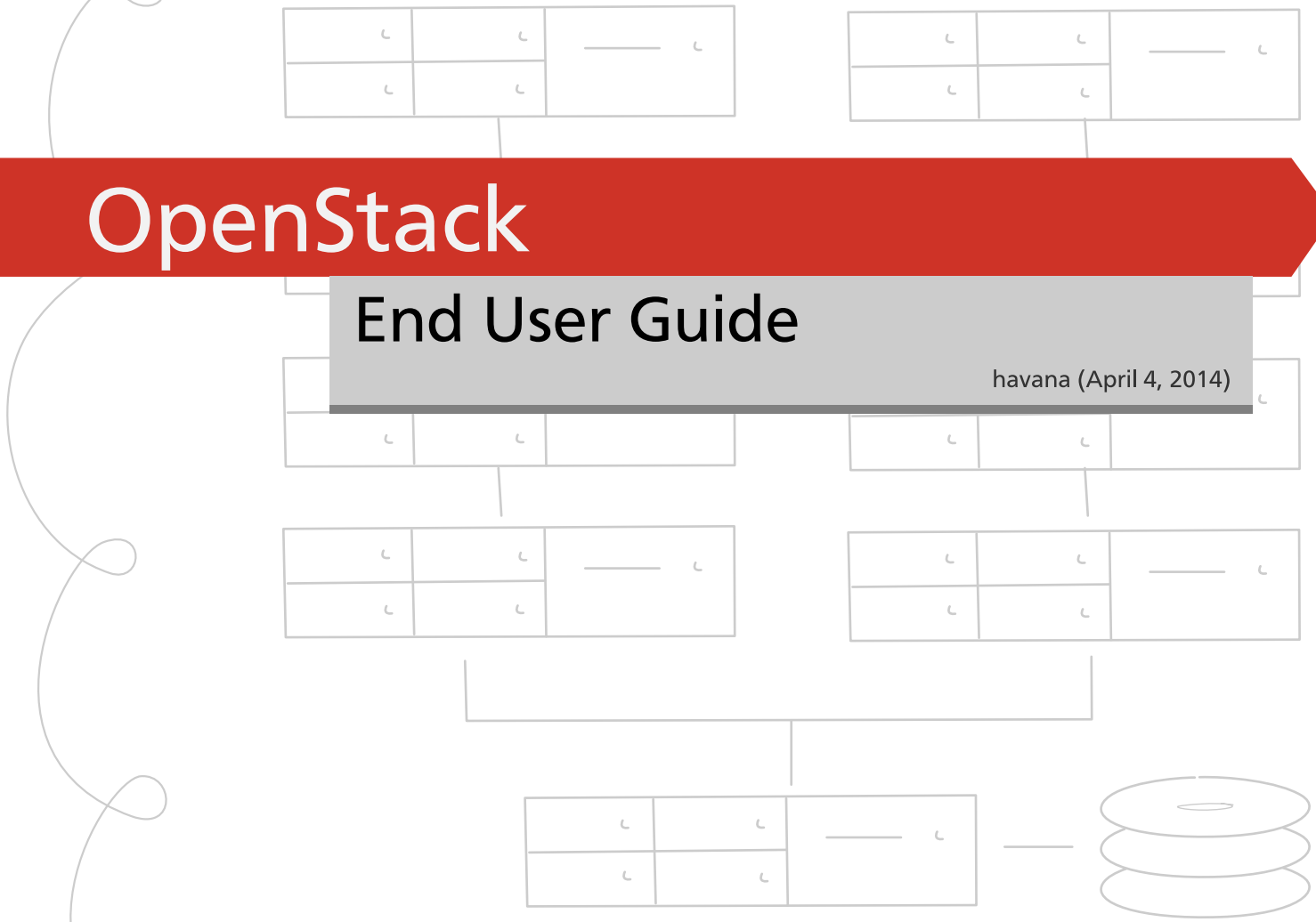
OpenStack

End User Guide

havana (April 4, 2014)



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OpenStack End User Guide

havana (2014-04-04)

OpenStack is an open source cloud computing platform for public and private clouds. A series of interrelated projects deliver a cloud infrastructure solution. This guide shows OpenStack end users how to create and manage resources in an OpenStack cloud with the OpenStack dashboard and OpenStack client commands.

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How can I use an OpenStack cloud?

As an OpenStack cloud end user, you can provision your own resources within the limits set by administrators.

The examples in this guide show you how to complete these tasks with either:

- The OpenStack dashboard. Use this Web-based graphical interface, code named horizon, to view, create, and manage resources.
- The OpenStack command-line clients. Each core OpenStack project has a command-line client that lets you run simple commands to view, create, and manage resources in a cloud and automate tasks by using scripts.

You can modify these examples for your specific use cases.

In addition to these ways of interacting with a cloud, you can access the OpenStack APIs directly or indirectly through cURL commands or open SDKs. You can automate access or build tools to manage resources and services by using the native OpenStack APIs or the EC2 compatibility API.

To use the OpenStack APIs, it helps to be familiar with HTTP/1.1, RESTful web services, the OpenStack services, and JSON or XML data serialization formats.

Conventions

The OpenStack documentation uses several typesetting conventions:

Admonitions

Admonitions take three forms:

Note

This is a note. The information in a note is usually in the form of a handy tip or reminder.

Important

This is important. The information in an important admonition is something you must be aware of before moving on.

Warning

This is a warning. The information in warnings is critical. Warnings provide additional information about risk of data loss or security issues.

Command prompts

Commands prefixed with the # prompt are to be executed by the `root` user. These examples can also be executed using the **sudo** command, if available.

Commands prefixed with the $ prompt can be executed by any user, including `root`.

Document change history

This version of the guide replaces and obsoletes all previous versions. The following table describes the most recent changes:

Revision Date	Summary of Changes
January 31, 2014	• Remove the command reference appendix. This information is now in *OpenStack Command Line Interface Reference*.
December 30, 2013	• Added the OpenStack Python SDK chapter.
October 17, 2013	• Havana release.
August 19, 2013	• Editorial changes.
July 29, 2013	• First edition of this document.

1. OpenStack dashboard

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As a cloud end user, you can use the OpenStack dashboard to provision your own resources within the limits set by administrators. You can modify these examples to create other types and sizes of server instances.

Log in to the dashboard

The dashboard is available on the node with the `nova-dashboard` server role.

1. Ask the cloud operator for the host name or public IP address from which you can access the dashboard, and your user name and password.

2. Open a Web browser. Make sure that JavaScript and cookies are enabled.

   ### Note

   To use the Virtual Network Computing (VNC) client for the dashboard, your browser must support HTML5 Canvas and HTML5 WebSockets. The VNC client is based on noVNC. For details, see noVNC: HTML5 VNC Client. For a list of supported browsers, see Browser support.

3. In the address bar, type the host name or IP address for the dashboard:

   ```
   https://IP_ADDRESS_OR_HOSTNAME/
   ```

   ### Certificate warning

   If a certificate warning appears when you try to access the URL for the first time, a self-signed certificate is in use, which is not considered trustworthy by default. Verify the certificate or add an exception in the browser to bypass the warning.

4. On the **Log In** page, enter your user name and password, and click **Sign In**.

   The top-level row shows your user name. You can also access **Settings** or sign out of the dashboard.

   The visible tabs and functions in the dashboard depend on the access permissions, or *roles*, of the user you are logged in as.

   If you are logged in as an end user, the main screen shows the Project tab.

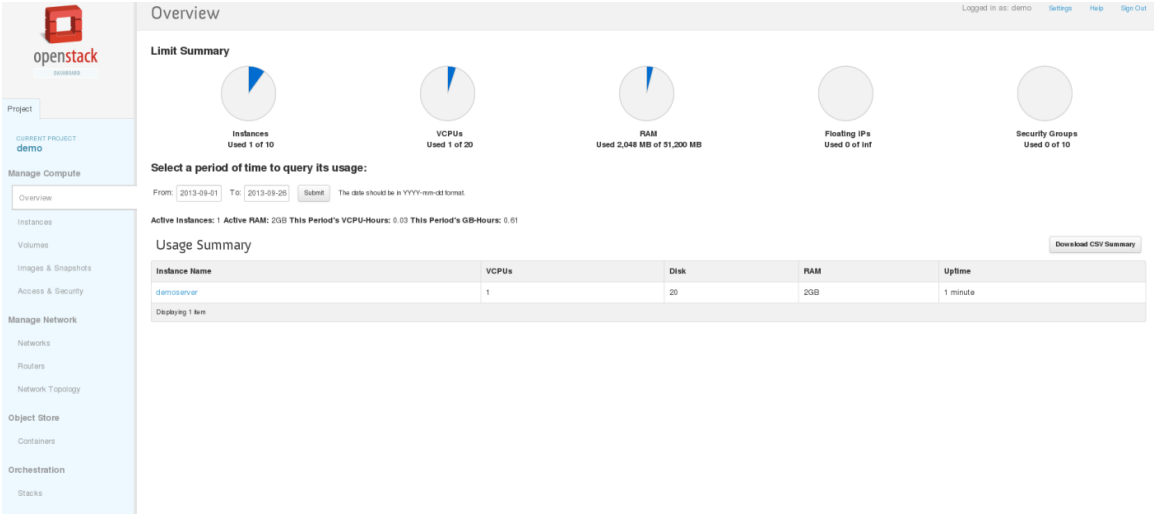
   If you are logged in as an administrator, the main screen shows the Project tab and Admin tab.

OpenStack dashboard—Project tab

Select a project from the **CURRENT PROJECT** drop-down list on the left side to view and manage resources in that project.

The **Project** tab displays the details of the selected project.

Figure 1.1. Dashboard projects



Access the following tabs:

Manage Compute tab

Overview	View reports for the project.
Instances	View, launch, create a snapshot from, stop, pause, or reboot instances, or connect to them through VNC.
Volumes	View, create, edit, and delete volumes.
Images & Snapshots	View images, instance snapshots, and volume snapshots created project users, plus any images that are publicly available. Create, edit, and delete images, and launch instances from images and snapshots.
Access & Security	Use the following tabs to complete these tasks: **Security Groups tab.** View, create, edit, and delete security groups and security group rules. **Keypairs tab.** View, create, edit, and import keypairs, and delete keypairs. **Floating IPs tab.** Allocate an IP address to or release it from a project. **API Access tab.** View API endpoints.

Manage Network tab

Networks	Create and manage public and private networks.
Routers	Create and manage subnets.
Network Topology	View the network topology.

Object Store tab

Containers Create and manage object storage.

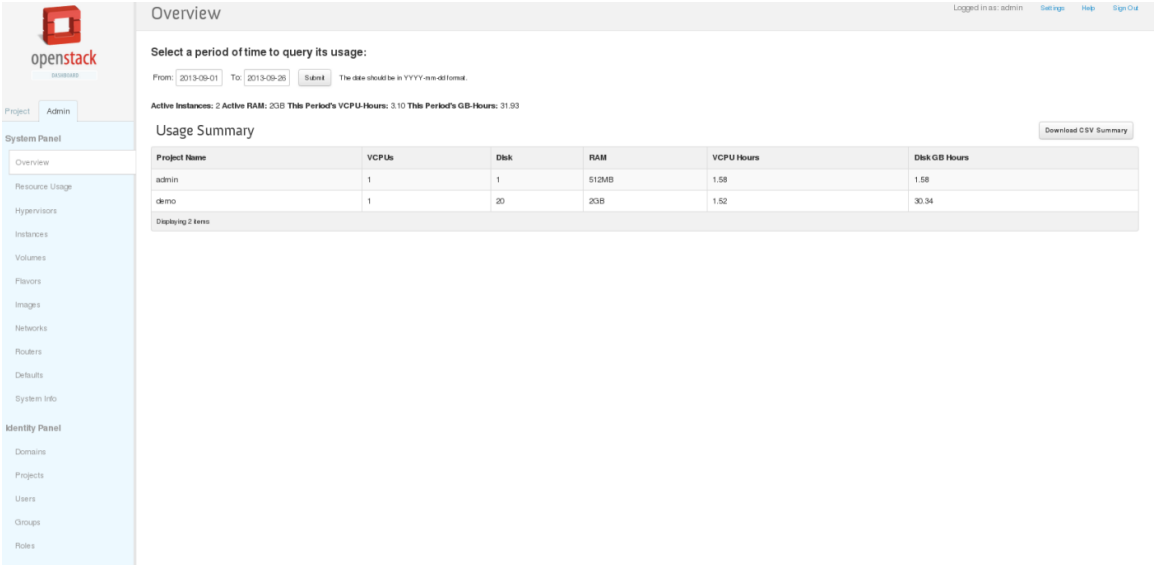
Orchestration tab

Stacks Use REST API to orchestrate multiple composite cloud applications

OpenStack dashboard—Admin tab

Enables administrative users to view usage and manage instances, volumes, flavors, images, projects, users, services, and quotas.

Figure 1.2. Admin tab



Access the following categories to complete these tasks:

Overview View basic reports.

Resource Usage Use the following tabs to view the following usages:

Global Disk Usage tab. View the global disk usage for all tenants as an average over the last 30 days.

Global Network Traffic Usage tab. View the global network usage for all tenants as an average over the last 30 days.

Global Object Storage Usage tab. View the global object storage usage for all tenants as an average over the last 30 days.

Global Network Usage tab. View the global network usage for all tenants as an average over the last 30 days.

Stats tab. View the statistics of all resources.

Hypervisors View the hypervisor summary.

Instances	View, pause, resume, suspend, migrate, soft or hard reboot, and delete running instances that belong to users of some, but not all, projects. Also, view the log for an instance or access an instance through VNC.
Volumes	View, create, edit, and delete volumes and volume types.
Flavors	View, create, edit, view extra specs for, and delete flavors. A flavor is size for an instance.
Images	View, create, edit properties for, and delete custom images.
Networks	View, create, edit properties for, and delete networks.
Routers	View, create, edit properties for, and delete routers.
Defaults	View default quota values. Quotas are hard-coded in OpenStack Compute and define the maximum allowable size and number of resources.
System Info	Use the following tabs to view the service info: **Services tab.** View a list of the services. **Compute Services tab.** View a list of all Compute services. **Availability Zones tab.** View the availability zones. **Host Aggregates tab.** View host aggregates. **Network Agents tab.** View the network agents.
Domains	View domains.
Projects	View, create, assign users to, remove users from, and delete projects.
Users	View, create, enable, disable, and delete users.
Groups	View, create, enable, disable, and delete groups.
Roles	View, create, enable, disable, and delete roles.

Create and manage images

The cloud operator assigns roles to users. Roles determine who can upload and manage images. Operators might restrict the upload and management of images to cloud administrators or operators only.

If you have admin privileges, you can use the dashboard to create and manage images in the **admin** project.

Manage images by using clients and APIs

You can also use the **glance** and **nova** command-line clients or the Image Service and Compute APIs to manage images. See the section called "Manage images" [30].

Create images

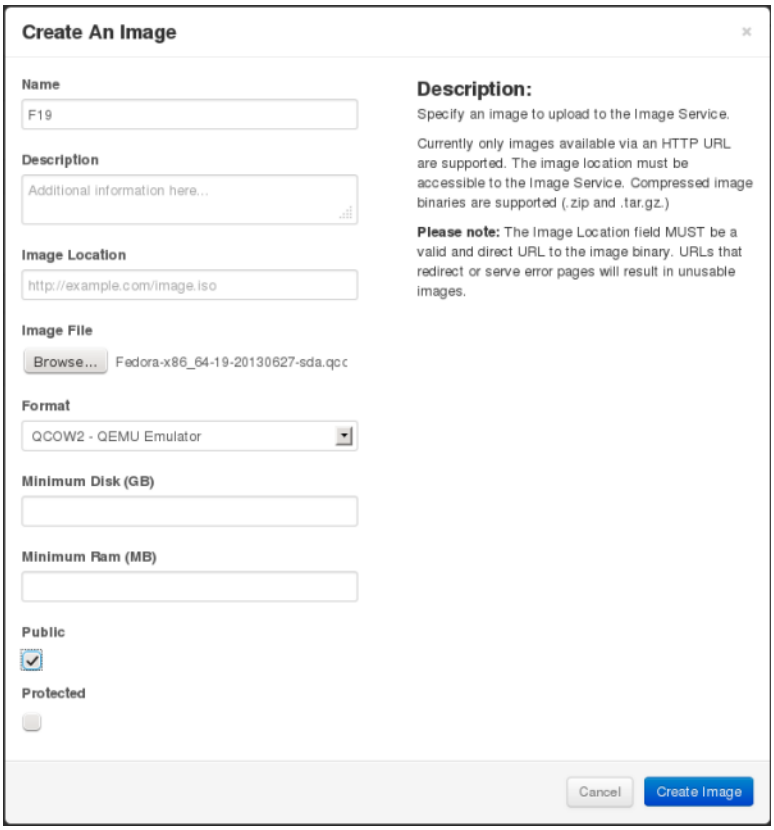
For details about image creation, see the *Virtual Machine Image Guide*.

1. Log in to the dashboard.

   Choose the **admin** project from the **CURRENT PROJECT** drop-down list.

2. On the **Project** tab, click the **Images & Snapshots** category.

3. Click **Create Image**. The **Create An Image** window appears:



4. In the **Create An Image** window, enter or select the following values:

Name	Enter a name for the image.
Description	Enter a brief description about the image.
Image Source	Choose the image source from the dropdown list. Your choices are **Image Location** and **Image File**.
Image File or **Image Location**	Based on your selection, there is an **Image File** or **Image Location** field. You can include the location URL or browse to the image file on your file system and add it.
Format	Select the correct type from the drop-down menu (for example, QCOW2).
Minimum Disk (GB) and **Minimum RAM (MB)**	Leave these fields empty.
Public	Select this option to make the image public to all users.
Protected	Select this option to ensure that only users with permissions can delete it.

5. Click **Create Image**.

   The image is queued to be uploaded. It might take some time before the status changes from queued to active.

