image Service actually saves incoming virtual machine images.

The backend stores that OpenStack Image Service can work with are as follows:

- OpenStack Object Storage - OpenStack Object Storage is the highly-available object storage project in OpenStack.
- Filesystem - The default backend that OpenStack Image Service uses to store virtual machine images is the filesystem backend. This simple backend writes image files to the local filesystem.
- S3 - This backend allows OpenStack Image Service to store virtual machine images in Amazon's S3 service.
- HTTP - OpenStack Image Service can read virtual machine images that are available via HTTP somewhere on the Internet. This store is readonly.

8.3. OpenStack Image Service Registry Servers

OpenStack Image Service registry servers are servers that conform to the OpenStack Image Service Registry API. OpenStack Image Service ships with a reference implementation of a registry server that complies with this API (bin/OpenStack Image Service-registry).

8.4. Installing and Configuring OpenStack Image Service

The OpenStack system has several key projects that are separate installations but can work together depending on your cloud needs: OpenStack Compute, OpenStack Object Storage, and an OpenStack Image Service with a project name of Glance. You can install any of these projects separately and then configure them either as standalone or connected entities.

8.4.1. System Requirements for OpenStack Image Service (Glance)

Hardware: OpenStack components are intended to run on standard hardware.

Operating System: The OpenStack Image Service itself currently runs on Ubuntu but the images it stores may contain different operating systems.

Networking: 1000 Mbps are suggested.

Database: Any SQLAlchemy-compatible database, such as MySQL, Oracle, PostgreSQL, or SQLite. The reference registry server implementation that ships with OpenStack Image

Service uses a SQL database to store information about an image, and publishes this information via an HTTP/REST-like interface.

Permissions: You can install OpenStack imaging service either as root or as a user with sudo permissions if you configure the sudoers file to enable all the permissions.

8.4.2. Installing OpenStack Image Service on Ubuntu

The installation of the Image Services themselves are separate from the storage of the virtual images to be retrieved.

8.4.2.1. Example Installation Architecture

These installation instructions have you set up the services on a single node, so the API server and registry services are on the same server. The images themselves can be stored either in OpenStack Object Storage, Amazon's S3 infrastructure, in a filesystem, or if you want read-only access, on a web server to be served via HTTP.

8.4.2.2. Installing OpenStack Image Service (Glance)

First, add the Glance PPA to your sources.lst.

```
sudo add-apt-repository ppa:glance-core/trunk
```

Run update.

```
sudo apt-get update
```

Now, install the Glance server.

```
sudo apt-get install glance
```

All dependencies should be automatically installed.

Refer to the Glance developer documentation site to install from a Bazaar branch.

8.4.3. Configuring and Controlling Glance Servers

You start Glance either by calling the server program, glance-api, or using the server daemon wrapper program named glance-control.

Glance ships with an etc/ directory that contains sample paste.deploy configuration files that you can copy to a standard configuration directory and adapt for your own uses.

If you do not specify a configuration file on the command line when starting the glance-api server, Glance attempts to locate a glance.conf configuration file in one of the following directories, and uses the first config file it finds in this order:

1. .
2. ~/.glance
3. ~/

4. /etc/glance/

5. /etc

If Glance doesn't find a configuration file in one of these locations, you see an error: `ERROR: Unable to locate any configuration file. Cannot load application glance-api`.

Manually starting the server

To manually start the glance-api server, use a command like the following:

```
sudo glance-api etc/glance.conf.sample --debug
```

Supply the configuration file as the first argument (etc/glance.conf.sample in the above example) and then any common options you want to use. In the above example, the –debug option shows some of the debugging output that the server shows when starting up. Call the server program with –help to see all available options you can specify on the command line.

Note that the server does not daemonize itself when run manually from the terminal. You can force the server to daemonize using the standard shell backgrounding indicator, However, for most use cases, we recommend using the glance-control server daemon wrapper for daemonizing. See below for more details on daemonization with glance-control.

Starting the server with the glance-control wrapper script

The second way to start up a Glance server is to use the glance-control program. glance-control is a wrapper script that allows the user to start, stop, restart, and reload the other Glance server programs in a fashion that is more conducive to automation and scripting.

Servers started via the glance-control program are always daemonized, meaning that the server program process runs in the background.

To start a Glance server with glance-control, simply call glance-control with a server and the word “start”, followed by any command-line options you wish to provide. Start the server with glance-control in the following way:

```
sudo glance-control {SERVER} start [CONFPATH]
```

Here is an example that shows how to start the glance-registry server with the glance-control wrapper script.

```
sudo glance-control registry start etc/glance.conf.sample
             Starting glance-registry with /home/jpipes/repos/glance/trunk/
etc/glance.conf.sample
```

To start all the Glance servers (currently the glance-api and glance-registry programs) at once, you can specify “all” for the {SERVER}.

Stopping a Glance server

You can use Ctrl-C to stop a Glance server if it was started manually.

If you started the Glance server using the glance-control program, you can use the glance-control program to stop it. Simply do the following:

```
sudo glance-control {SERVER} stop
```

as this example shows:

```
sudo glance-control registry stop
                Stopping glance-registry  pid: 17602  signal: 15
```

Restarting a Glance server

You can restart a server with the glance-control program, as demonstrated here:

```
        sudo glance-control registry restart etc/glance.conf.sample
        Stopping glance-registry  pid: 17611  signal: 15
        Starting glance-registry with /home/jpipes/repos/glance/trunk/etc/
glance.conf.sample
```

8.4.4. Configuring Compute to use Glance

Once Glance is installed and the server is running, you should edit your nova.conf file to add or edit the following flags:

```
      --glance_host=GLANCE_SERVER_IP
      --image_service=nova.image.glance.GlanceImageService
```

Where the GLANCE_SERVER_IP is the IP address of the server running the glance-api service.

8.5. Configuring Logging for Glance

There are a number of configuration options in Glance that control how Glance servers log messages. The configuration options are specified in the glance.conf configuration file.

Table 8.1. Description of glance.conf flags for Glance logging

Flag	Default	Description
–log-config=PATH	default: none	Path name to a configuration file to use for configuring logging: Specified on the command line only.
–log-format	default: %(asctime)s %(levelname)8s [%(name)s] %(message)s	Format of log records: Because of a bug in the PasteDeploy package, this option is only available on the command line. See the Python logging module documentation for more information about the options in the format string.
–log_file	default: none	Path name: The filepath of the file to use for logging messages from Glance's servers. Without this setting, the default is to output messages to stdout, so if you are running Glance servers in a daemon mode (using

Flag	Default	Description
		glance-control) you should make sure that the log_file option is set appropriately.
–log_dir	default: none	Path name: The filepath of the directory to use for log files. If not specified (the default) the log_file is used as an absolute filepath.
–log_date_format	default: %Y-%m-%d %H:%M:%S	Python logging module formats: The format string for timestamps in the log output. See the Python logging module documentation for more information on setting this format string.

8.6. OpenStack Image Service (Glance) REST API

Glance has a RESTful API that exposes both metadata about registered virtual machine images and the image data itself.

A host that runs the bin/glance-api service is said to be a Glance API Server.

Assume there is a Glance API server running at the URL http://glance.example.com.

Let's walk through how a user might request information from this server.

8.6.1. Requesting a List of Public VM Images

We want to see a list of available virtual machine images that the Glance server knows about.

We issue a GET request to http://glance.example.com/images/ to retrieve this list of available public images. The data is returned as a JSON-encoded mapping in the following format:

```
{'images': [
  {'uri': 'http://glance.example.com/images/1',
   'name': 'Ubuntu 10.04 Plain',
   'type': 'kernel',
   'size': '5368709120'}
  ...]}
```

All images returned from the above GET request are public images

8.6.2. Requesting Detailed Metadata on Public VM Images

We want to see more detailed information on available virtual machine images that the Glance server knows about.

We issue a GET request to http://glance.example.com/images/detail to retrieve this list of available public images. The data is returned as a JSON-encoded mapping in the following format:

```
{'images': [
  {'uri': 'http://glance.example.com/images/1',
```

```
   'name': 'Ubuntu 10.04 Plain 5GB',
   'type': 'kernel',
   'size': '5368709120',
   'store': 'swift',
   'created_at': '2010-02-03 09:34:01',
   'updated_at': '2010-02-03 09:34:01',
   'deleted_at': '',
   'status': 'active',
   'is_public': True,
   'properties': {'distro': 'Ubuntu 10.04 LTS'}},
  ...]}
```

Notes

All images returned from the above *GET* request are public images.

All timestamps returned are in UTC

The *updated_at* timestamp is the timestamp when an image's metadata was last updated, not its image data, as all image data is immutable once stored in Glance

The properties field is a mapping of free-form key/value pairs that have been saved with the image metadata

8.6.3. Requesting Detailed Metadata on a Specific Image

We want to see detailed information for a specific virtual machine image that the Glance server knows about.

We have queried the Glance server for a list of public images and the data returned includes the uri field for each available image. This uri field value contains the exact location needed to get the metadata for a specific image.

Continuing the example from above, in order to get metadata about the first public image returned, we can issue a HEAD request to the Glance server for the image's URI.