Update images

1. Log in to the dashboard.

   Choose the **admin** project from the **CURRENT PROJECT** drop-down list.

2. On the **Project** tab, click the **Images & Snapshots** category.

3. Select the image that you want to edit. In the **More** drop-down list, click **Edit**.

4. In the **Update Image** window, you can change the name for the image. Select the **Public** check box to make the image public. Clear this check box to make the image private.

5. Click **Update Image**.

Delete images

1. Log in to the dashboard.

   Choose the **admin** project from the **CURRENT PROJECT** drop-down list.

2. On the **Project** tab, click the **Images & Snapshots** category.

3. Select the images that you want to delete.

4. Click **Delete Images**.

5. In the **Confirm Delete Image** window, click **Delete Images** to confirm the deletion. You cannot undo this action.

Configure access and security for instances

Before you launch a virtual machine, you can add security group rules to enable users to ping and SSH to the instances. To do so, you either add rules to the default security group or add a security group with rules.

Keypairs are SSH credentials that are injected into images when they are launched. For this to work, the image must contain the `cloud-init` package. Create at least one keypair for each project. For information, see the section called “Add a keypair” [8].

If you have generated a keypair with an external tool, you can import it into OpenStack. The keypair can be used for multiple instances that belong to a project. For information, see the section called “Import a keypair” [9].

Add rules to the default security group

1. Log in to the dashboard, choose a project, and click the **Access & Security** category. The dashboard shows the security groups that are available for this project.
2. Select the default security group and click **Edit Rules**.
3. To allow ssh access, click **Add Rule**.
4. In the **Add Rule** window, enter the following values:

Rule	SSH
Remote	CIDR
CIDR	0.0.0.0/0

Note

To accept requests from a particular range of IP addresses, specify the IP address block in the **CIDR** box.

5. Click **Add**.

   The ssh port 22 is now open for requests from any IP address.
6. To add an ICMP rule, click **Add Rule**.
7. In the **Add Rule** window, enter the following values:

Rule	All ICMP
Direction	Ingress
Remote	CIDR
CIDR	0.0.0.0/0

8. Click **Add**.

Add a keypair

Create at least one keypair for each project.

1. Log in to the dashboard, choose a project, and click the **Access & Security** category.
2. The **Keypairs** tab shows the keypairs that are available for this project.
3. Click **Create Keypair**.
4. In the **Create Keypair** window, enter a name for your keypair, and click **Create Keypair**.
5. Respond to the prompt to download the keypair.

Import a keypair

1. Log in to the dashboard, choose a project, and click the **Access & Security** category.
2. The **Keypairs** tab shows the keypairs that are available for this project.
3. Click **Import Keypair**.
4. In the **Import Keypair** window, enter the name of your keypair. In the **Public Key** box, copy the public key. Then, click **Import Keypair**.
5. Save the `*.pem` file locally. To change its permissions so that only you can read and write to the file, run the following command:

```
$ chmod 0600 MY_PRIV_KEY.pem
```

Note

If you are using the dashboard from a Windows-based computer, use puttygen to load the `*.pem` and convert and save as `*.ppk`. Refer to WinSCP information for more details.

6. To make the keypair known to SSH, run the **ssh-add** command:

```
$ ssh-add MY_PRIV_KEY.pem
```

The Compute database registers the public key of the keypair.

The dashboard lists the keypair in the **Access & Security** category.

Allocating floating IP addresses to instances

When an instance is created in OpenStack, it is automatically assigned a fixed IP address in the network to which the instance is assigned. This IP address is permanently associated with the instance until the instance is terminated.

However, in addition to the fixed IP address, a floating IP address can also be attached to an instance. Unlike fixed IP addresses, floating IP addresses are able to have their associations modified at any time, regardless of the state of the instances involved. This procedure details the reservation of a floating IP address from an existing pool of addresses and the association of that address with a specific instance.

1. Log in to the dashboard, choose a project, and click the **Access & Security** category.

2. The **Access & Security** window opens to the **Security Groups** tab by default.

   Click on the **Floating IPs** tab. The **Floating IPs** tab shows the floating IP addresses allocated to instances.

3. Click the **Allocate IP to Project** button.

4. Choose the **Pool** from which the IP address should be picked.

5. Click the **Allocate IP** button.

6. In the **Floating IPs** list, click the **Associate** button. The **Manage Floating IP Associations** window opens.

7. In the **Manage Floating IP Associations** window, choose the following options:

   1. The **IP Address** field is filled automatically.

      You can choose to add a new IP address by using the + button.

   2. In the **Ports to be associated** field, select a port from the dropdown list.

      The dropdown lists all the instances with their respective fixed IP addresses.

8. Click the **Associate** button.

Note

To disassociate the IP address from an instance, click the **Disassociate** button.

To release the floating IP address back into the pool of addresses, click the **More** dropdown button and select **Release Floating IP** option.

Launch and manage instances

Instances are virtual machines that run inside the cloud.

You can launch an instance from various sources. The OpenStack Image Service provides a pool of images that are accessible to members of different projects.

You can also launch an instance from an image that you have copied to a persistent volume. The instance boots from the volume, which is provided by `cinder-volume` through iSCSI. When you launch an instance from a volume, especially note the following steps:

- To select from which volume to boot, launch an instance from an arbitrary image. The image you select does not boot. It is replaced by the image on the volume that you choose in the next steps.

  To boot a Xen image from a volume, the image you launch in must be the same type, fully virtualized or paravirtualized, as the one on the volume.

- Select the volume or volume snapshot from which to boot. Enter a device name. Enter `vda` for KVM images or `xvda` for Xen images.

Launch an instance

When you launch an instance from an image, OpenStack creates a local copy of the image on the compute node where the instance starts.

1. Log in to the dashboard, choose a project, and click the **Images & Snapshot** category.

   The dashboard shows the images that have been uploaded to OpenStack Image Service and are available for this project.

   For details on creating images, see Creating images manually in the *OpenStack Virtual Machine Image Guide*.

2. Select an image and click **Launch**.

3. In the **Launch Instance** window, specify the following values:

Details tab	
Availability Zone	By default, this value is set to the availability zone given by the cloud provider (for example, `us-west` or `apac-south`). Though, it could be `nova` for most cases.
Instance Name	The name to assign to the virtual machine.  **Note** The name you assign here becomes the initial host name of the server. After the server is built, if you change the server name in the API or change the host name directly, the names are not updated in the dashboard. Server names are not guaranteed to be unique when created so you could have two instances with the same host name.
Flavor	The size of the virtual machine to launch.
Instance Count	To launch multiple instances, enter a value greater than 1. Default is 1.
Instance Boot Source	Your options are: • **Boot from image** - If you choose this option, a new field for **Image Name** displays. You can select the image from the dropdown list. • **Boot from snapshot** - If you choose this option, a new field for **Instance Snapshot** displays. You can select the snapshot from the dropdown list. • **Boot from volume** - If you choose this option, a new field for **Volume** displays. You can select the volume from the dropdown list. • **Boot from image (creates a new volume)** - With this option, you can boot from an image and create a volume by entering the **Device Size** and **Device Name** for your volume. • **Boot from volume snapshot (creates a new volume)** - Using this option, you can boot from a volume snapshot and create a new volume by choosing **Volume**

Details tab	
	Snapshot from a dropdown list and adding a **Device Name** for your volume. Since you are launching an instance from an image, **Boot from image** is chosen by default.
Image Name	This field changes based on your previous selection. Since you have chosen to launch an instance using an image, the **Image Name** field displays. Select the image name from the dropdown list.
Access & Security tab	
Keypair	Select a keypair from the dropdown list. In case an image uses a static root password or a static key set (neither is recommended), you do not need to provide a keypair to launch the instance.
Security Groups	Activate the security groups that you want to assign to the instance. Security groups are a kind of cloud firewall that define which incoming network traffic is forwarded to instances. For details, see the section called "Add rules to the default security group" [8]. If you have not created any security groups, you can assign only the default security group to the instance.
Networking tab	
Selected Networks	To add a network to the instance, click the + in the **Available Networks** field.
Post-Creation tab	
Customization Script	A customization script that runs after your instance launches.

4. Click **Launch**. The instance starts on a compute node in the cloud.

5. The **Instances** category shows the instance name, its private and public IP addresses, size, status, task, and power state.

6. If you did not provide a keypair, security groups, or rules so far, users can only access the instance from inside the cloud through VNC. Even pinging the instance is not possible. To access the instance through a VNC console, see the section called "Get a console to access an instance" [57].

SSH in to your instance

To SSH into your instance, you use the downloaded keypair file.

Note

The user name is `ubuntu` for the Ubuntu cloud images on TryStack.

1. Copy the IP address for your instance.
2. Use the SSH command to make a secure connection to the instance. For example:

```
$ ssh -i MyKey.pem ubuntu@10.0.0.2
```

3. At the prompt, type `yes`.

Track usage for instances

You can track usage for instances for each tenant, also known as a project. You can track costs per month by showing metrics like number of VCPUs, disks, RAM, and uptime for all your instances.

1. Log in to the dashboard, choose a project, and click the **Overview** category.
2. To query the instance usage for a month, select a month and click **Submit**.
3. To download a summary, click **Download CSV Summary**.

Create instance snapshots

1. Log in to the dashboard, choose a project, and click the **Instances** category.
2. Select the instance from which to create a snapshot. From the **Actions** drop-down list, select **Create Snapshot**.
3. In the **Create Snapshot** window, enter a name for the snapshot. Click **Create Snapshot**. The **Images & Snapshots** category shows the instance snapshot.
4. To launch an instance from the snapshot, select the snapshot and click **Launch**. Proceed with the section called "Launch an instance" [12].

Manage an instance

1. Log in to the dashboard, choose a project, and click the **Instances** category.
2. Select an instance.
3. In the **More** drop-down list in the **Actions** column, select the state.

   You can resize or rebuild an instance. You can also choose to view the instance console log. Depending on the current state of the instance, you can choose to pause, resume, suspend, soft or hard reboot, or terminate an instance.

Create and manage networks

OpenStack Networking service provides a scalable system for managing the network connectivity within an OpenStack cloud deployment.

It can easily and quickly react to changing network needs (for example, creating and assigning new IP addresses).

Create a network

1. Log in to the dashboard, choose a project, and click the **Networks** category.
2. Click **Create Network**.
3. In the **Create Network** window, specify the following values.

Network tab	
Network Name	A name to identify the network.
Subnet tab	
Create Subnet	Check this option to create a subnet You do not have to initially specify a subnet (although this will result in the status of 'error' for any attached instance).
Subnet Name	Name for the subnet.
Network Address	IP address for the subnet.
IP Version	IPv4 or IPv6.
Gateway IP	IP address for a specific gateway. This parameter is optional.
Disable Gateway	Check this option to disable gateway IP address.
Subnet Detail tab	
Enable DHCP	Check this option to enable DHCP
Allocation Pools	You can allocate IP address pools.
DNS Name Servers	You can allocate a name for the DNS server.
Host Routes	Include IP address of host routes.

4. Click **Create** to create a network.
5. The dashboard shows the network in the **Networks** category.

Create a router

1. Log in to the dashboard, choose a project, and click the **Routers** category.
2. Click the **Create Router** button. The **Create Router** window is displayed.
3. Specify a name for the router and click the **Create Router** button. The new router is now displayed in the router list.
4. Click the new router's **Set Gateway** button.

5. Specify the network to which the router will connect in the **External Network** field, and click the **Set Gateway** button.

6. To connect a private network to the newly created router:

   a. Click on the router name in the router list.

   b. Click the **Add Interface** button. The **Add Interface** window is displayed.

   c. Specify the following information:

Subnet	Select a subnet.
IP Address (optional)	Enter the router interface IP address for the selected subnet.  **Note** If this value is not set, then by default, the first host IP address in the subnet is used by OpenStack Networking.

   The **Router Name** and **Router ID** fields are automatically updated.

7. Click the **Add Interface** button.

You have successfully created the router. You can view the new topology by clicking **Network Topology** in the **Manage Network** menu.

Create and manage object containers

Container service is one of the services provided by the Object Storage Service.

A container is a storage compartment for your data and provides a way for you to organize your data. It is similar to the concept as a Linux file directory but cannot be nested.

Create a container

1. Log in to the dashboard.
2. On the **Project** tab, click the **Containers** category.
3. Click the **Create Container** button. The **Create Container** window is displayed.
4. Enter a name for the container. Click the **Create Container** button.

You have successfully created a container.

Note

To delete a container, click the **More** dropdown button and select the **Delete Container** option.

Upload an object

1. Log in to the dashboard.
2. On the **Project** tab, click the **Containers** category.
3. Select the container in which you want to store your object.
4. Click the **Upload Object** button. The **Upload Object To Container: *`CONTAINER_NAME`*** window is displayed.

   `CONTAINER_NAME` is replaced by the name of the container to which you are uploading the object.
5. Enter a name for the object.
6. Browse and select the file you want to upload.
7. Click the **Upload Object** button.

You have successfully uploaded an object to the container.

Note

To delete an object, click the **More** dropdown button and select the **Delete Object** option.

Manage volumes

Volumes are block storage devices that you attach to instances to enable persistent storage. You can attach a volume to a running instance or detach a volume and attach it to another instance at any time. You can also create a snapshot from or delete a volume. Only administrative users can create volume types.

Create a volume

1. Log in to the dashboard, choose a project, and click the **Volumes** category.
2. Click **Create Volume**.

   In the window that opens, enter or select the following values.

Volume Name	A name to identify the volume.
Description	A brief description for the volume.
Type	Leave this field blank.
Size (GB)	The size of the volume in GB.
Volume Source	Options are: • **No source, empty volume** - Choose this option to create an empty volume.  **Note** An empty volume does not contain either a file system or a partition table. • **Image** - Choose this option to create a volume from an image. Select the image from the dropdown list.

3. Click the **Create Volume** button to confirm your changes.
4. The dashboard shows the volume in the **Volumes** category.

Attach volumes to instances

After you create one or more volumes, you can attach them to instances.

1. Log in to the dashboard, choose a project, and click the **Volumes** category.
2. Select the volume to add to an instance and click **Edit Attachments**.
3. In the **Manage Volume Attachments** window, select an instance.
4. Enter the name of the device from where the volume should be accessible on the virtual machine.

Note

The actual device name might differ due to hypervisor settings.

5. Click **Attach Volume** to confirm your changes. The dashboard shows the instance to which the volume is now attached and the device name. You can attach a volume to one instance at a time.

6. View the status of a volume in the **Volumes** category of the dashboard. The volume is either available or In-Use.

7. Now you can log in to the instance and mount, format, and use the disk.

Detach a volume from an instance

1. Log in to the dashboard, choose a project, and click the **Volumes** category.

2. Select the volume and click **Edit Attachments**.

3. Click **Detach Volume** and confirm your changes.

4. A message indicates whether the action was successful.

Create volume snapshots

1. Log in to the dashboard, choose a project, and click the **Volumes** category.

2. Select a volume from which to create a snapshot.

3. From the **More** drop-down list, select **Create Snapshot**.

4. In the window that opens, enter a snapshot name and a brief description.

5. Confirm your changes.

   The dashboard shows the new volume snapshot in the **Images & Snapshots** category.

Delete volumes

When you delete an instance, the data of its attached volumes is not destroyed.

1. Log in to the dashboard, choose a project, and click the **Volumes** category.

2. Activate the check boxes in front of the volumes that you want to delete.

3. Click **Delete Volumes** and confirm your choice in the pop-up that appears.

4. A message indicates whether the action was successful.

Launch and manage stacks

Use the Orchestration service to orchestrate multiple composite cloud applications. This service supports use of both the AWS CloudFormation template format through a Query API and the OpenStack-native *Heat Orchestration Template (HOT)* format through a REST API.

These flexible template languages enable application developers to describe and automate the deployment of infrastructure, services, and applications. The templates allow creation of most OpenStack resource types such as instances, floating IPs, volumes, security groups, and users.

The template languages are described in the Template Guide in the Heat developer documentation.

Launch a stack

1. Log in to the dashboard, choose a project, and click **Stacks** in the **Orchestration** category.
2. Click **Launch Stack**.
3. In the **Select Template** window, choose a template source option, **URL**, **File**, or **Direct Input**, from the drop-down list.
4. Enter the URL, browse to the file location, or directly include the template based on your previous selection.
5. In the **Launch Stack** window, specify the following values.

Stack Name	A name to identify the stack.
Creation Timeout (minutes)	Creation Timeout in minutes.
Rollback On Failure	Check this option if you want Heat to rollback on failure.
Password for user "demo"	Password for the user logged in.
DBUsername	Database user name.
LinuxDistribution	Linux Distribution used in the stacks.
DBRootPassword	Database root password.
KeyName	Name of the keypair.
DBName	Database name.
DBPassword	Database password.
InstanceType	Flavor of the instance.

6. Click **Launch** to create a stack.
7. The dashboard shows the stack in the **Stacks** category.

After the stack is created, click on the stack name to see these details:

Topology The topology of the stack created.

Overview	The parameters and details of the stack under the following headings: **Info**, **Status**, **Outputs**, **Stack Parameters**, and **Launch Parameters**.
Resources	The resources used by the stack.
Events	The events related to the stack.

Delete stacks

1. Log in to the dashboard.
2. On the **Project** tab, click the **Stacks** category.
3. Select the stack that you want to delete.
4. Click **Delete Stack**.
5. In the **Confirm Delete Stack** window, click **Delete Stack** to confirm the deletion. You cannot undo this action.

2. OpenStack command-line clients

Table of Contents

Overview

You can use the OpenStack command-line clients to run simple commands that make API calls. You can run these commands from the command line or in scripts to automate tasks. As long as you provide OpenStack credentials, you can run these commands on any machine.

Internally, each client command runs cURL commands that embed API requests. The OpenStack APIs are RESTful APIs that use the HTTP protocol, including methods, URIs, media types, and response codes.

These open-source Python clients run on Linux or Mac OS X systems and are easy to learn and use. Each OpenStack service has its own command-line client. On some client commands, you can specify a *debug* parameter to show the underlying API request for the command. This is a good way to become familiar with the OpenStack API calls.