We issue a *HEAD* request to http://glance.example.com/images/1 to retrieve complete metadata for that image. The metadata is returned as a set of HTTP headers that begin with the prefix x-image-meta-. The following shows an example of the HTTP headers returned from the above HEAD request:

```
x-image-meta-uri              http://glance.example.com/images/1
x-image-meta-name             Ubuntu 10.04 Plain 5GB
x-image-meta-type             kernel
x-image-meta-size             5368709120
x-image-meta-store            swift
x-image-meta-created_at       2010-02-03 09:34:01
x-image-meta-updated_at       2010-02-03 09:34:01
x-image-meta-deleted_at
x-image-meta-status           available
x-image-meta-is_public        True
x-image-meta-property-distro  Ubuntu 10.04 LTS
```

Notes

All timestamps returned are in UTC

The *x-image-meta-updated_at* timestamp is the timestamp when an image's metadata was last updated, not its image data, as all image data is immutable once stored in Glance

There may be multiple headers that begin with the prefix *x-image-meta-property-*. These headers are free-form key/value pairs that have been saved with the image metadata. The key is the string after *x-image-meta-property-* and the value is the value of the header

8.6.4. Retrieving a Virtual Machine Image

We want to retrieve that actual raw data for a specific virtual machine image that the Glance server knows about.

We have queried the Glance server for a list of public images and the data returned includes the *uri* field for each available image. This *uri* field value contains the exact location needed to get the metadata for a specific image.

Continuing the example from above, in order to get metadata about the first public image returned, we can issue a HEAD request to the Glance server for the image's URI.

We issue a GET request to http://glance.example.com/images/1 to retrieve metadata for that image as well as the image itself encoded into the response body.

The metadata is returned as a set of HTTP headers that begin with the prefix x-image-meta-. The following shows an example of the HTTP headers returned from the above GET request:

```
x-image-meta-uri              http://glance.example.com/images/1
x-image-meta-name             Ubuntu 10.04 Plain 5GB
x-image-meta-type             kernel
x-image-meta-size             5368709120
x-image-meta-store            swift
x-image-meta-created_at       2010-02-03 09:34:01
x-image-meta-updated_at       2010-02-03 09:34:01
x-image-meta-deleted_at
x-image-meta-status           available
x-image-meta-is_public        True
x-image-meta-property-distro  Ubuntu 10.04 LTS
```

Notes

All timestamps returned are in UTC

The *x-image-meta-updated_at* timestamp is the timestamp when an image's metadata was last updated, not its image data, as all image data is immutable once stored in Glance

There may be multiple headers that begin with the prefix *x-image-meta-property-*. These headers are free-form key/value pairs that have been saved with the image metadata. The key is the string after *x-image-meta-property-* and the value is the value of the header

The response's *Content-Length* header shall be equal to the value of the *x-image-meta-size* header

The image data itself will be the body of the HTTP response returned from the request, which will have content-type of *application/octet-stream*.

8.6.5. Adding a New Virtual Machine Image

We have created a new virtual machine image in some way (created a "golden image" or snapshotted/backed up an existing image) and we want to do two things:

- Store the disk image data in Glance
- Store metadata about this image in Glance

We can do the above two activities in a single call to the Glance API. Assuming, like in the examples above, that a Glance API server is running at glance.example.com, we issue a POST request to add an image to Glance:

```
POST http://glance.example.com/images/
```

The metadata about the image is sent to Glance in HTTP headers. The body of the HTTP request to the Glance API will be the MIME-encoded disk image data.

8.6.6. Adding Image Metadata in HTTP Headers

Glance will view as image metadata any HTTP header that it receives in a POST request where the header key is prefixed with the strings x-image-meta- and x-image-meta-property-.

The list of metadata headers that Glance accepts are listed below.

- *x-image-meta-name*

  This header is required. Its value should be the name of the image.

  Note that the name of an image *is not unique to a Glance node*. It would be an unrealistic expectation of users to know all the unique names of all other user's images.

- *x-image-meta-id*

  This header is optional.

  When present, Glance will use the supplied identifier for the image. If the identifier already exists in that Glance node, then a *409 Conflict* will be returned by Glance.

  When this header is *not* present, Glance will generate an identifier for the image and return this identifier in the response (see below)

- *x-image-meta-store*

  This header is optional. Valid values are: file, s3, or swift.

  When present, Glance will attempt to store the disk image data in the backing store indicated by the value of the header. If the Glance node does not support the backing store, Glance will return a *400 Bad Request*.

  When not present, Glance will store the disk image data in the backing store that is marked default. See the configuration option default_store for more information.

- *x-image-meta-type*

This header is required. Valid values are: kernel, machine, raw, or ramdisk.

- *x-image-meta-size*

  This header is optional.

  When present, Glance assumes that the expected size of the request body will be the value of this header. If the length in bytes of the request body *does not match* the value of this header, Glance will return a *400 Bad Request*.

  When not present, Glance will calculate the image's size based on the size of the request body.

- *x-image-meta-is_public*

  This header is optional.

  When present, Glance converts the value of the header to a boolean value, so "on, 1, true" are all true values. When true, the image is marked as a public image, meaning that any user may view its metadata and may read the disk image from Glance.

  When not present, the image is assumed to be *not public* and specific to a user.

- *x-image-meta-property-**

  When Glance receives any HTTP header whose key begins with the string prefix x-image-meta-property-, Glance adds the key and value to a set of custom free-form image properties stored with the image The key is the lower-cased string following the prefix x-image-meta-property- with dashes and punctuation replaced with underscores.

  For example, if the following HTTP header were sent:

```
x-image-meta-property-distro  Ubuntu 10.10
```

  Then a key/value pair of "distro"/"Ubuntu 10.10" will be stored with the image in Glance.

  There is no limit on the number of free-form key/value attributes that can be attached to the image. However, keep in mind that the 8K limit on the size of all HTTP headers sent in a request will effectively limit the number of image properties.

8.6.7. Updating an Image

Glance will view as image metadata any HTTP header that it receives in a PUT request where the header key is prefixed with the strings x-image-meta- and x-image-meta-property-.

If an image was previously reserved, and thus is in the queued state, then image data can be added by including it as the request body. If the image already as data associated with it (e.g. not in the queued state), then including a request body will result in a *409 Conflict* exception.

On success, the PUT request will return the image metadata encoded as HTTP headers.

9. OpenStack Interfaces

Table of Contents

You can use a dashboard interface with an OpenStack Compute installation with a web-based console provided by the Openstack-Dashboard and Django-Nova projects. Together they provide a reference implementation of a Django site that provides web-based interactions with the OpenStack Compute cloud controller. For more information about the Django-Nova project, please visit: http://launchpad.net/django-nova. These instructions are for a test deployment of an OpenStack Dashboard. They configure your dashboard to use a sqlite3 database and the default Django server. To create a more robust, production-ready installation, you would configure this with an Apache web server and MySQL/Postgres database.

9.1. System Requirements

You should have a running OpenStack Compute installation with the EC2 API enabled.

The dashboard needs to be installed on the node that is running the nova-api service.

You should know the URL of your nova-api instance.

You must know the credentials of a valid nova admin user, including the username, their EC2 Access Key, and their EC2 Secret Key. These credentials are found in the novarc file created when you created a nova project.

Python 2.6 is required, and these instructions have been tested with Ubuntu 10.10.

9.2. Installing the OpenStack Dashboard

To build a reference dashboard you must use the two projects together. Here are the overall steps for building the dashboard.

1. Get the source for the openstack-dashboard project.

2. Build and configure the openstack-dashboard.

3. Create the openstack-dashboard database with the syncdb command.

4. Run the server that starts the dashboard.

Before you begin, you must have bazaar installed. It's straightforward to install it with `sudo apt-get install bzr`.

Create a source directory to house the project:

```
mkdir src
cd src
```

Next, get the openstack-dashboard project, which provides all the look and feel for the OpenStack Dashboard.

```
mkdir openstack-dashboard
cd openstack-dashboard
bzr init-repo .
bzr branch lp:openstack-dashboard trunk
```

You should now have a directory called trunk, which contains the OpenStack Dashboard application.

9.2.1. Build and Configure Openstack-Dashboard

Now you can configure the dashboard application. The first step in configuring the application is to create your local_settings.py file. An example is provided that you can copy to local_settings.py and then modify for your environment.

```
cd trunk/openstack-dashboard/local
cp local_settings.py.example local_settings.py
vi local_settings.py
```

In the new copy of the local_settings.py file, change these important options:

- NOVA_DEFAULT_ENDPOINT : this needs to be set to nova-api instance URL from above. You can use 'http://localhost:8773/services/Cloud' if you plan to view the dashboard on the same machine as your nova-api.
- NOVA_ACCESS_KEY : this should be the EC2_ACCESS_KEY in your novarc file (which includes the project name).
- NOVA_SECRET_KEY : this should be the EC2_SECRET_KEY in your novarc file.

If you are using an admin user that is named something other than "admin", add the following two options to the local_settings.py file. In this example, the admin user is named "osadmin".

- NOVA_ADMIN_USER = 'osadmin' The CLOUD_SERVERS_USERNAME from your admin credentials file is fine.
- NOVA_PROJECT = 'osadmin' This can be any project (defined in your nova database) for which the NOVA_ADMIN_USER is defined as project_manager.

One additional option is available in the local_settings.py file, the default region. This can be set to anything, but is set to nova by default.

- NOVA_DEFAULT_REGION = 'nova'

Now install the openstack-dashboard environment. This installs all the dependencies for openstack-dashboard (including the django-nova from earlier). If you don't already have easy_install installed, use sudo apt-get install python-setuptools.

```
apt-get install -y python-setuptools
sudo easy_install virtualenv
python tools/install_venv.py ../../django-nova/trunk
```

This step takes some time since it downloads a number of dependencies.