The following table lists the command-line client for each OpenStack service, together with its package name and description.

Table 2.1. OpenStack services and clients

Service	Client	Package	Description
Block Storage	**cinder**	python-cinderclient	Create and manage volumes.
Compute	**nova**	python-novaclient	Create and manage images, instances, and flavors.
Database Service	**trove**	python-troveclient	Create and manage databases.

Service	Client	Package	Description
Identity	**keystone**	python-keystoneclient	Create and manage users, tenants, roles, endpoints, and credentials.
Image Service	**glance**	python-glanceclient	Create and manage images.
Networking	**neutron**	python-neutronclient	Configure networks for guest servers. This client was previously known as **quantum**.
Object Storage	**swift**	python-swiftclient	Gather statistics, list items, update metadata, and upload, download, and delete files stored by the Object Storage service. Gain access to an Object Storage installation for ad hoc processing.
Orchestration	**heat**	python-heatclient	Launch stacks from templates, view details of running stacks including events and resources, and update and delete stacks.
Telemetry	**ceilometer**	python-ceilometerclient	Create and collect measurements across OpenStack.

An OpenStack **common** client is in development.

Install the OpenStack command-line clients

Install the prerequisite software and the Python package for each OpenStack client.

Note

For each command, replace *PROJECT* with the lower case name of the client to install, such as `nova`. Repeat for each client.

Table 2.2. Prerequisite software

Prerequisite	Description
Python 2.6 or newer	Currently, the clients do not support Python 3.
setuptools package	Installed by default on Mac OS X. Many Linux distributions provide packages to make setuptools easy to install. Search your package manager for setuptools to find an installation package. If you cannot find one, download the setuptools package directly from http://pypi.python.org/pypi/setuptools. The recommended way to install setuptools on Microsoft Windows is to follow the documentation provided on the setuptools website. Another option is to use the unofficial binary installer maintained by Christoph Gohlke (http://www.lfd.uci.edu/~gohlke/pythonlibs/#setuptools).

pip package	To install the clients on a Linux, Mac OS X or Microsoft Windows system, use pip. It is easy to use, ensures that you get the latest version of the clients from the Python Package Index, and lets you update or remove the packages later on.
	
	Install pip through the package manager for your system:
	
	Mac OS X.
	
	`# easy_install pip`
	
	Microsoft Windows. Make sure that the `C:\Python27\Scripts` directory is defined in the PATH environment variable, and use the **easy_install** command from the setuptools package:
	
	`C:\>easy_install pip`
	
	Another option is to use the unofficial binary installer provided by Christoph Gohlke (http://www.lfd.uci.edu/~gohlke/pythonlibs/#pip).
	
	Ubuntu 12.04. A packaged version enables you to use dpkg or aptitude to install the python-novaclient:
	
	`# aptitude install python-novaclient`
	
	Ubuntu.
	
	`# aptitude install python-pip`
	
	RHEL, CentOS, or Fedora. A packaged version available in RDO enables you to use yum to install the clients:
	
	`# yum install python-PROJECTclient`
	
	Alternatively, install pip and use it to manage client installation:
	
	`# yum install python-pip`
	
	openSUSE 12.2 and earlier. A packaged version available in the Open Build Service enables you to use rpm or zypper to install the python-novaclient:

Prerequisite	Description

	`# zypper install python-PROJECT`
	
	Alternatively, install pip and use it to manage client installation:
	
	`# zypper install python-pip`
	
	openSUSE 12.3 and newer. A packaged version enables you to use rpm or zypper to install the clients:
	
	`# zypper install python-PROJECTclient`

Install the clients

Use pip to install the OpenStack clients on a Linux, Mac OS X or Microsoft Windows system. It is easy and ensures that you get the latest version of the client from the Python Package Index. Also, pip lets you update or remove a package. After you install the clients, you must source an `openrc.sh` file to set required environment variables before you can request OpenStack services through the clients or the APIs.

1. Install each client separately using:

   - For Mac OS X or Linux:

     ```
     # pip install python-PROJECTclient
     ```

   - For Microsoft Windows:

     ```
     C:\>pip install python-PROJECTclient
     ```

   Where *PROJECT* is the project name and has one of the following values:

   - `ceilometer` - Telemetry API.
   - `cinder` - Block Storage API and extensions.
   - `glance` - Image Service API.
   - `heat` - Orchestration API.
   - `keystone` - Identity service API and extensions.
   - `neutron` - Networking API.
   - `nova` - Compute API and extensions.
   - `swift` - Object Storage API.
   - `trove` - Database Service API.

   For example, to install the nova client, run this command:

   ```
   # pip install python-novaclient
   ```

   To remove the nova client, run this command:

   ```
   # pip uninstall python-novaclient
   ```

Note

To upgrade a package, add the `--upgrade` option to the **pip** command.

For example, to update the `nova` client, run this command:

```
# pip install --upgrade python-novaclient
```

2. Before you can run client commands, you must create and source the `openrc.sh` file to set environment variables. See the section called “The OpenStack RC file” [28].

Get the version for a client

Run this command get the version number for a client:

```
$ PROJECT --version
```

Where *PROJECT* is a project name:

- `ceilometer` - Telemetry API.
- `cinder` - Block Storage API and extensions.
- `glance` - Image Service API.
- `heat` - Orchestration API.
- `keystone` - Identity service API and extensions.
- `neutron` - Networking API.
- `nova` - Compute API and extensions.
- `swift` - Object Storage API.
- `trove` - Database Service API.

For example, to see the version number for the **nova** client, run this command:

```
$ nova --version
2.15.0
```

To see the version number for the **keystone** client, run this command:

```
$ keystone --version
0.4.0
```

The OpenStack RC file

To set the required environment variables for the OpenStack command-line clients, you must create an environment file. If your OpenStack installation provides it, you can download the file from the OpenStack dashboard as an administrative user or any other user. This project-specific environment file contains the credentials that all OpenStack services use.

When you source the file, environment variables are set for your current shell. The variables enable the OpenStack client commands to communicate with the OpenStack services that run in the cloud.

Environment variables on Microsoft Windows

Defining environment variables using an environment file is not a common practice on Microsoft Windows. Environment variables are usually defined in the `Advanced` tab of the `System Properties` dialog.

Download and source the OpenStack RC file

1. Log in to the OpenStack dashboard, choose the project for which you want to download the OpenStack RC file, and click **Access & Security**.
2. Click on the API Access tab. Click **Download OpenStack RC File** and save the file.
3. Copy the `openrc.sh` file to the machine from where you want to run OpenStack commands.

   For example, copy the file to the machine from where you want to upload an image with a glance client command.
4. On any shell from where you want to run OpenStack commands, source the `openrc.sh` file for the respective project.

   In this example, you source the `demo-openrc.sh` file for the demo project:

   ```
   $ source demo-openrc.sh
   ```
5. When you are prompted for an OpenStack password, enter the password for the user who downloaded the `openrc.sh` file.

Create and source the OpenStack RC file

Alternatively, you can create the `openrc.sh` file from scratch.

1. Create the `openrc.sh` file and add the authentication information:

   ```
   export OS_USERNAME=USERNAME
   export OS_PASSWORD=PASSWORD
   export OS_TENANT_NAME=PROJECT_NAME
   export OS_AUTH_URL=https://IDENTITY_HOST:PORT/v2.0
   # The following lines can be omitted
   export OS_TENANT_ID=9d792532ffce494583138c495801d164
   export OS_REGION_NAME=RegionOne
   ```

2. On any shell from where you want to run OpenStack commands, source the `openrc.sh` file for the respective project:

```
$ source openrc.sh
```

Note

You are not prompted for the password with this method. The password lives in clear text format in the `openrc.sh` file. Restrict the permissions on this file to avoid security problems. You can also remove the `OS_PASSWORD` variable from the file, and use the *`--password`* parameter with OpenStack client commands.

Override environment variable values

When you run OpenStack client commands, you can override some environment variable settings by using the options that are listed at the end of the **nova help** output. For example, you can override the `OS_PASSWORD` setting in the `openrc.sh` file by specifying a password on a **nova** command, as follows:

```
$ nova --password <password> image-list
```

Where *`password`* is your password.

Manage images

The cloud operator assigns roles to users. Roles determine who can upload and manage images. The operator might restrict image upload and management to only cloud administrators or operators.

You can upload images through the glance client or the Image Service API. You can also use the nova client to list images, set, and delete image metadata, delete images, and take a snapshot of a running instance to create an image. After you upload an image, you cannot change it.

For details about image creation, see the *Virtual Machine Image Guide*.

List or get details for images (glance)

1. To list the available images:

```
$ glance image-list
+--------------------------------------+---------------------------------
+-------------+------------------+----------+--------+
| ID                                   | Name                            |
 Disk Format | Container Format | Size     | Status |
+--------------------------------------+---------------------------------
+-------------+------------------+----------+--------+
| 397e713c-b95b-4186-ad46-6126863ea0a9 | cirros-0.3.1-x86_64-uec         |
 ami         | ami              | 25165824 | active |
| df430cc2-3406-4061-b635-a51c16e488ac | cirros-0.3.1-x86_64-uec-kernel  |
 aki         | aki              | 4955792  | active |
| 3cf852bd-2332-48f4-9ae4-7d926d50945e | cirros-0.3.1-x86_64-uec-ramdisk |
 ari         | ari              | 3714968  | active |
| 7e5142af-1253-4634-bcc6-89482c5f2e8a | myCirrosImage                   |
 ami         | ami              | 14221312 | active |
+--------------------------------------+---------------------------------
+-------------+------------------+----------+--------+
```

You can use grep to filter the list, as follows:

```
$ glance image-list | grep 'cirros'
| 397e713c-b95b-4186-ad46-6126863ea0a9 | cirros-0.3.1-x86_64-uec         |
 ami         | ami              | 25165824 | active |
| df430cc2-3406-4061-b635-a51c16e488ac | cirros-0.3.1-x86_64-uec-kernel  |
 aki         | aki              | 4955792  | active |
| 3cf852bd-2332-48f4-9ae4-7d926d50945e | cirros-0.3.1-x86_64-uec-ramdisk |
 ari         | ari              | 3714968  | active |
```

2. To get image details, by name or ID:

```
$ glance image-show myCirrosImage
+---------------------------------------+--------------------------------------+
| Property                              | Value                                |
+---------------------------------------+--------------------------------------+
| Property 'base_image_ref'             | 397e713c-b95b-4186-ad46-6126863ea0a9 |
| Property 'image_location'             | snapshot                             |
| Property 'image_state'                | available                            |
| Property 'image_type'                 | snapshot                             |
| Property 'instance_type_ephemeral_gb' | 0                                    |
| Property 'instance_type_flavorid'     | 2                                    |
| Property 'instance_type_id'           | 5                                    |
| Property 'instance_type_memory_mb'    | 2048                                 |
| Property 'instance_type_name'         | m1.small                             |
| Property 'instance_type_root_gb'      | 20                                   |
| Property 'instance_type_rxtx_factor'  | 1                                    |
| Property 'instance_type_swap'         | 0                                    |
| Property 'instance_type_vcpu_weight'  | None                                 |
| Property 'instance_type_vcpus'        | 1                                    |
| Property 'instance_uuid'              | 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 |
```

```
| Property 'kernel_id'                | df430cc2-3406-4061-b635-a51c16e488ac |
| Property 'owner_id'                 | 66265572db174a7aa66eba661f58eb9e     |
| Property 'ramdisk_id'               | 3cf852bd-2332-48f4-9ae4-7d926d50945e |
| Property 'user_id'                  | 376744b5910b4b4da7d8e6cb483b06a8     |
| checksum                            | 8e4838effa1969ad591655d6485c7ba8     |
| container_format                    | ami                                  |
| created_at                          | 2013-07-22T19:45:58                  |
| deleted                             | False                                |
| disk_format                         | ami                                  |
| id                                  | 7e5142af-1253-4634-bcc6-89482c5f2e8a |
| is_public                           | False                                |
| min_disk                            | 0                                    |
| min_ram                             | 0                                    |
| name                                | myCirrosImage                        |
| owner                               | 66265572db174a7aa66eba661f58eb9e     |
| protected                           | False                                |
| size                                | 14221312                             |
| status                              | active                               |
| updated_at                          | 2013-07-22T19:46:42                  |
+-------------------------------------+--------------------------------------+
```

Note

To store location metadata for images, which enables direct file access for a client, update the `/etc/glance/glance.conf` file with the following statements:

- `show_multiple_locations = True`
- `filesystem_store_metadata_file = filePath`, where *`filePath`* points to a JSON file that defines the mount point for OpenStack images on your system and a unique ID. For example:

```
[{
    "id": "b9d69795-5951-4cb0-bb5c-29491e1e2daf",
    "mountpoint": "/var/lib/glance/images/"
}]
```

After you restart the Image Service, you can use the following syntax to view the image's location information:

```
$ glance --os-image-api-version=2 image-show imageID
```

For example:

```
$ glance --os-image-api-version=2 image-show 2d9bb53f-70ea-4066-
a68b-67960eaae673
```

Create or update an image (glance)

1. To upload a CentOS 6.3 image in qcow2 format and configure it for public access:

```
$ glance image-create --name centos63-image --disk-format=qcow2 \
  --container-format=bare --is-public=True --file=./centos63.qcow2
```

2. To update an image by name or ID:

```
$ glance image-update IMAGE
```

To modify image properties, use the following optional arguments:

`--name NAME`	The name of the image.
`--disk-format DISK_FORMAT`	The disk format of the image. Acceptable formats are ami, ari, aki, vhd, vmdk, raw, qcow2, vdi, and iso.
`--container-format CONTAINER_FORMAT`	The container format of the image. Acceptable formats are ami, ari, aki, bare, and ovf.

--owner TENANT_ID	The tenant who should own the image.
--size SIZE	The size of image data, in bytes.
--min-disk DISK_GB	The minimum size of disk needed to boot image, in gigabytes.
--min-ram DISK_RAM	The minimum amount of ram needed to boot image, in megabytes.
--location IMAGE_URL	The URL where the data for this image resides. For example, if the image data is stored in swift, you could specify `swift://account:key@example.com/container/obj`.
--file FILE	Local file that contains disk image to be uploaded during update. Alternatively, you can pass images to the client through stdin.
--checksum CHECKSUM	Hash of image data to use for verification.
--copy-from IMAGE_URL	Similar to *--location* in usage, but indicates that the Image server should immediately copy the data and store it in its configured image store.
--is-public [True|False]	Makes an image accessible to the public.
--is-protected [True|False]	Prevents an image from being deleted.
--property KEY=VALUE	Arbitrary property to associate with image. Can be used multiple times.
--purge-props	Deletes all image properties that are not explicitly set in the update request. Otherwise, those properties not referenced are preserved.
--human-readable	Prints image size in a human-friendly format.

3. To annotate an image with a property that describes the `disk_bus`, `cdrom_bus`, and `vif_model`:

```
$ glance image-update \
    --property hw_disk_bus=scsi \
    --property hw_cdrom_bus=ide \
    --property hw_vif_model=e1000 \
    f16-x86_64-openstack-sda
```

Currently libvirt will determine the disk/cdrom/vif device models based on the configured hypervisor type (`libvirt_type` in `/etc/nova/nova.conf`). For the sake of optimal performance, it will default to using virtio for both disk and VIF (NIC) models. The downside of this approach is that it is not possible to run operating systems that lack virtio drivers, for example, BSD, Solaris, old Linux, and old Windows.

If you specify a disk or CD-ROM bus model that is not supported, see Table 2.3, "Disk and CD-ROM bus model values" [33]. If you specify a VIF model that is not supported, the instance fails to launch. See Table 2.4, "VIF model values" [33].

The valid model values depend on the `libvirt_type` setting, as shown in the following tables:

Table 2.3. Disk and CD-ROM bus model values

libvirt_type setting	Supported model values
qemu or kvm	• virtio • scsi • ide • virtio
xen	• xen • ide

Table 2.4. VIF model values

libvirt_type setting	Supported model values
qemu or kvm	• virtio • ne2k_pci • pcnet • rtl8139 • e1000
xen	• netfront • ne2k_pci • pcnet • rtl8139 • e1000
vmware	• VirtualE1000 • VirtualPCNet32 • VirtualVmxnet

Create image (nova)

You can use the nova client to list images, set and delete image metadata, delete images, and take a snapshot of a running instance to create an image.

The safest approach is to shut down the instance before you take a snapshot.

You cannot create a snapshot from an instance that has an attached volume. Detach the volume, create the image, and re-mount the volume.

1. Write any buffered data to disk.

   For more information, see Taking Snapshots in the *OpenStack Operations Guide*.

2. To create the image, list instances to get the server ID:

```
$ nova list
+--------------------------------------+----------------------+--------+------------+-------------+------------------+
| ID                                   | Name                 | Status | Task State | Power State | Networks         |
+--------------------------------------+----------------------+--------+------------+-------------+------------------+
| 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 | myCirrosServer       | ACTIVE | None       | Running     | private=10.0.0.3 |
+--------------------------------------+----------------------+--------+------------+-------------+------------------+
```

In this example, the server is named `myCirrosServer`. Use this server to create a snapshot, as follows:

```
$ nova image-create myCirrosServer myCirrosImage
```

The command creates a qemu snapshot and automatically uploads the image to your repository. Only the tenant that creates the image has access to it.