Once the download completes, create the database and insert the credentials for your Nova user:

```
tools/with_venv.sh dashboard/manage.py syncdb
```

Midway through the script, you are asked, "You just installed Django's auth system, which means you don't have any superusers defined. Would you like to create one now? (yes/no):" Answer Yes, and insert these values as shown:

```
Username (Leave blank to use 'root'): *ENTER YOUR NOVA_ADMIN-LEVEL_USERNAME
 FROM NOVARC*
E-mail address: *ENTER YOUR EMAIL ADDRESS*
Password: *MAKE UP A PASSWORD*
Password (again): *REPEAT YOUR PASSWORD*
```

Once this configuration is complete, you should be returned to the prompt with no errors. If you get 403 errors, it probably means the user is undefined. Check the nova-api log file (typically /var/log/nova/nova-api.log) for specifics.

If you get permission denied errors, you may have a project error - try creating a project named 'dashboard' with your user as admin:

```
sudo nova-manage project create dashboard YOUR_ADMIN_USER
```

Before you can retry, you should probably clear the existing database:

```
rm local/dashboard_openstack.sqlite3
```

9.2.2. Run the Server

Now run the built-in server on a high port value so that you can validate the installation.

```
tools/with_venv.sh dashboard/manage.py runserver 0.0.0.0:8000
```

Make sure that your firewall isn't blocking TCP/8000 and just point your browser at this server on port 8000. If you are running the server on the same machine as your browser, this would be "http://localhost:8000".

10. OpenStack Compute Tutorials

Table of Contents

We want OpenStack to make sense, and sometimes the best way to make sense of the cloud is to try out some basic ideas with cloud computing. Flexible, elastic, and scalable are a few attributes of cloud computing, so these tutorials show various ways to use virtual computing or web-based storage with OpenStack components.

10.1. Running Your First Elastic Web Application on the Cloud

In this OpenStack tutorial, we'll walk through the creation of an elastic, scalable cloud running a WordPress installation on a few virtual machines.

The tutorial assumes you have OpenStack Compute already installed on Ubuntu 10.04. You can tell OpenStack Compute is installed by running "sudo nova-manage service list" to ensure it is installed and the necessary services are running and ready. You should see a set of nova- services in a response. You should run the tutorial as a root user or a user with sudo access.

If you haven't installed OpenStack Compute yet, a scripted method is fast and offers a walk-through. Get the script from https://github.com/dubsquared/OpenStack-NOVA-Installer-Script.

We'll go through this tutorial in parts:

- Setting up a user, project, and network for this cloud.
- Getting images for your application servers.
- On the instances you spin up, installing Wordpress and its dependencies, the Memcached plugin, and multiple memcache servers.

10.1.1. Part I: Setting Up the Cloud Infrastructure

In this part, we'll get the networking layer set up based on what we think most networks would work like. We'll also create a user and a project to house our cloud and its network. Onward, brave cloud pioneers!

Configuring the network

Ideally on large OpenStack Compute deployments, each project is in a protected network segment. Our project in this case is a LAMP stack running Wordpress with the Memcached plugin for added database efficiency. So we need a public IP address for the Wordpress server but we can use flat networking for this. Here's how you set those network settings.

Usually networking is set in nova.conf, but VLAN-based networking with DHCP is the default setting when no network manager is defined in nova.conf. To check this network setting, open your nova.conf, typically in /etc/nova/nova.conf and look for -network_manager. The possible options are:

- -network_manager=nova.network.manager.FlatManager for a simple, no-VLAN networking type,
- -network_manager=nova.network.manager.FlatDHCPManager for flat networking with DHCP,
- -network_manager= nova.network.manager.VlanManager for the type of networking we want for the tutorial.

Here is an example nova.conf for a single node installation of OpenStack Compute.

```
--network_manager=nova.network.manager.FlatManager
--use_ipv6=false
--dhcpbridge_flagfile=/etc/nova/nova.conf
--dhcpbridge=nova-dhcpbridge
--logdir=/var/log/nova
--state_path=/var/lib/nova
--verbose
--s3_host=184.106.239.134
--rabbit_host=184.106.239.134
--ec2_api=184.106.239.134
--ec2_url=http://184.106.239.134:8773/services/Cloud
--fixed_range=192.168.0.0/12
--network_size=24
--routing_source_ip=184.106.239.134
--verbose
--sql_connection=mysql://nova:notnova@184.106.239.134/nova
```

Now that we know the networking configuration, let's set up the network for our project.

For this tutorial, we set a /24 network since that falls inside the /12 range that's set in ‘fixed-range’ in nova.conf. We probably won't use that many at first, but it's good to have the room to scale.

Currently, there can only be one network set in nova.conf.

Note

The nova-manage service assumes that the first IP address is your network (like 192.168.0.0), that the 2nd IP is your gateway (192.168.0.1), and that the broadcast is the very last IP in the range you defined (192.168.0.255). If this is not the case you will need to manually edit the sql db ‘networks’ table.o but that scenario shouldn't happen for this tutorial.

Run this command as root or sudo:

```
nova-manage network create 192.168.3.0/12 1 255
```

On running this command, entries are made in the 'networks' and 'fixed_ips' table in the nova database. However, one of the networks listed in the 'networks' table needs to be marked as bridge in order for the code to know that a bridge exists. The Network is marked as bridged automatically based on the type of network manager selected.