3. Get details for your image to check its status:

```
$ nova image-show IMAGE
+-------------------------------------+--------------------------------------+
| Property                            | Value                                |
+-------------------------------------+--------------------------------------+
| metadata owner_id                   | 66265572db174a7aa66eba661f58eb9e     |
| minDisk                             | 0                                    |
| metadata instance_type_name         | m1.small                             |
| metadata instance_type_id           | 5                                    |
| metadata instance_type_memory_mb    | 2048                                 |
| id                                  | 7e5142af-1253-4634-bcc6-89482c5f2e8a |
| metadata instance_type_root_gb      | 20                                   |
| metadata instance_type_rxtx_factor  | 1                                    |
| metadata ramdisk_id                 | 3cf852bd-2332-48f4-9ae4-7d926d50945e |
| metadata image_state                | available                            |
| metadata image_location             | snapshot                             |
| minRam                              | 0                                    |
| metadata instance_type_vcpus        | 1                                    |
| status                              | ACTIVE                               |
| updated                             | 2013-07-22T19:46:42Z                 |
| metadata instance_type_swap         | 0                                    |
| metadata instance_type_vcpu_weight  | None                                 |
| metadata base_image_ref             | 397e713c-b95b-4186-ad46-6126863ea0a9 |
| progress                            | 100                                  |
| metadata instance_type_flavorid     | 2                                    |
| OS-EXT-IMG-SIZE:size                | 14221312                             |
| metadata image_type                 | snapshot                             |
| metadata user_id                    | 376744b5910b4b4da7d8e6cb483b06a8     |
| name                                | myCirrosImage                        |
| created                             | 2013-07-22T19:45:58Z                 |
| metadata instance_uuid              | 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 |
| server                              | 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 |
| metadata kernel_id                  | df430cc2-3406-4061-b635-a51c16e488ac |
| metadata instance_type_ephemeral_gb | 0                                    |
+-------------------------------------+--------------------------------------+
```

The image status changes from `SAVING` to `ACTIVE`. Only the tenant who creates the image has access to it.

4. To launch an instance from your image, include the image ID and flavor ID, as follows:

```
$ nova boot newServer --image 7e5142af-1253-4634-bcc6-89482c5f2e8a \
   --flavor 3
+-------------------------------------+--------------------------------------+
| Property                            | Value                                |
+-------------------------------------+--------------------------------------+
| OS-EXT-STS:task_state               | scheduling                           |
| image                               | myCirrosImage                        |
| OS-EXT-STS:vm_state                 | building                             |
| OS-EXT-SRV-ATTR:instance_name       | instance-00000007                    |
| flavor                              | m1.medium                            |
| id                                  | d7efd3e4-d375-46d1-9d57-372b6e4bdb7f |
| security_groups                     | [{u'name': u'default'}]              |
| user_id                             | 376744b5910b4b4da7d8e6cb483b06a8     |
| OS-DCF:diskConfig                   | MANUAL                               |
| accessIPv4                          |                                      |
| accessIPv6                          |                                      |
| progress                            | 0                                    |
| OS-EXT-STS:power_state              | 0                                    |
| OS-EXT-AZ:availability_zone         | nova                                 |
| config_drive                        |                                      |
| status                              | BUILD                                |
| updated                             | 2013-07-22T19:58:33Z                 |
| hostId                              |                                      |
| OS-EXT-SRV-ATTR:host                | None                                 |
| key_name                            | None                                 |
| OS-EXT-SRV-ATTR:hypervisor_hostname | None                                 |
| name                                | newServer                            |
| adminPass                           | jis88nN46RGP                         |
| tenant_id                           | 66265572db174a7aa66eba661f58eb9e     |
| created                             | 2013-07-22T19:58:33Z                 |
| metadata                            | {}                                   |
+-------------------------------------+--------------------------------------+
```

Troubleshoot image creation

- You cannot create a snapshot from an instance that has an attached volume. Detach the volume, create the image, and re-mount the volume.
- Make sure the version of qemu you are using is version 0.14 or greater. Older versions of qemu result in an "`unknown option -s`" error message in the `nova-compute.log`.
- Examine the `/var/log/nova-api.log` and `/var/log/nova-compute.log` log files for error messages.

Configure access and security for instances

When you launch a virtual machine, you can inject a *keypair*, which provides SSH access to your instance. For this to work, the image must contain the `cloud-init` package. Create at least one keypair for each project. If you generate a keypair with an external tool, you can import it into OpenStack. You can use the keypair for multiple instances that belong to that project. In case an image uses a static root password or a static key set – neither is recommended – you must not provide a keypair when you launch the instance.

A *security group* is a named collection of network access rules that you use to limit the types of traffic that have access to instances. When you launch an instance, you can assign one or more security groups to it. If you do not create security groups, new instances are automatically assigned to the default security group, unless you explicitly specify a different security group. The associated *rules* in each security group control the traffic to instances in the group. Any incoming traffic that is not matched by a rule is denied access by default. You can add rules to or remove rules from a security group. You can modify rules for the default and any other security group.

You must modify the rules for the default security group because users cannot access instances that use the default group from any IP address outside the cloud.

You can modify the rules in a security group to allow access to instances through different ports and protocols. For example, you can modify rules to allow access to instances through SSH, to ping them, or to allow UDP traffic – for example, for a DNS server running on an instance. You specify the following parameters for rules:

- **Source of traffic**. Enable traffic to instances from either IP addresses inside the cloud from other group members or from all IP addresses.
- **Protocol**. Choose TCP for SSH, ICMP for pings, or UDP.
- **Destination port on virtual machine**. Defines a port range. To open a single port only, enter the same value twice. ICMP does not support ports: Enter values to define the codes and types of ICMP traffic to be allowed.

Rules are automatically enforced as soon as you create or modify them.

You can also assign a floating IP address to a running instance to make it accessible from outside the cloud. You assign a floating IP address to an instance and attach a block storage device, or volume, for persistent storage. See the section called “Manage IP addresses” [51].

Add a keypair

You can generate a keypair or upload an existing public key.

1. To generate a keypair, run the following command:

```
$ nova keypair-add KEY_NAME > MY_KEY.pem
```

   The command generates a keypair named *KEY_NAME*, writes the private key to the *MY_KEY*.pem file, and registers the public key at the Nova database.

2. To set the permissions of the *MY_KEY*.pem file, run the following command:

```
$ chmod 600 MY_KEY.pem
```

   The command changes the permissions of the *MY_KEY*.pem file so that only you can read and write to it.

Import a keypair

1. If you have already generated a keypair with the public key located at ~/.ssh/id_rsa.pub, run the following command to upload the public key:

```
$ nova keypair-add --pub_key ~/.ssh/id_rsa.pub KEY_NAME
```

   The command registers the public key at the Nova database and names the keypair *KEY_NAME*.

2. List keypairs to make sure that the uploaded keypair appears in the list:

```
$ nova keypair-list
```

Create and manage security groups

1. To list security groups for the current project, including descriptions, enter the following command:

```
$ nova secgroup-list
```

2. To create a security group with a specified name and description, enter the following command:

```
$ nova secgroup-create SEC_GROUP_NAME GROUP_DESCRIPTION
```

3. To delete a specified group, enter the following command:

```
$ nova secgroup-delete SEC_GROUP_NAME
```

Note

You cannot delete the default security group for a project. Also, you cannot delete a security group that is assigned to a running instance.

Create and manage security group rules

Modify security group rules with the **nova secgroup-*-rule** commands.

1. On a shell, source the OpenStack RC file. For details, see the section called "The OpenStack RC file" [28].

2. To list the rules for a security group

```
$ nova secgroup-list-rules SEC_GROUP_NAME
```

3. To allow SSH access to the instances, choose one of the following sub-steps:

   a. **Add rule for all IPs**

      Either from all IP addresses (specified as IP subnet in CIDR notation as 0.0.0.0/0):

```
$ nova secgroup-add-rule SEC_GROUP_NAME tcp 22 22 0.0.0.0/0
```

   b. **Add rule for security groups**

      Alternatively, you can allow only IP addresses from other security groups (source groups) to access the specified port:

```
$ nova secgroup-add-group-rule --ip_proto tcp --from_port 22 \
    --to_port 22 SEC_GROUP_NAME SOURCE_GROUP_NAME
```

4. To allow pinging the instances, choose one of the following sub-steps:

   a. **To allow pinging from IPs**

      Specify all IP addresses as IP subnet in CIDR notation: `0.0.0.0/0`. This command allows access to all codes and all types of ICMP traffic, respectively:

```
$ nova secgroup-add-rule SEC_GROUP_NAME icmp -1 -1 0.0.0.0/0
```

   b. **To allow pinging from other security groups**

      To allow only members of other security groups (source groups) to ping instances:

```
$ nova secgroup-add-group-rule --ip_proto icmp --from_port -1 \
    --to_port -1 SEC_GROUP_NAME SOURCE_GROUP_NAME
```

5. To allow access through a UDP port, such as allowing access to a DNS server that runs on a VM, complete one of the following sub-steps:

   a. To allow UDP access from IPs, specify all IP addresses as IP subnet in CIDR notation: `0.0.0.0/0`.

```
$ nova secgroup-add-rule SEC_GROUP_NAME udp 53 53 0.0.0.0/0
```

   b. To allow only IP addresses from other security groups (source groups) to access the specified port:

```
$ nova secgroup-add-group-rule --ip_proto udp --from_port 53 \
     --to_port 53 SEC_GROUP_NAME SOURCE_GROUP_NAME
```

6. To delete a security group rule, specify the same arguments that you used to create the rule.

   To delete the security rule that you created in Step 3.a [38]:

```
$ nova secgroup-delete-rule SEC_GROUP_NAME tcp 22 22 0.0.0.0/0
```

To delete the security rule that you created in Step 3.b [38]:

```
$ nova secgroup-delete-group-rule --ip_proto tcp --from_port 22 \
    --to_port 22 SEC_GROUP_NAME SOURCE_GROUP_NAME
```

Launch instances

Instances are virtual machines that run inside the cloud.

Before you can launch an instance, gather the following parameters:

- The **instance source**, which is an image or snapshot. Alternatively, you can boot from a volume, which is block storage, to which you've copied an image or snapshot.
- The **image** or **snapshot**, which represents the operating system.
- A **name** for your instance.
- The **flavor** for your instance, which defines the compute, memory, and storage capacity of nova computing instances. A flavor is an available hardware configuration for a server. It defines the "size" of a virtual server that can be launched.
- `User Data` is a special key in the metadata service that holds a file that cloud-aware applications in the guest instance can access. For example, the cloudinit system is an open-source package from Ubuntu that is available on various Linux distributions including Ubuntu, Fedora, and openSUSE and that handles early initialization of a cloud instance that uses `user data`.
- Access and security credentials, which include one or both of the following credentials:
  - A **keypair** for your instance, which are SSH credentials that are injected into images when they are launched. For this to work, the image must contain the `cloud-init` package. Create at least one keypair for each project. If you already have generated a keypair with an external tool, you can import it into OpenStack. You can use the keypair for multiple instances that belong to that project.
  - A **security group**, which defines which incoming network traffic is forwarded to instances. Security groups hold a set of firewall policies, known as *security group rules*.
- If needed, you can assign a **floating (public) IP address** to a running instance and attach a block storage device, or volume, for persistent storage.

After you gather the parameters you need to launch an instance, you can launch it from an image or a volume.

You can launch an instance directly from one of the available OpenStack images or from an image that you have copied to a persistent volume. The OpenStack Image Service provides a pool of images that are accessible to members of different projects.

Gather parameters to launch an instance

1. On a shell, source the OpenStack RC file. See the section called "The OpenStack RC file" [28].

2. List the available flavors:

```
$ nova flavor-list
```

```
+----+-----------+-----------+------+-----------+------+-------+-------------+-----------+
| ID | Name      | Memory_MB | Disk | Ephemeral | Swap | VCPUs | RXTX_Factor | Is_Public |
+----+-----------+-----------+------+-----------+------+-------+-------------+-----------+
| 1  | m1.tiny   | 512       | 0    | 0         |      | 1     | 1.0         | True      |
| 2  | m1.small  | 2048      | 20   | 0         |      | 1     | 1.0         | True      |
| 3  | m1.medium | 4096      | 40   | 0         |      | 2     | 1.0         | True      |
| 4  | m1.large  | 8192      | 80   | 0         |      | 4     | 1.0         | True      |
| 5  | m1.xlarge | 16384     | 160  | 0         |      | 8     | 1.0         | True      |
+----+-----------+-----------+------+-----------+------+-------+-------------+-----------+
```

   Note the ID of the flavor that you want to use for your instance.

3. List the available images:

```
$ nova image-list
```

```
+--------------------------------------+---------------------------------+--------+--------+
| ID                                   | Name                            | Status | Server |
+--------------------------------------+---------------------------------+--------+--------+
| 397e713c-b95b-4186-ad46-6126863ea0a9 | cirros-0.3.1-x86_64-uec         | ACTIVE |        |
| df430cc2-3406-4061-b635-a51c16e488ac | cirros-0.3.1-x86_64-uec-kernel  | ACTIVE |        |
| 3cf852bd-2332-48f4-9ae4-7d926d50945e | cirros-0.3.1-x86_64-uec-ramdisk | ACTIVE |        |
+--------------------------------------+---------------------------------+--------+--------+
```

   You can also filter the image list by using grep to find a specific image, like this:

```
$ nova image-list | grep 'kernel'
```

```
| df430cc2-3406-4061-b635-a51c16e488ac | cirros-0.3.1-x86_64-uec-kernel  | ACTIVE |        |
```

   Note the ID of the image that you want to boot your instance from.

4. List the available security groups:

Note

If you are an admin user, specify the `--all-tenants` parameter to list groups for all tenants.

```
$ nova secgroup-list --all-tenants
```

```
+----+---------+-------------+----------------------------------+
| Id | Name    | Description | Tenant_ID                        |
+----+---------+-------------+----------------------------------+
| 2  | default | default     | 66265572db174a7aa66eba661f58eb9e |
| 1  | default | default     | b70d90d65e464582b6b2161cf3603ced |
+----+---------+-------------+----------------------------------+
```

   If you have not created any security groups, you can assign the instance to only the default security group.

   You can also list rules for a specified security group:

```
$ nova secgroup-list-rules default
```

   This example modifies the default security group to allow HTTP traffic on the instance by permitting TCP traffic on Port 80.

5. List the available keypairs.

```
$ nova keypair-list
```

Note the name of the keypair that you use for SSH access.

Launch an instance from an image

1. Now you have all parameters required to launch an instance, run the following command and specify the server name, flavor ID, and image ID. Optionally, you can provide a key name for access control and security group for security. You can also include metadata key and value pairs. For example, you can add a description for your server by providing the *--meta description="My Server"* parameter.

   You can pass user data in a local file at instance launch by using the flag *--user-data USER-DATA-FILE* parameter.

```
$ nova boot --flavor FLAVOR_ID --image IMAGE_ID --key-name KEY_NAME \
  --user-data mydata.file --security-groups SEC_GROUP --meta KEY=VALUE \
  myCirrosServer
```

   Depending on the parameters that you provide, the command returns a list of server properties.

   A status of BUILD indicates that the instance has started, but is not yet online.

   A status of ACTIVE indicates that the instance is active.

```
+--------------------------------------+--------------------------------------+
| Property                             | Value                                |
+--------------------------------------+--------------------------------------+
| OS-EXT-STS:task_state                | scheduling                           |
| image                                | cirros-0.3.1-x86_64-uec              |
| OS-EXT-STS:vm_state                  | building                             |
| OS-EXT-SRV-ATTR:instance_name        | instance-00000002                    |
| flavor                               | m1.small                             |
| id                                   | b3cdc6c0-85a7-4904-ae85-71918f734048 |
| security_groups                      | [{u'name': u'default'}]              |
| user_id                              | 376744b5910b4b4da7d8e6cb483b06a8     |
| OS-DCF:diskConfig                    | MANUAL                               |
| accessIPv4                           |                                      |
| accessIPv6                           |                                      |
| progress                             | 0                                    |
| OS-EXT-STS:power_state               | 0                                    |
| OS-EXT-AZ:availability_zone          | nova                                 |
| config_drive                         |                                      |
| status                               | BUILD                                |
| updated                              | 2013-07-16T16:25:34Z                 |
| hostId                               |                                      |
| OS-EXT-SRV-ATTR:host                 | None                                 |
| key_name                             | None                                 |
| OS-EXT-SRV-ATTR:hypervisor_hostname  | None                                 |
| name                                 | myCirrosServer                       |
| adminPass                            | tVs5pL8HcPGw                         |
| tenant_id                            | 66265572db174a7aa66eba661f58eb9e     |
| created                              | 2013-07-16T16:25:34Z                 |
| metadata                             | {u'KEY': u'VALUE'}                   |
+--------------------------------------+--------------------------------------+
```

   Copy the server ID value from the `id` field in the output. You use this ID to get details for or delete your server.

   Copy the administrative password value from the `adminPass` field. You use this value to log into your server.

Note

Arbitrary local files can also be placed into the instance file system at creation time using the `--file <dst-path=src-path>` option. You may store up to 5 files. For example, if you have a special authorized_keys file named `special_authorized_keysfile` that you want to put on the instance rather than using the regular ssh key injection, you can use the following command:

```
$ nova boot --image ubuntu-cloudimage --flavor 1 vm-name \
  --file /root/.ssh/authorized_keys=special_authorized_keysfile
```

2. Check if the instance is online:

```
$ nova list
```

The list shows the ID, name, status, and private (and if assigned, public) IP addresses for all instances in the project that you belong to:

```
+--------------------------------------+----------------------+--------+------------+-------------+-----------------+
| ID                                   | Name                 | Status | Task State | Power State | Networks        |
+--------------------------------------+----------------------+--------+------------+-------------+-----------------+
| 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 | myCirrosServer       | ACTIVE | None       | Running     | private=10.0.0.3 |
| 8a99547e-7385-4ad1-ae50-4ecfaaad5f42 | myInstanceFromVolume | ACTIVE | None       | Running     | private=10.0.0.4 |
+--------------------------------------+----------------------+--------+------------+-------------+-----------------+
```

If the status for the instance is ACTIVE, the instance is online.

To view the available options for the **nova list** command, run the following command:

```
$ nova help list
```

3. If you did not provide a keypair, security groups, or rules, you can only access the instance from inside the cloud through VNC. Even pinging the instance is not possible.

Launch an instance from a volume

You can boot instances from a volume instead of an image. Use the **nova boot** `--block-device` parameter to define how volumes are attached to an instance when you create it. You can use the `--block-device` parameter with existing or new volumes that you create from a source image, volume, or snapshot.

Note

To attach a volume to a running instance, see *Manage volumes*.

Create volume from image and boot instance

Use this procedure to create a volume from an image, and use it to boot an instance.

1. You can create a volume from an existing image, volume, or snapshot.

   List available images:

```
$ nova image-list
+--------------------------------------+---------------------------------
+--------+--------+
| ID                                   | Name                            |
 Status | Server |
+--------------------------------------+---------------------------------
+--------+--------+
| e0b7734d-2331-42a3-b19e-067adc0da17d | cirros-0.3.1-x86_64-uec         |
 ACTIVE |        |
| 75bf193b-237b-435e-8712-896c51484de9 | cirros-0.3.1-x86_64-uec-kernel  |
 ACTIVE |        |
| 19eee81c-f972-44e1-a952-1dceee148c47 | cirros-0.3.1-x86_64-uec-ramdisk |
 ACTIVE |        |
+--------------------------------------+---------------------------------
+--------+--------+
```

2. To create a bootable volume from an image and launch an instance from this volume, use the `--block-device` parameter.

   For example:

```
$ nova boot --flavor FLAVOR --block-device source=SOURCE,id=ID,dest=DEST,
size=SIZE,shutdown=PRESERVE,bootindex=INDEX NAME
```

   The parameters are:

Parameter	Description
`--flavor FLAVOR`	The flavor ID or name.
`--block-device` source=*SOURCE*,id=*ID*,dest=*DEST*,size=*SIZE*,shutdown=*PRESERVE*,bootindex=*INDEX*	• *SOURCE*: The type of object used to create the block device. Valid values are `volume`, `snapshot`, `image` and `blank`. • *ID*: The ID of the source object. • *DEST*: The type of the target virtual device. Valid values are `volume` and `local`. • *SIZE*: The size of the volume that will be created.

Parameter	Description
	• *PRESERVE*: What to do with the volume when the instance is terminated. `preserve` will not delete the volume, `remove` will. • *INDEX*: Used to order the boot disks. Use `0` to boot from this volume.
NAME	The name for the server.

3. Create a bootable volume from an image, before the instance boots. The volume is not deleted when the instance is terminated:

```
$ nova boot --flavor 2 \
    --block-device source=image,id=e0b7734d-2331-42a3-b19e-067adc0da17d,
dest=volume,size=10,shutdown=preserve,bootindex=0 \
    myInstanceFromVolume
+--------------------------------------
+------------------------------------------------+
| Property                               | Value
              |
+--------------------------------------
+------------------------------------------------+
| OS-EXT-STS:task_state                  | scheduling
              |
| image                                  | Attempt to boot from volume - no
 image supplied |
| OS-EXT-STS:vm_state                    | building
              |
| OS-EXT-SRV-ATTR:instance_name          | instance-00000003
              |
| OS-SRV-USG:launched_at                 | None
              |
| flavor                                 | m1.small
              |
| id                                     | 2e65c854-dba9-4f68-8f08-
fe332e546ecc            |
| security_groups                        | [{u'name': u'default'}]
              |
| user_id                                | 352b37f5c89144d4ad0534139266d51f
              |
| OS-DCF:diskConfig                      | MANUAL
              |
| accessIPv4                             |
              |
| accessIPv6                             |
              |
| progress                               | 0
              |
| OS-EXT-STS:power_state                 | 0
              |
| OS-EXT-AZ:availability_zone            | nova
              |
| config_drive                           |
              |
| status                                 | BUILD
              |
| updated                                | 2014-02-02T13:29:54Z
              |
```

```
| hostId                                |
              |
| OS-EXT-SRV-ATTR:host                  | None
              |
| OS-SRV-USG:terminated_at              | None
              |
| key_name                              | None
              |
| OS-EXT-SRV-ATTR:hypervisor_hostname   | None
              |
| name                                  | myInstanceFromVolume
              |
| adminPass                             | TzjqyGsRcJo9
              |
| tenant_id                             | f7ac731cc11f40efbc03a9f9e1d1d21f
              |
| created                               | 2014-02-02T13:29:53Z
              |
| os-extended-volumes:volumes_attached | []
              |
| metadata                              | {}
              |
+--------------------------------------
+------------------------------------------------+
```

4. List volumes to see the bootable volume and its attached `myInstanceFromVolume` instance:

```
$ cinder list
+--------------------------------------+--------+--------------+------
+-------------+----------+--------------------------------------+
|                  ID                  | Status | Display Name | Size |
 Volume Type | Bootable |             Attached to              |
+--------------------------------------+--------+--------------+------
+-------------+----------+--------------------------------------+
| 2fff50ab-1a9c-4d45-ae60-1d054d6bc868 | in-use |              |  10  |
  None    |   true   | 2e65c854-dba9-4f68-8f08-fe332e546ecc |
+--------------------------------------+--------+--------------+------
+-------------+----------+--------------------------------------+
```

Attach non-bootable volume to an instance

Use the *--block-device* parameter to attach an existing, non-bootable volume to a new instance.

1. Create a volume:

```
$ cinder create --display-name my-volume 8
+---------------------+--------------------------------------+
|       Property      |                Value                 |
+---------------------+--------------------------------------+
|     attachments     |                  []                  |
|  availability_zone  |                 nova                 |
|       bootable      |                false                 |
|      created_at     |      2014-02-04T21:25:18.730961      |
| display_description |                 None                 |
|     display_name    |              my-volume               |
|          id         | 3195a5a7-fd0d-4ac3-b919-7ba6cbe11d46 |
|       metadata      |                  {}                  |
```

```
|         size        |                 8                   |
|     snapshot_id     |                None                 |
|     source_volid    |                None                 |
|        status       |              creating               |
|     volume_type     |                None                 |
+---------------------+--------------------------------------+
```

2. List volumes:

```
$ cinder list
+--------------------------------------+---------+--------------+------
+-------------+----------+-------------+
|                  ID                  |   Status  | Display Name | Size |
 Volume Type | Bootable | Attached to |
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
| 3195a5a7-fd0d-4ac3-b919-7ba6cbe11d46 | available |  my-volume   |  8   |
     None    |  false   |             |
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
```

Note

The volume is not bootable because it was not created from an image.

The volume is also entirely empty: It has no partition table and no file system.

3. Run this command to create an instance and boot it with the volume that is attached to this instance. An image is used as boot source:

```
$ nova boot --flavor 2 --image e0b7734d-2331-42a3-b19e-067adc0da17d \
       --block-device source=volume,id=3195a5a7-fd0d-4ac3-
b919-7ba6cbe11d46,dest=volume,shutdown=preserve \
       myInstanceWithVolume
+-------------------------------------
+-----------------------------------------------------+
| Property                            | Value
                 |
+-------------------------------------
+-----------------------------------------------------+
| OS-EXT-STS:task_state                | scheduling
                 |
| image                                | e0b7734d-2331-42a3-
b19e-067adc0da17d               |
| OS-EXT-STS:vm_state                  | building
                 |
| OS-EXT-SRV-ATTR:instance_name        | instance-00000003
                 |
| flavor                               | m1.small
                 |
| id                                   | 8ed8b0f9-70de-4662-
a16c-0b51ce7b17b4               |
| security_groups                      | [{u'name': u'default'}]
                 |
| user_id                              | 352b37f5c89144d4ad0534139266d51f
                 |
| OS-DCF:diskConfig                    | MANUAL
                 |
```

```
| accessIPv4                           |
                  |
| accessIPv6                           |
                  |
| progress                             | 0
                  |
| OS-EXT-STS:power_state               | 0
                  |
| OS-EXT-AZ:availability_zone          | nova
                  |
| config_drive                         |
                  |
| status                               | BUILD
                  |
| updated                              | 2013-10-16T01:43:26Z
                  |
| hostId                               |
                  |
| OS-EXT-SRV-ATTR:host                 | None
                  |
| OS-SRV-USG:terminated_at             | None
                  |
| key_name                             | None
                  |
| OS-EXT-SRV-ATTR:hypervisor_hostname  | None
                  |
| name                                 | myInstanceWithVolume
                  |
| adminPass                            | BULD33uzYwhq
                  |
| tenant_id                            | f7ac731cc11f40efbc03a9f9e1d1d21f
                  |
| created                              | 2013-10-16T01:43:25Z
                  |
| os-extended-volumes:volumes_attached | [{u'id': u'3195a5a7-fd0d-4ac3-
b919-7ba6cbe11d46'}] |
| metadata                             | {}
                  |
+--------------------------------------
+------------------------------------------------------+
```

4. List volumes:

```
$ nova volume-list
```

Note that the volume is attached to a server:

```
+--------------------------------------+-----------+--------------+------
+-------------+--------------------------------------+
| ID                                   | Status    | Display Name | Size |
 Volume Type | Attached to                          |
+--------------------------------------+-----------+--------------+------
+-------------+--------------------------------------+
| 3195a5a7-fd0d-4ac3-b919-7ba6cbe11d46 | in-use    |  my-volume   | 8    |
 None        | 8ed8b0f9-70de-4662-a16c-0b51ce7b17b4 |
+--------------------------------------+-----------+--------------+------
+-------------+--------------------------------------+
```

Attach swap or ephemeral disk to an instance

Use the **nova boot** *--swap* parameter to attach a swap disk on boot or the **nova boot** *--ephemeral* parameter to attach an ephemeral disk on boot. When you terminate the instance, both disks are deleted.

Boot an instance with a 512 MB swap disk and 2 GB ephemeral disk:

```
$ nova boot --flavor FLAVOR --image IMAGE_ID --swap 512 --ephemeral size=
2 NAME
```

Note

The flavor defines the maximum swap and ephemeral disk size. You cannot exceed these maximum values.

Manage instances and hosts

Instances are virtual machines that run inside the cloud.

Manage IP addresses

Each instance can have a private, or fixed, IP address and a public, or floating, one.

Private IP addresses are used for communication between instances, and public ones are used for communication with the outside world.

When you launch an instance, it is automatically assigned a private IP address that stays the same until you explicitly terminate the instance. Rebooting an instance has no effect on the private IP address.

A pool of floating IPs, configured by the cloud operator, is available in OpenStack Compute.

You can allocate a certain number of these to a project: The maximum number of floating IP addresses per project is defined by the quota.

You can add a floating IP address from this set to an instance of the project. Floating IP addresses can be dynamically disassociated and associated with other instances of the same project at any time.

Before you can assign a floating IP address to an instance, you first must allocate floating IPs to a project. After floating IP addresses have been allocated to the current project, you can assign them to running instances.

You can assign a floating IP address to one instance at a time.

List floating IP address information

1. To list all floating IP addresses:

```
$ nova floating-ip-bulk-list
```

```
+------------+---------------+---------------+--------+-----------+
| project_id | address       | instance_uuid | pool   | interface |
+------------+---------------+---------------+--------+-----------+
| None       | 172.24.4.225  | None          | public | eth0      |
| None       | 172.24.4.226  | None          | public | eth0      |
| None       | 172.24.4.227  | None          | public | eth0      |
| None       | 172.24.4.228  | None          | public | eth0      |
| None       | 172.24.4.229  | None          | public | eth0      |
| None       | 172.24.4.230  | None          | public | eth0      |
| None       | 172.24.4.231  | None          | public | eth0      |
| None       | 172.24.4.232  | None          | public | eth0      |
| None       | 172.24.4.233  | None          | public | eth0      |
| None       | 172.24.4.234  | None          | public | eth0      |
| None       | 172.24.4.235  | None          | public | eth0      |
| None       | 172.24.4.236  | None          | public | eth0      |
| None       | 172.24.4.237  | None          | public | eth0      |
| None       | 172.24.4.238  | None          | public | eth0      |
| None       | 192.168.253.1 | None          | test   | eth0      |
| None       | 192.168.253.2 | None          | test   | eth0      |
```

```
| None       | 192.168.253.3 | None          | test   | eth0      |
| None       | 192.168.253.4 | None          | test   | eth0      |
| None       | 192.168.253.5 | None          | test   | eth0      |
| None       | 192.168.253.6 | None          | test   | eth0      |
+------------+---------------+---------------+--------+-----------+
```

2. To list all pools that provide floating IP addresses:

```
$ nova floating-ip-pool-list
```

```
+--------+
| name   |
+--------+
| public |
| test   |
+--------+
```

Assign floating IP addresses

You can assign floating IP addresses to a project or an instance.

1. Allocate a floating IP address to the current project. If more than one IP address pool is available, you can specify the pool from which to allocate the IP address. This example specifies the `public` pool:

```
$ nova floating-ip-create public
```

```
+--------------+-------------+----------+--------+
| Ip           | Instance Id | Fixed Ip | Pool   |
+--------------+-------------+----------+--------+
| 172.24.4.225 | None        | None     | public |
+--------------+-------------+----------+--------+
```

2. To release a floating IP address from the current project:

```
$ nova floating-ip-delete FLOATING_IP
```

The IP address is returned to the pool of IP addresses that are available for all projects. If an IP address is assigned to a running instance, it is disassociated from the instance.

3. To associate an IP address with an instance, at least one floating IP address must be allocated to the current project.

To assign a floating IP address to an instance:

```
$ nova add-floating-ip INSTANCE_NAME_OR_ID FLOATING_IP
```

After you assign the IP address and configure security group rules for the instance, the instance is publicly available at the floating IP address.

4. To remove a floating IP address from an instance, specify the same arguments that you used to assign the IP address:

```
$ nova remove-floating-ip INSTANCE_NAME_OR_ID FLOATING_IP
```

Change the size of your server

You change the size of a server by changing its flavor.

1. List the available flavors:

```
$ nova flavor-list
```

```
+----+-----------+-----------+------+-----------+------+-------
+-------------+-----------+
| ID | Name      | Memory_MB | Disk | Ephemeral | Swap | VCPUs |
 RXTX_Factor | Is_Public |
+----+-----------+-----------+------+-----------+------+-------
+-------------+-----------+
| 1  | m1.tiny   | 512       | 0    | 0         |      | 1     | 1.0
   | True      |
| 2  | m1.small  | 2048      | 20   | 0         |      | 1     | 1.0
   | True      |
| 3  | m1.medium | 4096      | 40   | 0         |      | 2     | 1.0
   | True      |
| 4  | m1.large  | 8192      | 80   | 0         |      | 4     | 1.0
   | True      |
| 5  | m1.xlarge | 16384     | 160  | 0         |      | 8     | 1.0
   | True      |
+----+-----------+-----------+------+-----------+------+-------
+-------------+-----------+
```

2. Show information about your server, including its size:

```
$ nova show myCirrosServer
```

```
+-------------------------------------
+-----------------------------------------------------------------+
| Property                            | Value
                             |
+-------------------------------------
+-----------------------------------------------------------------+
| status                              | ACTIVE
                             |
| updated                             | 2013-07-18T15:08:20Z
                             |
| OS-EXT-STS:task_state               | None
                             |
| OS-EXT-SRV-ATTR:host                | devstack-grizzly
                             |
| key_name                            | None
                             |
| image                               | cirros-0.3.1-x86_64-uec (397e713c-
b95b-4186-ad46-6126863ea0a9) |
| private network                     | 10.0.0.3
                             |
| hostId                              |
 6e1e69b71ac9b1e6871f91e2dfc9a9b9ceca0f05db68172a81d45385       |
| OS-EXT-STS:vm_state                 | active
                             |
| OS-EXT-SRV-ATTR:instance_name       | instance-00000005
                             |
| OS-EXT-SRV-ATTR:hypervisor_hostname | devstack-grizzly
                             |
| flavor                              | m1.small (2)
                             |
| id                                  | 84c6e57d-a6b1-44b6-81eb-
fcb36afd31b5                         |
| security_groups                     | [{u'name': u'default'}]
                             |
```

```
| user_id                              | 376744b5910b4b4da7d8e6cb483b06a8
                           |
| name                                 | myCirrosServer
                           |
| created                              | 2013-07-18T15:07:59Z
                           |
| tenant_id                            | 66265572db174a7aa66eba661f58eb9e
                           |
| OS-DCF:diskConfig                    | MANUAL
                           |
| metadata                             | {u'description': u'Small test
 image', u'creator': u'joecool'}  |
| accessIPv4                           |
                           |
| accessIPv6                           |
                           |
| progress                             | 0
                           |
| OS-EXT-STS:power_state               | 1
                           |
| OS-EXT-AZ:availability_zone          | nova
                           |
| config_drive                         |
                           |
+--------------------------------------
+------------------------------------------------------------------+
```

The size of the server is `m1.small (2)`.

3. To resize the server, pass the server ID and the desired flavor to the nova **resize** command. Include the `--poll` parameter to report the resize progress.

```
$ nova resize myCirrosServer 4 --poll
```

```
Instance resizing... 100% complete
Finished
```

4. Show the status for your server:

```
$ nova list
```

```
+--------------------------------------+-------------+--------
+--------------------------------------+
| ID                                    | Name        | Status | Networks
                              |
+--------------------------------------+-------------+--------
+--------------------------------------+
| 970e4ca0-f9b7-4c44-80ed-bf0152c96ae1 | resize-demo | RESIZE | private=
172.16.101.6, public=10.4.113.6 |
+--------------------------------------+-------------+--------
+--------------------------------------+
```

5. When the resize completes, the status becomes VERIFY_RESIZE. To confirm the resize:

```
$ nova resize-confirm 6beefcf7-9de6-48b3-9ba9-e11b343189b3
```

The server status becomes ACTIVE.

6. If the resize fails or does not work as expected, you can revert the resize:

```
$ nova resize-revert 6beefcf7-9de6-48b3-9ba9-e11b343189b3
```

The server status becomes ACTIVE.

Search for an instance using IP address

You can search for an instance using the IP address parameter.

- Use the *–ip* to search for an instance using the IP address.

```
$ nova list --ip IP_ADDRESS
```

For example, use the **nova list** command as follows:

```
$ nova list --ip 10.0.0.4
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| ID                                   | Name                 | Status |
 Task State | Power State | Networks         |
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| 8a99547e-7385-4ad1-ae50-4ecfaaad5f42 | myInstanceFromVolume | ACTIVE |
 None       | Running     | private=10.0.0.4 |
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
```

Stop and start an instance

Use one of the following methods to stop and start an instance.