Next you want to integrate this network bridge, named br100, into your network. A bridge connects two Ethernet segments together.

Ensure the Database is Up-to-date

The first command you run using nova-manage is one called db sync, which ensures that your database is updated. You must run this as root.

```
nova-manage db sync
```

Creating a user

OpenStack Compute can run many projects for many users, so for our tutorial we'll create a user and project just for this scenario.

We control the actions a user can take through roles, such as admin for Administrator who has complete system access, itsec for IT Security, netadmin for Network Administrator, and so on.

In addition to these roles controlling access to the Eucalyptus API, credentials are supplied and bundled by OpenStack compute in a zip file when you create a project. The user accessing the cloud infrastructure through ec2 commands are given an access and secret key through the project itself. Let's create a user that has the access we want for this project.

To add an admin user named cloudypants, use:

```
nova-manage user admin cloudypants
```

Creating a project and related credentials

Next we'll create the project, which in turn gives you certifications in a zip file.

Enter this command to create a project named wpscales as the admin user, cloudypants, that you created above.

```
nova-manage project create wpscales cloudypants
```

Great, now you have a project that is set apart from the rest of the clouds you might control with OpenStack Compute. Now you need to give the user some credentials so they can run commands for the instances with in that project's cloud.

These are the certs you will use to launch instances, bundle images, and all the other assorted API and command-line functions.

First, we'll create a directory that'll house these credentials, in this case in the root directory. You need to sudo here or save this to your own directory with 'mkdir -p ~/creds' so that the credentials match the user and are stored in their home.

```
mkdir –p /root/creds
```

Now, run nova-manage to create a zip file for your project called wpscales with the user cloudypants (the admin user we created previously).

```
sudo nova-manage project zipfile wpscales cloudypants /root/creds/
novacreds.zip
```

Next, you can unzip novacreds.zip in your home directory, and add these credentials to your environment.

```
unzip /root/creds/novacreds.zip -d /root/creds/
```

Sending that information and sourcing it as part of your .bashrc file remembers those credentials for next time.

```
cat /root/creds/novarc >> ~/.bashrc
source ~/.bashrc
```

Okay, you've created the basic scaffolding for your cloud so that you can get some images and run instances. Onward to Part II!

10.1.2. Part II: Getting Virtual Machines to Run the Virtual Servers

Understanding what you can do with cloud computing means you should have a grasp on the concept of virtualization. With virtualization, you can run operating systems and applications on virtual machines instead of physical computers. To use a virtual machine, you must have an image that contains all the information about which operating system to run, the user login and password, files stored on the system, and so on.

For this tutorial, we've created an image that you can download that allows the networking you need to run web applications and so forth. In order to use it with the OpenStack Compute cloud, you download the image, then use uec-publish-tarball to publish it.

Here are the commands to get your virtual image. Be aware that the download of the compressed file may take a few minutes.

```
image="ubuntu1010-UEC-localuser-image.tar.gz"
wget http://c0179148.cdn1.cloudfiles.rackspacecloud.com/
ubuntu1010-UEC-localuser-image.tar.gz
uec-publish-tarball $image wpbucket x86_64
```

What you'll get in return from this command is three references: emi, eri and eki. These are acronyms - emi stands for eucalyptus machine image, eri stands for eucalyptus ramdisk image, and eki stands for eucalyptus kernal image. Amazon has similar references for their images - ami, ari, and aki.

You need to use the emi value when you run the instance. These look something like “ami-zqkyh9th" - basically a unique identifier.

Okay, now that you have your image and it's published, realize that it has to be decompressed before you can launch an image from it. We can realize what state an image is in using the 'euca-describe-instances' command. Basically, run:

```
euca-describe-instances
```

and look for the state in the text that returns. You can also use euca-describe-images to ensure the image is untarred. Wait until the state shows "available" so that you know the instances is ready to roll.

10.1.3. Part III: Installing the Needed Software for the Web-Scale Scenario

Once that state is "available" you can enter this command, which will use your credentials to start up the instance with the identifier you got by publishing the image.

```
emi=ami-zqkyh9th
euca-run-instances $emi -k mykey -t m1.tiny
```

Now you can look at the state of the running instances by using euca-describe-instances again. The instance will go from “launching” to “running” in a short time, and you should be able to connect via SSH. Look at the IP addresses so that you can connect to the instance once it starts running.

Basically launch a terminal window from any computer, and enter:

```
ssh -i mykey ubuntu@10.127.35.119
```

On this particular image, the 'ubuntu' user has been set up as part of the sudoers group, so you can escalate to 'root' via the following command:

```
sudo -i
```

On the first VM, install WordPress

Now, you can install WordPress. Create and then switch to a blog directory:

```
mkdir blog
cd blog
```

Download WordPress directly to you by using wget:

```
wget http://wordpress.org/latest.tar.gz
```

Then unzip the package using:

```
tar -xzvf latest.tar.gz
```

The WordPress package will extract into a folder called wordpress in the same directory that you downloaded latest.tar.gz.