Pause and un-pause an instance

- To pause a server, run the following command:

```
$ nova pause SERVER
```

This command stores the state of the VM in RAM. A paused instance continues to run in a frozen state.

To un-pause the server, run the following command:

```
$ nova unpause SERVER
```

Suspend and resume an instance

Administrative users might want to suspend an infrequently used instance or to perform system maintenance.

1. When you suspend an instance, its VM state is stored on disk, all memory is written to disk, and the virtual machine is stopped. Suspending an instance is similar to placing a device in hibernation; memory and vCPUs become available.

   To initiate a hypervisor-level suspend operation, run the following command:

```
$ nova suspend SERVER
```

2. To resume a suspended server:

```
$ nova resume SERVER
```

Reboot an instance

You can soft or hard reboot a running instance. A soft reboot attempts a graceful shut down and restart of the instance. A hard reboot power cycles the instance.

- By default, when you reboot a server, it is a soft reboot.

```
$ nova reboot SERVER
```

To perform a hard reboot, pass the `--hard` parameter, as follows:

```
$ nova reboot --hard SERVER
```

Delete an instance

When you no longer need an instance, you can delete it.

1. List all instances:

```
$ nova list
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| ID                                   | Name                 | Status |
 Task State | Power State | Networks         |
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 | myCirrosServer       | ACTIVE |
 None       | Running     | private=10.0.0.3 |
| 8a99547e-7385-4ad1-ae50-4ecfaaad5f42 | myInstanceFromVolume | ACTIVE |
 None       | Running     | private=10.0.0.4 |
| d7efd3e4-d375-46d1-9d57-372b6e4bdb7f | newServer            | ERROR  |
 None       | NOSTATE     |                  |
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
```

2. Use the following command to delete the `newServer` instance, which is in ERROR state:

```
$ nova delete newServer
```

3. The command does not notify that your server was deleted.

   Instead, run the **nova list** command:

```
$ nova list
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| ID                                   | Name                 | Status |
 Task State | Power State | Networks         |
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 | myCirrosServer       | ACTIVE |
 None       | Running     | private=10.0.0.3 |
| 8a99547e-7385-4ad1-ae50-4ecfaaad5f42 | myInstanceFromVolume | ACTIVE |
 None       | Running     | private=10.0.0.4 |
```

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

The deleted instance does not appear in the list.

Get a console to access an instance

- To get a VNC console to access an instance, run the following command:

```
$ nova get-vnc-console myCirrosServer xvpvnc
```

The command returns a URL from which you can access your instance:

```
+--------
+-------------------------------------------------------------------------------
+
| Type   | Url
              |
+--------
+-------------------------------------------------------------------------------
+
| xvpvnc | http://166.78.190.96:6081/console?token=
c83ae3a3-15c4-4890-8d45-aefb494a8d6c |
+--------
+-------------------------------------------------------------------------------
+
```

Note

To get a non-VNC console, specify the *novnc* parameter instead of the *xvpvnc* parameter.

Manage bare metal nodes

The bare metal driver for OpenStack Compute manages provisioning of physical hardware using common cloud APIs and tools such as Orchestration (Heat). The use case for this driver is for single tenant clouds such as a high-performance computing cluster or deploying OpenStack itself. Development efforts are focused on moving the driver out of the Compute code base in the Icehouse release. If you use the bare metal driver, you must create and add a network interface to a bare metal node. Then, you can launch an instance from a bare metal image.

You can list and delete bare metal nodes. When you delete a node, any associated network interfaces are removed. You can list and remove network interfaces that are associated with a bare metal node.

Commands

- **baremetal-interface-add**. Adds a network interface to a bare metal node.
- **baremetal-interface-list**. Lists network interfaces associated with a bare metal node.
- **baremetal-interface-remove**. Removes a network interface from a bare metal node.
- **baremetal-node-create**. Creates a bare metal node.

- **baremetal-node-delete**. Removes a bare metal node and any associated interfaces.
- **baremetal-node-list**. Lists available bare metal nodes.
- **baremetal-node-show**. Shows information about a bare metal node.

1. Create a bare metal node:

```
$ nova baremetal-node-create --pm_address=1.2.3.4 --pm_user=ipmi --
pm_password=ipmi $(hostname -f) 1 512 10 aa:bb:cc:dd:ee:ff
```

```
+------------------+------------------+
| Property         | Value            |
+------------------+------------------+
| instance_uuid    | None             |
| pm_address       | 1.2.3.4          |
| interfaces       | []               |
| prov_vlan_id     | None             |
| cpus             | 1                |
| memory_mb        | 512              |
| prov_mac_address | aa:bb:cc:dd:ee:ff |
| service_host     | ubuntu           |
| local_gb         | 10               |
| id               | 1                |
| pm_user          | ipmi             |
| terminal_port    | None             |
+------------------+------------------+
```

2. Add a network interface to the node:

```
$ nova baremetal-interface-add 1 aa:bb:cc:dd:ee:ff
```

```
+-------------+------------------+
| Property    | Value            |
+-------------+------------------+
| datapath_id | 0                |
| id          | 1                |
| port_no     | 0                |
| address     | aa:bb:cc:dd:ee:ff |
+-------------+------------------+
```

3. Launch an instance from a bare metal image:

```
$ nova boot --image my-baremetal-image --flavor my-baremetal-flavor test
```

```
+----------------------------+--------------------------------------+
| Property                   | Value                                |
+----------------------------+--------------------------------------+
| status                     | BUILD                                |
| id                         | cc302a8f-cd81-484b-89a8-b75eb3911b1b |

... wait for instance to become active ...
```

4. List bare metal nodes and interfaces:

```
$ nova baremetal-node-list
```

When a node is in use, its status includes the UUID of the instance that runs on it:

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

```
  +------+------------+-------------+-------------+---------------+
| ID | Host   | CPUs | Memory_MB | Disk_GB | MAC Address
  | VLAN | PM Address | PM Username | PM Password | Terminal Port |
+----+--------+------+-----------+---------+-------------------
  +------+------------+-------------+-------------+---------------+
| 1  | ubuntu | 1    | 512       | 10      | aa:bb:cc:dd:ee:ff
  | None | 1.2.3.4    | ipmi        |             | None          |
+----+--------+------+-----------+---------+-------------------
  +------+------------+-------------+-------------+---------------+
```

5. Show details for a bare metal node:

```
$ nova baremetal-node-show 1
```

```
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| instance_uuid    | cc302a8f-cd81-484b-89a8-b75eb3911b1b |
| pm_address       | 1.2.3.4                              |
| interfaces       |
  [{u'datapath_id': u'0', u'id': 1, u'port_no': 0, u'address':
 u'aa:bb:cc:dd:ee:ff'}] |
| prov_vlan_id     | None                                 |
| cpus             | 1                                    |
| memory_mb        | 512                                  |
| prov_mac_address | aa:bb:cc:dd:ee:ff                    |
| service_host     | ubuntu                               |
| local_gb         | 10                                   |
| id               | 1                                    |
| pm_user          | ipmi                                 |
| terminal_port    | None                                 |
+------------------+--------------------------------------+
```

Note

Set the *--availability_zone* parameter to specify which zone or node to use to start the server. Separate the zone from the host name with a comma. For example:

```
$ nova boot --availability_zone=zone:host,node
```

host is optional for the *--availability_zone* parameter. *zone:,node* also works.

Show usage statistics for hosts and instances

You can show basic statistics on resource usage for hosts and instances.

Note

For more sophisticated monitoring, see the Ceilometer project, which is under development. You can also use tools, such as Ganglia or Graphite, to gather more detailed data.

To show host usage statistics

1. List the hosts and the nova-related services that run on them:

```
$ nova host-list
+-----------------+-------------+----------+
| host_name       | service     | zone     |
+-----------------+-------------+----------+
| devstack-grizzly | conductor   | internal |
| devstack-grizzly | compute     | nova     |
| devstack-grizzly | cert        | internal |
| devstack-grizzly | network     | internal |
| devstack-grizzly | scheduler   | internal |
| devstack-grizzly | consoleauth | internal |
+-----------------+-------------+----------+
```

2. Get a summary of resource usage of all of the instances running on the host.

```
$ nova host-describe devstack-grizzly
+-----------------+----------------------------------+-----+-----------
+---------+
| HOST            | PROJECT                          | cpu | memory_mb |
 disk_gb |
+-----------------+----------------------------------+-----+-----------
+---------+
| devstack-grizzly | (total)                          | 2   | 4003      |
 157     |
| devstack-grizzly | (used_now)                       | 3   | 5120      |
 40      |
| devstack-grizzly | (used_max)                       | 3   | 4608      |
 40      |
| devstack-grizzly | b70d90d65e464582b6b2161cf3603ced | 1   | 512       |
 0       |
| devstack-grizzly | 66265572db174a7aa66eba661f58eb9e | 2   | 4096      |
 40      |
+-----------------+----------------------------------+-----+-----------
+---------+
```

The `cpu` column shows the sum of the virtual CPUs for instances running on the host.

The `memory_mb` column shows the sum of the memory (in MB) allocated to the instances that run on the hosts.

The `disk_gb` column shows the sum of the root and ephemeral disk sizes (in GB) of the instances that run on the hosts.

The `used_now` row shows the sum of the resources allocated to the instances that run on the host plus the resources allocated to the virtual machine of the host itself.

The `used_max` row shows the sum of the resources allocated to the instances that run on the host.

Note

These values are computed by using only information about the flavors of the instances that run on the hosts. This command does not query the CPU usage, memory usage, or hard disk usage of the physical host.

To show instance usage statistics

1. Get CPU, memory, I/O, and network statistics for an instance.

First, list instances:

```
$ nova list
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| ID                                   | Name                 | Status |
 Task State | Power State | Networks         |
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
| 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 | myCirrosServer       | ACTIVE |
 None       | Running     | private=10.0.0.3 |
| 8a99547e-7385-4ad1-ae50-4ecfaaad5f42 | myInstanceFromVolume | ACTIVE |
 None       | Running     | private=10.0.0.4 |
+--------------------------------------+----------------------+--------
+------------+-------------+------------------+
```

Then, get diagnostic statistics:

```
$ nova diagnostics myCirrosServer
+------------------+----------------+
| Property         | Value          |
+------------------+----------------+
| vnet1_rx         | 1210744        |
| cpu0_time        | 19624610000000 |
| vda_read         | 0              |
| vda_write        | 0              |
| vda_write_req    | 0              |
| vnet1_tx         | 863734         |
| vnet1_tx_errors  | 0              |
| vnet1_rx_drop    | 0              |
| vnet1_tx_packets | 3855           |
| vnet1_tx_drop    | 0              |
| vnet1_rx_errors  | 0              |
| memory           | 2097152        |
| vnet1_rx_packets | 5485           |
| vda_read_req     | 0              |
| vda_errors       | -1             |
+------------------+----------------+
```

2. Get summary statistics for each tenant:

```
$ nova usage-list
Usage from 2013-06-25 to 2013-07-24:
+----------------------------------+-----------+-------------+-----------
+---------------+
| Tenant ID                        | Instances | RAM MB-Hours | CPU Hours
 | Disk GB-Hours |
+----------------------------------+-----------+-------------+-----------
+---------------+
| b70d90d65e464582b6b2161cf3603ced | 1         | 344064.44    | 672.00
 | 0.00          |
| 66265572db174a7aa66eba661f58eb9e | 3         | 671626.76    | 327.94
 | 6558.86       |
+----------------------------------+-----------+-------------+-----------
+---------------+
```

Provide user data to instances

User data is a special key in the metadata service that holds a file that cloud-aware applications in the guest instance can access. For example the cloudinit system is a Ubuntu open source package that handles early initialization of a cloud instance and that makes use of `user data`.

You can place user data in a local file and pass it through the `--user-data <user-data-file>` parameter at instance creation:

```
$ nova boot --image ubuntu-cloudimage --flavor 1 --user-data mydata.file
```

Use snapshots to migrate instance

Note

Some cloud providers allow only administrators to perform these steps.

To use snapshots to migrate instances from OpenStack projects to clouds, complete these steps:

1. Create a snapshot of the instance.
2. Download the snapshot as an image.
3. Import the snapshot to the new environment.
4. Boot a new instance from the snapshot.

Note

Perform the the section called “Create a snapshot of the instance” [63] and the section called “Download the snapshot as an image” [64] procedures in the source project.

Perform the the section called “Import the snapshot to new environment” [65] and the section called “Boot a new instance from the snapshot” [65] in the destination project.

Create a snapshot of the instance

1. Always shut down the source VM before you take the snapshot to make sure that all data is flushed to disk.

```
$ nova list
                +--------------------------------------+------------
+--------+------------------------------+
                    | ID                                   | Name       |
 Status | Networks                     |
                    +--------------------------------------+------------
+--------+------------------------------+
                    | c41f3074-c82a-4837-8673-fa7e9fea7e11 | example    |
 ACTIVE | private=10.0.0.3             |
                    +--------------------------------------+------------
+--------+------------------------------+
```

```
$ nova stop example
```

2. Confirm that the instance shows a SHUTOFF status.

```
$ nova list
                +--------------------------------------+------------
+---------+------------------------------+
                    | ID                                   | Name       |
 Status  | Networks                      |
                    +--------------------------------------+------------
+---------+------------------------------+
```

```
                    | c41f3074-c82a-4837-8673-fa7e9fea7e11 | example    |
 SHUTOFF | private=10.0.0.3             |
                    +--------------------------------------+------------
+---------+------------------------------+
```

3. Use the **nova image-create** command to take a snapshot. Use the **nova image-list** command to check the status until the status is ACTIVE:

```
$ nova list
                +--------------------------------------+------------
+---------+------------------------------+
                    | ID                                   | Name       |
 Status  | Networks                     |
                    +--------------------------------------+------------
+---------+------------------------------+
                    | c41f3074-c82a-4837-8673-fa7e9fea7e11 | example    |
 SHUTOFF | private=10.0.0.3             |
                    +--------------------------------------+------------
+---------+------------------------------+
```

```
$ nova image-create --poll example examplesnapshot
                Instance snapshotting... 50% complete
```

```
$ nova image-list
                +--------------------------------------
+---------------------------------+--------+--------+
                    | ID                                   | Name
                   | Status | Server |
                    +--------------------------------------
+---------------------------------+--------+--------+
                    | 657ebb01-6fae-47dc-986a-e49c4dd8c433 | cirros-0.3.1-
x86_64-uec         | ACTIVE |        |
                    | 72074c6d-bf52-4a56-a61c-02a17bf3819b | cirros-0.3.1-
x86_64-uec-kernel  | ACTIVE |        |
                    | 3c5e5f06-637b-413e-90f6-ca7ed015ec9e | cirros-0.3.1-
x86_64-uec-ramdisk | ACTIVE |        |
                    | f30b204e-1ce6-40e7-b8d9-b353d4d84e7d |
 examplesnapshot                | ACTIVE |        |
                    +--------------------------------------
+---------------------------------+--------+--------+
```

Download the snapshot as an image

1. Get the image ID:

```
$ nova image-list
+--------------------------------------+------------------+--------
+--------------------------------------+
| ID                                   | Name             | Status |
 Server                               |
+--------------------------------------+------------------+--------
+--------------------------------------+
| f30b204e-1ce6-40e7-b8d9-b353d4d84e7d | examplesnapshot  | ACTIVE |
 c41f3074-c82a-4837-8673-fa7e9fea7e11 |
+--------------------------------------+------------------+--------
+--------------------------------------+
```

2. Download the snapshot by using the image ID that was returned in the previous step:

```
$ glance image-download --file snapshot.raw f30b204e-1ce6-40e7-b8d9-
b353d4d84e7d
```

Note

The **glance image-download** command requires the image ID and cannot use the image name.

Ensure there is sufficient space on the destination file system for the image file.

3. Make the image available to the new environment, either through http or with direct upload to a machine (**scp**).

Import the snapshot to new environment

- In the new project or cloud environment, import the snapshot:

```
$ glance image-create --copy-from IMAGE_URL
```

Boot a new instance from the snapshot

- In the new project or cloud environment, use the snapshot to create the new instance:

```
$ nova boot --flavor m1.tiny --image EXAMPLE_SNAPSHOT NEW_INSTANCE
```

Store metadata on a configuration drive

You can configure OpenStack to write metadata to a special configuration drive that attaches to the instance when it boots. The instance can mount this drive and read files from it to get information that is normally available through the metadata service.

One use case for the configuration drive is to pass a networking configuration when you do not use DHCP to assign IP addresses to instances. For example, you might pass the IP configuration for the instance through the configuration drive, which the instance can mount and access before you configure the network settings for the instance.

Any modern guest operating system that is capable of mounting an ISO9660 or VFAT file system can use the configuration drive.

Requirements and guidelines

Compute host requirements

- The following hypervisors support the configuration drive: libvirt, xenserver, hyper-v, and vmware.
- To use configuration drive with libvirt, xenserver, or vmware, you must first install the genisoimage package on each compute host. Otherwise, instances do not boot properly.

  Use the `mkisofs_cmd` flag to set the path where you install the genisoimage program. If genisoimage is in same path as the `nova-compute` service, you do not need to set this flag.

  Note

  By default, Ubuntu packages do not install this package. See bug #1165174.

- To use configuration drive with hyper-v, you must set the `mkisofs_cmd` value to the full path to an `mkisofs.exe` installation. Additionally, you must set the `qemu_img_cmd` value in the `hyperv` configuration section to the full path to an `qemu-img` command installation.

Image requirements

- An image built with a recent version of the cloud-init package can automatically access metadata passed through the configuration drive. The cloud-init package version 0.7.1 works with Ubuntu and Fedora-based images, such as RHEL.
- If an image does not have the cloud-init package installed, you must customize the image to run a script that mounts the configuration drive on boot, reads the data from the drive, and takes appropriate action such as adding the public key to an account. See the section called "Configuration drive contents" [68] for details on how data is organized on the configuration drive.
- If you use Xen with a configuration drive, use the `xenapi_disable_agent` configuration parameter to disable the agent.