Next, enter "exit" and disconnect from this SSH session.

On a second VM, install MySQL

Next, SSH into another virtual machine and install MySQL and use these instructions to install the WordPress database using the MySQL Client from a command line: Using the MySQL Client - Wordpress Codex.

On a third VM, install Memcache

Memcache makes Wordpress database reads and writers more efficient, so your virtual servers can go to work for you in a scalable manner. SSH to a third virtual machine and install Memcache:

```
apt-get install memcached
```

Configure the Wordpress Memcache plugin

From a web browser, point to the IP address of your Wordpress server. Download and install the Memcache Plugin. Enter the IP address of your Memcache server.

10.1.4. Running a Blog in the Cloud

That's it! You're now running your blog on a cloud server in OpenStack Compute, and you've scaled it horizontally using additional virtual images to run the database and Memcache. Now if your blog gets a big boost of comments, you'll be ready for the extra reads-and-writes to the database.

11. Support and Troubleshooting

Table of Contents

Online resources aid in supporting OpenStack and the community members are willing and able to answer questions and help with bug suspicions. We are constantly improving and adding to the main features of OpenStack, but if you have any problems, do not hesitate to ask. Here are some ideas for supporting OpenStack and troubleshooting your existing installations.

11.1. Community Support

Here are some places you can locate others who want to help.

The Launchpad Answers area

During setup or testing, you may have questions about how to do something, or end up in a situation where you can't seem to get a feature to work correctly. One place to look for help is the Answers section on Launchpad. Launchpad is the "home" for the project code and its developers and thus is a natural place to ask about the project. When visiting the Answers section, it is usually good to at least scan over recently asked questions to see if your question has already been answered. If that is not the case, then proceed to adding a new question. Be sure you give a clear, concise summary in the title and provide as much detail as possible in the description. Paste in your command output or stack traces, link to screenshots, and so on. The Launchpad Answers areas are available here - OpenStack Compute: https://answers.launchpad.net/nova OpenStack Object Storage: https://answers.launchpad.net/swift.

OpenStack mailing list

Posting your question or scenario to the OpenStack mailing list is a great way to get answers and insights. You can learn from and help others who may have the same scenario as you. Go to https://launchpad.net/~openstack and click "Subscribe to mailing list" or view the archives at https://lists.launchpad.net/openstack/.

The OpenStack Wiki search

The OpenStack wiki contains content on a broad range of topics, but some of it sits a bit below the surface. Fortunately, the wiki search feature is very powerful in that it can do

both searches by title and by content. If you are searching for specific information, say about "networking" or "api" for nova, you can find lots of content using the search feature. More is being added all the time, so be sure to check back often. You can find the search box in the upper right hand corner of any OpenStack wiki page.

The Launchpad Bugs area

So you think you've found a bug. That's great! Seriously, it is. The OpenStack community values your setup and testing efforts and wants your feedback. To log a bug you must have a Launchpad account, so sign up at https://launchpad.net/+login if you do not already have a Launchpad ID. You can view existing bugs and report your bug in the Launchpad Bugs area. It is suggested that you first use the search facility to see if the bug you found has already been reported (or even better, already fixed). If it still seems like your bug is new or unreported then it is time to fill out a bug report.

Some tips:

- Give a clear, concise summary!
- Provide as much detail as possible in the description. Paste in your command output or stack traces, link to screenshots, etc.
- Be sure to include what version of the software you are using. This is especially critical if you are using a development branch eg. "Austin release" vs lp:nova rev.396.
- Any deployment specific info is helpful as well. eg. Ubuntu 10.04, multi-node install.

The Launchpad Bugs areas are available here - OpenStack Compute: https://bugs.launchpad.net/nova OpenStack Object Storage: https://bugs.launchpad.net/swift

The OpenStack IRC channel

The OpenStack community lives and breathes in the #openstack IRC channel on the Freenode network. You can come by to hang out, ask questions, or get immediate feedback for urgent and pressing issues. To get into the IRC channel you need to install an IRC client or use a browser-based client by going to http://webchat.freenode.net/. You can also use Colloquy (Mac OS X, http://colloquy.info/) or mIRC (Windows, http://www.mirc.com/) or XChat (Linux). When you are in the IRC channel and want to share code or command output, the generally accepted method is to use a Paste Bin, the OpenStack project has one at http://paste.openstack.org. Just paste your longer amounts of text or logs in the web form and you get a URL you can then paste into the channel. The OpenStack IRC channel is: #openstack on irc.freenode.net.

11.2. Troubleshooting OpenStack Object Storage

For OpenStack Object Storage, everything is logged in /var/log/syslog (or messages on some distros). Several settings enable further customization of logging, such as log_name, log_facility, and log_level, within the object server configuration files.