Guidelines

- Do not rely on the presence of the EC2 metadata present in the configuration drive, as this content might be removed in a future release. For example, do not rely on files in the `ec2` directory.
- When you create images that access configuration drive data and multiple directories are under the `openstack` directory, always select the highest API version by date that your consumer supports. For example, if your guest image supports the 2012-03-05, 2012-08-05, 2013-04-13 versions, try 2013-04-13 first and fall back to a previous version if 2013-04-13 is not present.

Enable and access the configuration drive

1. To enable the configuration drive, pass the `--config-drive=true` parameter to the **nova boot** command.

   This example enables the configuration drive and passes user data, two files, and two key/value metadata pairs, all of which are accessible from the configuration drive:

   ```
   $ nova boot --config-drive=true --image my-image-name --key-name mykey --
   flavor 1 --user-data ./my-user-data.txt myinstance --file /etc/network/
   interfaces=/home/myuser/instance-interfaces --file known_hosts=/home/
   myuser/.ssh/known_hosts --meta role=webservers --meta essential=false
   ```

   You can also configure the Compute service to always create a configuration drive.

   Set this option in the `/etc/nova/nova.conf` file:

   ```
   force_config_drive=true
   ```

   Note

   If a user passes the *`--config-drive=true`* flag to the **nova boot** command, an administrator cannot disable the configuration drive.

2. The configuration drive has the `config-2` volume label. If your guest operating system supports accessing disk by label, you can mount the configuration drive as the `/dev/disk/by-label/config-2` device.

   For example:

   ```
   # mkdir -p /mnt/config
   # mount /dev/disk/by-label/config-2 /mnt/config
   ```

   Note

   Make sure that you use at least version 0.3.1 of CirrOS for configuration drive support.

   If your guest operating system does not use `udev`, the `/dev/disk/by-label` directory is not present.

You can use the **blkid** command to identify the block device that corresponds to the configuration drive. For example, when you boot the CirrOS image with the `m1.tiny` flavor, the device is `/dev/vdb`:

```
# blkid -t LABEL="config-2" -odevice
```

```
/dev/vdb
```

Once identified, you can mount the device:

```
# mkdir -p /mnt/config
# mount /dev/vdb /mnt/config
```

Configuration drive contents

In this example, the contents of the configuration drive are:

```
ec2/2009-04-04/meta-data.json
ec2/2009-04-04/user-data
ec2/latest/meta-data.json
ec2/latest/user-data
openstack/2012-08-10/meta_data.json
openstack/2012-08-10/user_data
openstack/content
openstack/content/0000
openstack/content/0001
openstack/latest/meta_data.json
openstack/latest/user_data
```

The files that appear on the configuration drive depend on the arguments that you pass to the **nova boot** command.

OpenStack metadata format

The following example shows the contents of the `openstack/2012-08-10/meta_data.json` and `openstack/latest/meta_data.json` files. These files are identical. The file contents are formatted for readability:

```
{
   "availability_zone":"nova",
   "files":[
      {
         "content_path":"/content/0000",
         "path":"/etc/network/interfaces"
      },
      {
         "content_path":"/content/0001",
         "path":"known_hosts"
      }
   ],
   "hostname":"test.novalocal",
   "launch_index":0,
   "name":"test",
   "meta":{
      "role":"webservers",
      "essential":"false"
   },
```

```
   "public_keys":{
      "mykey":"ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAAAgQDBqUfVvCSez0/
Wfpd8dLLgZXV9GtXQ7hnMN+Z0OWQUyebVEHey1CXuin0uY1cAJMhUq8j98SiW
+cU0sU4J3x5l2+xi1bodDm1BtFWVeLIOQINpfV1n8fKjHB
+ynPpe1F6tMDvrFGUlJs44t30BrujMXBe8Rq44cCk6wqyjATA3rQ== Generated by Nova\n"
   },
   "uuid":"83679162-1378-4288-a2d4-70e13ec132aa"
}
```

Note the effect of the `--file /etc/network/interfaces=/home/myuser/instance-interfaces` argument that was passed to the **nova boot** command. The contents of this file are contained in the `openstack/content/0000` file on the configuration drive, and the path is specified as `/etc/network/interfaces` in the `meta_data.json` file.

EC2 metadata format

The following example shows the contents of the `ec2/2009-04-04/meta-data.json`, `latest/meta-data.json` files. These files are identical. The file contents are formatted to improve readability:

```
{
   "ami-id":"ami-00000001",
   "ami-launch-index":0,
   "ami-manifest-path":"FIXME",
   "block-device-mapping":{
      "ami":"sda1",
      "ephemeral0":"sda2",
      "root":"/dev/sda1",
      "swap":"sda3"
   },
   "hostname":"test.novalocal",
   "instance-action":"none",
   "instance-id":"i-00000001",
   "instance-type":"m1.tiny",
   "kernel-id":"aki-00000002",
   "local-hostname":"test.novalocal",
   "local-ipv4":null,
   "placement":{
      "availability-zone":"nova"
   },
   "public-hostname":"test.novalocal",
   "public-ipv4":"",
   "public-keys":{
      "0":{
         "openssh-key":"ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAAAgQDBqUfVvCSez0/
Wfpd8dLLgZXV9GtXQ7hnMN+Z0OWQUyebVEHey1CXuin0uY1cAJMhUq8j98SiW
+cU0sU4J3x5l2+xi1bodDm1BtFWVeLIOQINpfV1n8fKjHB
+ynPpe1F6tMDvrFGUlJs44t30BrujMXBe8Rq44cCk6wqyjATA3rQ== Generated by Nova\n"
      }
   },
   "ramdisk-id":"ari-00000003",
   "reservation-id":"r-7lfps8wj",
   "security-groups":[
      "default"
   ]
}
```

User data

The `openstack/2012-08-10/user_data`, `openstack/latest/user_data`, `ec2/2009-04-04/user-data`, and `ec2/latest/user-data` file are present only if the `--user-data` flag and the contents of the user data file are passed to the **nova boot** command.

Configuration drive format

The default format of the configuration drive as an ISO 9660 file system. To explicitly specify the ISO 9660 format, add the following line to the `/etc/nova/nova.conf` file:

```
config_drive_format=iso9660
```

By default, you cannot attach the configuration drive image as a CD drive instead of as a disk drive. To attach a CD drive, add this line to the `/etc/nova/nova.conf` file:

```
config_drive_cdrom=true
```

For legacy reasons, you can configure the configuration drive to use VFAT format instead of ISO 9660. It is unlikely that you would require VFAT format because ISO 9660 is widely supported across operating systems. However, to use the VFAT format, add the following line to the `/etc/nova/nova.conf` file:

```
config_drive_format=vfat
```

If you choose VFAT, the configuration drive is 64 MB.

Configuration drive reference

The following table shows the configuration options for the configuration drive:

Table 2.5. Description of configuration options for configdrive

Configuration option = Default value	Description
[DEFAULT]	
config_drive_format = iso9660	(StrOpt) Config drive format. One of iso9660 (default) or vfat
config_drive_skip_versions = 1.0 2007-01-19 2007-03-01 2007-08-29 2007-10-10 2007-12-15 2008-02-01 2008-09-01	(StrOpt) List of metadata versions to skip placing into the config drive
config_drive_tempdir = None	(StrOpt) Where to put temporary files associated with config drive creation
force_config_drive = None	(StrOpt) Set to force injection to take place on a config drive (if set, valid options are: always)
mkisofs_cmd = genisoimage	(StrOpt) Name and optionally path of the tool used for ISO image creation
[hyperv]	
config_drive_cdrom = False	(BoolOpt) Attaches the Config Drive image as a cdrom drive instead of a disk drive
config_drive_inject_password = False	(BoolOpt) Sets the admin password in the config drive image

Create and manage networks

Before you run commands, set the following environment variables:

```
export OS_USERNAME=admin
export OS_PASSWORD=password
export OS_TENANT_NAME=admin
export OS_AUTH_URL=http://localhost:5000/v2.0
```

Create networks

1. List the extensions of the system:

```
$ neutron ext-list -c alias -c name
```

```
+-----------------+-------------------------+
| alias           | name                    |
+-----------------+-------------------------+
| agent_scheduler | Agent Schedulers        |
| binding         | Port Binding            |
| quotas          | Quota management support |
| agent           | agent                   |
| provider        | Provider Network        |
| router          | Neutron L3 Router       |
| lbaas           | LoadBalancing service   |
| extraroute      | Neutron Extra Route     |
+-----------------+-------------------------+
```

2. Create a network:

```
$ neutron net-create net1
```

```
Created a new network:
+---------------------------+--------------------------------------+
| Field                     | Value                                |
+---------------------------+--------------------------------------+
| admin_state_up            | True                                 |
| id                        | 2d627131-c841-4e3a-ace6-f2dd75773b6d |
| name                      | net1                                 |
| provider:network_type     | vlan                                 |
| provider:physical_network | physnet1                             |
| provider:segmentation_id  | 1001                                 |
| router:external           | False                                |
| shared                    | False                                |
| status                    | ACTIVE                               |
| subnets                   |                                      |
| tenant_id                 | 3671f46ec35e4bbca6ef92ab7975e463     |
+---------------------------+--------------------------------------+
```

Note

Some fields of the created network are invisible to non-admin users.

3. Create a network with specified provider network type:

```
$ neutron net-create net2 --provider:network-type local
```

```
Created a new network:
```

```
+---------------------------+--------------------------------------+
| Field                     | Value                                |
+---------------------------+--------------------------------------+
| admin_state_up            | True                                 |
| id                        | 524e26ea-fad4-4bb0-b504-1ad0dc770e7a |
| name                      | net2                                 |
| provider:network_type     | local                                |
| provider:physical_network |                                      |
| provider:segmentation_id  |                                      |
| router:external           | False                                |
| shared                    | False                                |
| status                    | ACTIVE                               |
| subnets                   |                                      |
| tenant_id                 | 3671f46ec35e4bbca6ef92ab7975e463     |
+---------------------------+--------------------------------------+
```

Just as shown previously, the unknown option `--provider:network-type` is used to create a `local` provider network.

Create subnets

- Create a subnet:

```
$ neutron subnet-create net1 192.168.2.0/24 --name subnet1
```

```
Created a new subnet:
+------------------+------------------------------------------------------+
| Field            | Value                                                |
+------------------+------------------------------------------------------+
| allocation_pools | {"start": "192.168.2.2", "end": "192.168.2.254"} |
| cidr             | 192.168.2.0/24                                       |
| dns_nameservers  |                                                      |
| enable_dhcp      | True                                                 |
| gateway_ip       | 192.168.2.1                                          |
| host_routes      |                                                      |
| id               | 15a09f6c-87a5-4d14-b2cf-03d97cd4b456                 |
| ip_version       | 4                                                    |
| name             | subnet1                                              |
| network_id       | 2d627131-c841-4e3a-ace6-f2dd75773b6d                 |
| tenant_id        | 3671f46ec35e4bbca6ef92ab7975e463                     |
+------------------+------------------------------------------------------+
```

In the previous command, `net1` is the network name, `192.168.2.0/24` is the subnet's CIDR. They are positional arguments. `--name subnet1` is an unknown option, which specifies the subnet's name.

Create routers

1. Create a new router:

```
$ neutron router-create router1
```

```
Created a new router:
+-----------------------+--------------------------------------+
| Field                 | Value                                |
+-----------------------+--------------------------------------+
| admin_state_up        | True                                 |
| external_gateway_info |                                      |
```

```
| id                    | 6e1f11ed-014b-4c16-8664-f4f615a3137a |
| name                  | router1                              |
| status                | ACTIVE                               |
| tenant_id             | 7b5970fbe7724bf9b74c245e66b92abf     |
+-----------------------+--------------------------------------+
```

Take note of the unique router identifier returned, this will be required in subsequent steps.

2. Link the router to the external provider network:

```
$ neutron router-gateway-set ROUTER NETWORK
```

Replace *ROUTER* with the unique identifier of the router, replace *NETWORK* with the unique identifier of the external provider network.

3. Link the router to the subnet:

```
$ neutron router-interface-add ROUTER SUBNET
```

Replace *ROUTER* with the unique identifier of the router, replace *SUBNET* with the unique identifier of the subnet.

Create ports

1. Create a port with specified IP address:

```
$ neutron port-create net1 --fixed-ip ip_address=192.168.2.40
```

```
Created a new port:
+----------------------
+--------------------------------------------------------------------------------------
+
| Field                | Value
                                    |
+----------------------
+--------------------------------------------------------------------------------------
+
| admin_state_up       | True
                                    |
| binding:capabilities | {"port_filter": false}
                                    |
| binding:vif_type     | ovs
                                    |
| device_id            |
                                    |
| device_owner         |
                                    |
| fixed_ips            | {"subnet_id": "15a09f6c-87a5-4d14-
b2cf-03d97cd4b456", "ip_address": "192.168.2.40"} |
| id                   | f7a08fe4-e79e-4b67-bbb8-a5002455a493
                                    |
| mac_address          | fa:16:3e:97:e0:fc
                                    |
| name                 |
                                    |
| network_id           | 2d627131-c841-4e3a-ace6-f2dd75773b6d
                                    |
```

```
| status                | DOWN
                                  |
| tenant_id             | 3671f46ec35e4bbca6ef92ab7975e463
                                  |
+----------------------
+-------------------------------------------------------------------------------
+
```

In the previous command, `net1` is the network name, which is a positional argument. `--fixed-ip ip_address=192.168.2.40` is an option, which specifies the port's fixed IP address we wanted.

2. Create a port without specified IP address:

```
$ neutron port-create net1
```

```
Created a new port:
+----------------------
+-------------------------------------------------------------------------------
+
| Field| Value
                                  |
+----------------------
+-------------------------------------------------------------------------------
+
| admin_state_up       | True
                                  |
| binding:capabilities | {"port_filter": false}
                                  |
| binding:vif_type     | ovs
                                  |
| device_id            |
                                  |
| device_owner         |
                                  |
| fixed_ips            | {"subnet_id": "15a09f6c-87a5-4d14-
b2cf-03d97cd4b456", "ip_address": "192.168.2.2"} |
| id                   | baf13412-2641-4183-9533-de8f5b91444c
                                  |
| mac_address          | fa:16:3e:f6:ec:c7
                                  |
| name                 |
                                  |
| network_id           | 2d627131-c841-4e3a-ace6-f2dd75773b6d
                                  |
| status               | DOWN
                                  |
| tenant_id            | 3671f46ec35e4bbca6ef92ab7975e463
                                  |
+----------------------
+-------------------------------------------------------------------------------
+
```

We can see that the system will allocate one IP address if we do not specify the IP address in command line.

3. Query ports with specified fixed IP addresses:

```
$ neutron port-list --fixed-ips ip_address=192.168.2.2 ip_address=192.168.
2.40
```

```
+--------------------------------------+------+-------------------
+-------------------------------------------------------------------------------------------
+
| id                                   | name | mac_address       |
 fixed_ips
           |
+--------------------------------------+------+-------------------
+-------------------------------------------------------------------------------------------
+
| baf13412-2641-4183-9533-de8f5b91444c |      | fa:16:3e:f6:ec:c7 |
 {"subnet_id": "15a09f6c-87a5-4d14-b2cf-03d97cd4b456", "ip_address": "192.
168.2.2"}  |
| f7a08fe4-e79e-4b67-bbb8-a5002455a493 |      | fa:16:3e:97:e0:fc |
 {"subnet_id": "15a09f6c-87a5-4d14-b2cf-03d97cd4b456", "ip_address": "192.
168.2.40"} |
+--------------------------------------+------+-------------------
+-------------------------------------------------------------------------------------------
+
```

`--fixed-ips ip_address=192.168.2.2 ip_address=192.168.2.40` is one unknown option.

How to find unknown options? The unknown options can be easily found by watching the output of `create_xxx` or `show_xxx` command. For example, in the port creation command, we see the fixed_ips fields, which can be used as an unknown option.

Manage objects and containers

The OpenStack Object Storage Service provides the **swift** client, which is a command-line interface (CLI). Use this client to list objects and containers, upload objects to containers, and download or delete objects from containers. You can also gather statistics and update metadata for accounts, containers, and objects.

This client is based on the native swift client library, `client.py`, which seamlessly re-authenticates if the current token expires during processing, retries operations multiple times, and provides a processing concurrency of 10.

Create and manage containers

1. To create a container:

   ```
   $ swift post CONTAINER
   ```

   Replace *CONTAINER* with the name of your container.

   Users have roles on accounts. For example, a user with the admin role has full access to all containers and objects in an account. You can set access control lists (ACLs) at the container level and support lists for read and write access, which you set with the `X-Container-Read` and `X-Container-Write` header, respectively.

   To give a user read access, use the **swift post** command with the `-r` parameter. To give a user write access, use the `-w` parameter.

   The following example enables the `testuser` user to read objects in the container:

   ```
   $ swift post -r 'testuser'
   ```

   You can also use this command with a list of users.

   If you use StaticWeb middleware to enable Object Storage to serve public web content, use `.r:`, followed by a list of allowed referrers.