11.2.1. Handling Drive Failure

In the event that a drive has failed, the first step is to make sure the drive is unmounted. This will make it easier for OpenStack Object Storage to work around the failure until it has

been resolved. If the drive is going to be replaced immediately, then it is just best to replace the drive, format it, remount it, and let replication fill it up.

If the drive can't be replaced immediately, then it is best to leave it unmounted, and remove the drive from the ring. This will allow all the replicas that were on that drive to be replicated elsewhere until the drive is replaced. Once the drive is replaced, it can be re-added to the ring.

11.2.2. Handling Server Failure

If a server is having hardware issues, it is a good idea to make sure the OpenStack Object Storage services are not running. This will allow OpenStack Object Storage to work around the failure while you troubleshoot.

If the server just needs a reboot, or a small amount of work that should only last a couple of hours, then it is probably best to let OpenStack Object Storage work around the failure and get the machine fixed and back online. When the machine comes back online, replication will make sure that anything that is missing during the downtime will get updated.

If the server has more serious issues, then it is probably best to remove all of the server's devices from the ring. Once the server has been repaired and is back online, the server's devices can be added back into the ring. It is important that the devices are reformatted before putting them back into the ring as it is likely to be responsible for a different set of partitions than before.

11.2.3. Detecting Failed Drives

It has been our experience that when a drive is about to fail, error messages will spew into /var/log/kern.log. There is a script called swift-drive-audit that can be run via cron to watch for bad drives. If errors are detected, it will unmount the bad drive, so that OpenStack Object Storage can work around it. The script takes a configuration file with the following settings:

```
[drive-audit]
Option  Default  Description
log_facility  LOG_LOCAL0  Syslog log facility
log_level  INFO  Log level
device_dir  /srv/node  Directory devices are mounted under
minutes  60  Number of minutes to look back in /var/log/kern.log
error_limit  1  Number of errors to find before a device is unmounted
```

This script has only been tested on Ubuntu 10.04, so if you are using a different distro or OS, some care should be taken before using in production.

11.3. Troubleshooting OpenStack Compute

11.3.1. Log files for OpenStack Compute

Log files are stored in /var/log/nova and there is a log file for each service, for example nova-compute.log. You can format the log strings using flags for the nova.log module. The flags used to set format strings are: logging_context_format_string and logging_default_format_string. If the log level is set to debug, you can also specify logging_debug_format_suffix to append extra formatting. For information about what variables are available for the formatter see: http://docs.python.org/library/logging.html#formatter

You have two options for logging for OpenStack Compute based on configuration settings. In nova.conf, include the –logfile flag to enable logging. Alternatively you can set –use_syslog=1, and then the nova daemon logs to syslog.

11.3.2. Common Errors and Fixes for OpenStack Compute

The Launchpad Answers site offers a place to ask and answer questions, and you can also mark questions as frequently asked questions. This section describes some errors people have posted to Launchpad Answers and IRC. We are constantly fixing bugs, so online resources are a great way to get the most up-to-date errors and fixes.

Credential errors, 401, 403 forbidden errors

A 403 forbidden error is caused by missing credentials. Through current installation methods, there are basically two ways to get the novarc file. The manual method requires getting it from within a project zipfile, and the scripted method just generates novarc out of the project zip file and sources it for you. If you do the manual method through a zip file, then the following novarc alone, you end up losing the creds that are tied to the user you created with nova-manage in the steps before.

When you run nova-api the first time, it generates the certificate authority information, including openssl.cnf. If it gets started out of order, you may not be able to create your zip file. Once your CA information is available, you should be able to go back to nova-manage to create your zipfile.

You may also need to check your proxy settings to see if they are causing problems with the novarc creation.

Instance errors

Sometimes a particular instance shows "pending" or you cannot SSH to it. Sometimes the image itself is the problem. For example, when using flat manager networking, you do not have a dhcp server, and an ami-tiny image doesn't support interface injection so you cannot connect to it. The fix for this type of problem is to use an Ubuntu image, which should obtain an IP address correctly with FlatManager network settings. To troubleshoot other possible problems with an instance, such as one that stays in a spawning state, first check your instances directory for i-ze0bnh1q dir to make sure it has the following files:

- libvirt.xml

- disk
- disk-raw
- kernel
- ramdisk
- console.log (Once the instance actually starts you should see a console.log.)

Check the file sizes to see if they are reasonable. If any are missing/zero/very small then nova-compute has somehow not completed download of the images from objectstore.

Also check nova-compute.log for exceptions. Sometimes they don't show up in the console output.

Next, check the /var/log/libvirt/qemu/i-ze0bnh1q.log file to see if it exists and has any useful error messages in it.

Finally, from the instances/i-ze0bnh1q directory, try `virsh create libvirt.xml` and see if you get an error there.