   The following command gives object access to all referring domains:

   ```
   $ swift post -r '.r:*'
   ```

2. To list all containers:

   ```
   $ swift list
   ```

3. To check the status of containers:

   ```
   $ swift stat
   Account: AUTH_7b5970fbe7724bf9b74c245e77c03bcg
   Containers: 2
   Objects: 3
   Bytes: 268826
   Accept-Ranges: bytes
   X-Timestamp: 1392683866.17952
   Content-Type: text/plain; charset=utf-8
   ```

You can also use the **swift stat** command with the *ACCOUNT* or *CONTAINER* names as parameters.

```
$ swift stat CONTAINER
Account: AUTH_7b5970fbe7724bf9b74c245e77c03bcg
Container: storage1
Objects: 2
Bytes: 240221
Read ACL:
Write ACL:
Sync To:
Sync Key:
Accept-Ranges: bytes
X-Timestamp: 1392683866.20180
Content-Type: text/plain; charset=utf-8
```

Manage objects

1. To upload an object to a container:

   ```
   $ swift upload CONTAINER OBJECT_FILENAME
   ```

   To upload in chunks, for large files:

   ```
   $ swift upload -S CHUNK_SIZE CONTAINER OBJECT_FILENAME
   ```

2. To check the status of the object:

   ```
   $ swift stat CONTAINER OBJECT_FILENAME
   Account: AUTH_7b5970fbe7724bf9b74c245e77c03bcg
   Container: storage1
   Object: images
   Content Type: application/octet-stream
   Content Length: 211616
   Last Modified: Tue, 18 Feb 2014 00:40:36 GMT
   ETag: 82169623d55158f70a0d720f238ec3ef
   Meta Orig-Filename: images.jpg
   Accept-Ranges: bytes
   X-Timestamp: 1392684036.33306
   ```

3. To list objects in a container:

   ```
   $ swift list CONTAINER OBJECT_FILENAME
   ```

4. To download an object from a container:

   ```
   $ swift download CONTAINER OBJECT_FILENAME
   ```

Create and manage stacks

The template languages are described in the Template Guide in the Heat developer documentation.

Create a stack from an example template file

1. To create a stack, or template, from an example template file, run the following command:

```
$ heat stack-create mystack --template-file=/PATH_TO_HEAT_TEMPLATES/
WordPress_Single_Instance.template
     --parameters="InstanceType=m1.
large;DBUsername=USERNAME;DBPassword=PASSWORD;KeyName=HEAT_KEY;LinuxDistribution=
F17"
```

   The `--parameters` values that you specify depend on the parameters that are defined in the template. If a website hosts the template file, you can specify the URL with the `--template-url` parameter instead of the `--template-file` parameter.

   The command returns the following output:

```
+--------------------------------------+---------------
+--------------------+----------------------+
| id                                   | stack_name    | stack_status
  | creation_time        |
+--------------------------------------+---------------
+--------------------+----------------------+
| 4c712026-dcd5-4664-90b8-0915494c1332 | mystack       |
 CREATE_IN_PROGRESS | 2013-04-03T23:22:08Z |
+--------------------------------------+---------------
+--------------------+----------------------+
```

2. You can also use the **stack-create** command to validate a template file without creating a stack from it.

   To do so, run the following command:

```
$ heat stack-create mystack --template-file=/PATH_TO_HEAT_TEMPLATES/
WordPress_Single_Instance.template
```

   If validation fails, the response returns an error message.

Get information about stacks

To explore the state and history of a particular stack, you can run a number of commands.

- To see which stacks are visible to the current user, run the following command:

```
$ heat stack-list
+--------------------------------------+---------------+-----------------
+----------------------+
| id                                   | stack_name    | stack_status    |
 creation_time        |
+--------------------------------------+---------------+-----------------
+----------------------+
```

```
| 4c712026-dcd5-4664-90b8-0915494c1332 | mystack       | CREATE_COMPLETE |
 2013-04-03T23:22:08Z |
| 7edc7480-bda5-4e1c-9d5d-f567d3b6a050 | my-otherstack | CREATE_FAILED   |
 2013-04-03T23:28:20Z |
+--------------------------------------+---------------+-----------------
+----------------------+
```

- To show the details of a stack, run the following command:

```
$ heat stack-show mystack
```

- A stack consists of a collection of resources.

  To list the resources and their status, run the following command:

```
$ heat resource-list mystack
+---------------------+--------------------+-----------------
+----------------------+
| logical_resource_id | resource_type      | resource_status | updated_time
       |
+---------------------+--------------------+-----------------
+----------------------+
| WikiDatabase        | AWS::EC2::Instance | CREATE_COMPLETE |
 2013-04-03T23:25:56Z |
+---------------------+--------------------+-----------------
+----------------------+
```

- To show the details for the specified resource in a stack, run the following command:

```
$ heat resource-show mystack WikiDatabase
```

  Some resources have associated metadata which can change throughout the life-cycle of a resource:

```
$ heat resource-metadata mystack WikiDatabase
```

- A series of events is generated during the life-cycle of a stack.

  To display life-cycle events, run:

```
$ heat event-list mystack
+---------------------+----+-----------------------+-----------------
+----------------------+
| logical_resource_id | id | resource_status_reason | resource_status |
 event_time           |
+---------------------+----+-----------------------+-----------------
+----------------------+
| WikiDatabase        | 1  | state changed          | IN_PROGRESS     |
 2013-04-03T23:22:09Z |
| WikiDatabase        | 2  | state changed          | CREATE_COMPLETE |
 2013-04-03T23:25:56Z |
+---------------------+----+-----------------------+-----------------
+----------------------+
```

- To show the details for a particular event, run the following command:

```
$ heat event-show WikiDatabase 1
```

Update a stack

- To update an existing stack from a modified template file, run a command like the following command:

```
$ heat stack-update mystack --template-file=/path/to/heat/templates/
WordPress_Single_Instance_v2.template
     --parameters="InstanceType=m1.large;DBUsername=wp;DBPassword=
verybadpassword;KeyName=heat_key;LinuxDistribution=F17"
+--------------------------------------+--------------+----------------
+----------------------+
| id                                   | stack_name    | stack_status    |
 creation_time        |
+--------------------------------------+--------------+----------------
+----------------------+
| 4c712026-dcd5-4664-90b8-0915494c1332 | mystack       | UPDATE_COMPLETE |
 2013-04-03T23:22:08Z |
| 7edc7480-bda5-4e1c-9d5d-f567d3b6a050 | my-otherstack | CREATE_FAILED   |
 2013-04-03T23:28:20Z |
+--------------------------------------+--------------+----------------
+----------------------+
```

Some resources are updated in-place, while others are replaced with new resources.

Measure cloud resources

Telemetry measures cloud resources in OpenStack.

It collects information about how much, who, what, and when with regards to billing. Currently, metering is available through only the **ceilometer** command-line client.

To model data, Telemetry uses these abstractions:

Meter Measures a specific aspect of resource usage, such as the existence of a running instance, or ongoing performance, such as the CPU utilization for an instance. Meters exist for each type of resource. For example, a separate `cpu_util` meter exists for each instance. The life cycle of a meter is decoupled from the existence of its related resource. The meter persists after the resource goes away.

A meter has the following attributes:

- String name.
- A unit of measurement.
- A type. Indicates whether values increase monotonically (cumulative), are interpreted as a change from the previous value (delta), or are standalone and relate only to the current duration (gauge).

Sample An individual data point that is associated with a specific meter. Has the same attributes as the meter, with the addition of timestamp and value attributes. The value attribute is also known as the sample *volume*.

Statistic A set of data point aggregates over a time duration. (In contrast, a sample represents a single data point.) The Telemetry service employs these aggregation functions:

- **count**. The number of samples in each period.
- **max**. The maximum number of sample volumes in each period.
- **min**. The minimum number of sample volumes in each period.
- **avg**. The average of sample volumes over each period.
- **sum**. The sum of sample volumes over each period.

Alarm A set of rules that define a monitor and a current state, with edge-triggered actions associated with target states. Provides user-oriented Monitoring-as-a-Service and a general purpose utility for OpenStack. Orchestration auto scaling is a typical use-case. Alarms follow a tristate model of `ok`, `alarm`, and `insufficient data`. For conventional threshold-oriented alarms, a static threshold value and comparison operator govern state transitions. The comparison operator compares a selected meter statistic against an evaluation window of configurable length into the recent past.

This example uses the **heat** client to create an auto-scaling stack and the **ceilometer** client to measure resources.

1. Create an auto-scaling stack:

```
$ heat stack-create -f cfn/F17/AutoScalingCeilometer.yaml -P "KeyName=
heat_key"
```

2. List the heat resources that were created:

```
$ heat resource-list
+-------------------------+-----------------------------------------
+-----------------+----------------------+
| resource_name           | resource_type                          |
resource_status | updated_time         |
+-------------------------+-----------------------------------------
+-----------------+----------------------+
| CfnUser                 | AWS::IAM::User                         |
CREATE_COMPLETE | 2013-10-02T05:53:41Z |
| WebServerKeys           | AWS::IAM::AccessKey                    |
CREATE_COMPLETE | 2013-10-02T05:53:42Z |
| LaunchConfig            | AWS::AutoScaling::LaunchConfiguration  |
CREATE_COMPLETE | 2013-10-02T05:53:43Z |
| ElasticLoadBalancer     | AWS::ElasticLoadBalancing::LoadBalancer |
UPDATE_COMPLETE | 2013-10-02T05:55:58Z |
| WebServerGroup          | AWS::AutoScaling::AutoScalingGroup     |
CREATE_COMPLETE | 2013-10-02T05:55:58Z |
| WebServerScaleDownPolicy | AWS::AutoScaling::ScalingPolicy       |
CREATE_COMPLETE | 2013-10-02T05:56:00Z |
| WebServerScaleUpPolicy  | AWS::AutoScaling::ScalingPolicy        |
CREATE_COMPLETE | 2013-10-02T05:56:00Z |
| CPUAlarmHigh            | OS::Ceilometer::Alarm                  |
CREATE_COMPLETE | 2013-10-02T05:56:02Z |
| CPUAlarmLow             | OS::Ceilometer::Alarm                  |
CREATE_COMPLETE | 2013-10-02T05:56:02Z |
+-------------------------+-----------------------------------------
+-----------------+----------------------+
```

3. List the alarms that are set:

```
$ ceilometer alarm-list
+--------------------------------------+----------------------------
+------------------+---------+------------
+--------------------------------+
| Alarm ID                             | Name                        |
 State             | Enabled | Continuous | Alarm condition
 |
+--------------------------------------+----------------------------
+------------------+---------+------------
+--------------------------------+
| 4f896b40-0859-460b-9c6a-b0d329814496 | as-CPUAlarmLow-i6qqgkf2fubs  |
 insufficient data | True    | False      | cpu_util < 15.0 during 1x 60s
 |
| 75d8ecf7-afc5-4bdc-95ff-19ed9ba22920 | as-CPUAlarmHigh-sf4muyfruy5m |
 insufficient data | True    | False      | cpu_util > 50.0 during 1x 60s
 |
+--------------------------------------+----------------------------
+------------------+---------+------------+----------------------------+
```

4. List the meters that are set:

```
$ ceilometer meter-list
+--------------------------+------------+----------
+-----------------------------------------------------------------------------
+----------------------------------+
| Name                     | Type       | Unit     | Resource ID
               | User ID                          | Project ID
           |
+--------------------------+------------+----------
+-----------------------------------------------------------------------------
+----------------------------------+
| cpu                      | cumulative | ns       | 3965b41b-81b0-4386-
bea5-6ec37c8841c1 | d1a2996d3b1f4e0e8645ba9650308011 |
 bf03bf32e3884d489004ac995ff7a61c |
| cpu                      | cumulative | ns       | 62520a83-73c7-4084-
be54-275fe770ef2c | d1a2996d3b1f4e0e8645ba9650308011 |
 bf03bf32e3884d489004ac995ff7a61c |
| cpu_util                 | gauge      | %        | 3965b41b-81b0-4386-
bea5-6ec37c8841c1 | d1a2996d3b1f4e0e8645ba9650308011 |
 bf03bf32e3884d489004ac995ff7a61c |
+--------------------------+------------+----------
+-----------------------------------------------------------------------------
+----------------------------------+
```

5. List samples:

```
$ ceilometer sample-list -m cpu_util
+--------------------------------------+----------+-------+---------------
+------+---------------------+
| Resource ID                          | Name     | Type  | Volume
 | Unit | Timestamp           |
+--------------------------------------+----------+-------+---------------
+------+---------------------+
| 3965b41b-81b0-4386-bea5-6ec37c8841c1 | cpu_util | gauge | 3.98333333333
 | %    | 2013-10-02T10:50:12 |
+--------------------------------------+----------+-------+---------------
+------+---------------------+
```

6. View statistics:

```
$ ceilometer statistics -m cpu_util
+--------+---------------------+---------------------+-------
+---------------+---------------+---------------+---------------
+----------+---------------------+---------------------+
| Period | Period Start        | Period End          | Count | Min
    | Max           | Sum           | Avg           | Duration | Duration
 Start      | Duration End        |
+--------+---------------------+---------------------+-------
+---------------+---------------+---------------+---------------
+----------+---------------------+---------------------+
| 0      | 2013-10-02T10:50:12 | 2013-10-02T10:50:12 | 1     | 3.
98333333333 | 3.98333333333 | 3.98333333333 | 3.98333333333 | 0.0      |
 2013-10-02T10:50:12 | 2013-10-02T10:50:12 |
+--------+---------------------+---------------------+-------
+---------------+---------------+---------------+---------------
+----------+---------------------+---------------------+
```

Manage volumes

A volume is a detachable block storage device, similar to a USB hard drive. You can attach a volume to only one instance. To create and manage volumes, you use a combination of nova and cinder client commands.

This example creates a `my-new-volume` volume based on an image.

Create a volume

1. List images, and note the ID of the image to use for your volume:

```
$ nova image-list
```

```
+--------------------------------------+---------------------------------+--------
+--------------------------------------+
| ID                                   | Name                            | Status | Server
                       |
+--------------------------------------+---------------------------------+--------
+--------------------------------------+
| 397e713c-b95b-4186-ad46-6126863ea0a9 | cirros-0.3.1-x86_64-uec         | ACTIVE |
                       |
| df430cc2-3406-4061-b635-a51c16e488ac | cirros-0.3.1-x86_64-uec-kernel  | ACTIVE |
                       |
| 3cf852bd-2332-48f4-9ae4-7d926d50945e | cirros-0.3.1-x86_64-uec-ramdisk | ACTIVE |
                       |
| 7e5142af-1253-4634-bcc6-89482c5f2e8a | myCirrosImage                   | ACTIVE | 84c6e57d-
a6b1-44b6-81eb-fcb36afd31b5 |
| 89bcd424-9d15-4723-95ec-61540e8a1979 | mysnapshot                      | ACTIVE | f51ebd07-
c33d-4951-8722-1df6aa8afaa4 |
+--------------------------------------+---------------------------------+--------
+--------------------------------------+
```

2. List the availability zones, and note the ID of the availability zone in which to create your volume:

```
$ nova availability-zone-list
```

```
+----------------------+----------------------------------------+
| Name                 | Status                                 |
+----------------------+----------------------------------------+
| internal             | available                              |
| |- devstack-grizzly  |                                        |
| | |- nova-conductor  | enabled :-) 2013-07-25T16:50:44.000000 |
| | |- nova-consoleauth | enabled :-) 2013-07-25T16:50:44.000000 |
| | |- nova-scheduler  | enabled :-) 2013-07-25T16:50:44.000000 |
| | |- nova-cert       | enabled :-) 2013-07-25T16:50:44.000000 |
| | |- nova-network    | enabled :-) 2013-07-25T16:50:44.000000 |
| nova                 | available                              |
| |- devstack-grizzly  |                                        |
| | |- nova-compute    | enabled :-) 2013-07-25T16:50:39.000000 |
+----------------------+----------------------------------------+
```

3. Create a volume with 8 GB of space. Specify the availability zone and image:

```
$ cinder create 8 --display-name my-new-volume --image-id 397e713c-
b95b-4186-ad46-6126863ea0a9 --availability-zone nova
```

```
+---------------------+--------------------------------------+
|       Property      |                Value                 |
+---------------------+--------------------------------------+
|     attachments     |                  []                  |
|  availability_zone  |                 nova                 |
|       bootable      |                false                 |
|      created_at     |      2013-07-25T17:02:12.472269      |
| display_description |                 None                 |
|     display_name    |            my-new-volume             |
|          id         | 573e024d-5235-49ce-8332-be1576d323f8 |
|       image_id      | 397e713c-b95b-4186-ad46-6126863ea0a9 |
```

```
|       metadata      |                  {}                  |
|         size        |                  8                   |
|     snapshot_id     |                None                  |
|     source_volid    |                None                  |
|        status       |              creating                |
|     volume_type     |                None                  |
+---------------------+--------------------------------------+
```

4. To verify that your volume was created successfully, list the available volumes:

```
$ cinder list
```

```
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
|                  ID                  |   Status  |   Display Name  | Size | Volume Type |
 Bootable | Attached to |
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
| 573e024d-5235-49ce-8332-be1576d323f8 | available |  my-new-volume  |  8   |     None    |
 true   |             |
| bd7cf584-45de-44e3-bf7f-f7b50bf235e3 | available | my-bootable-vol |  8   |     None    |
 true   |             |
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
```

If your volume was created successfully, its status is `available`. If its status is `error`, you might have exceeded your quota.

Attach a volume to an instance

1. Attach your volume to a server:

```
$ nova volume-attach 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5
 573e024d-5235-49ce-8332-be1576d323f8 /dev/vdb
```

```
+----------+--------------------------------------+
| Property | Value                                |
+----------+--------------------------------------+
| device   | /dev/vdb                             |
| serverId | 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5 |
| id       | 573e024d-5235-49ce-8332-be1576d323f8 |
| volumeId | 573e024d-5235-49ce-8332-be1576d323f8 |
+----------+--------------------------------------+
```

Note the ID of your volume.

2. Show information for your volume:

```
$ cinder show 573e024d-5235-49ce-8332-be1576d323f8
```

```
+-----------------------------
+-----------------------------------------------------------------------------------------------------------------------------------
+
|           Property           |
                                      Value
                                                 |
+-----------------------------
+-----------------------------------------------------------------------------------------------------------------------------------
+
|         attachments          |             [{u'device': u'/dev/vdb', u'server_id': u'84c6e57d-
a6b1-44b6-81eb-fcb36afd31b5', u'id': u'573e024d-5235-49ce-8332-be1576d323f8', u'volume_id':
 u'573e024d-5235-49ce-8332-be1576d323f8'}]             |
|      availability_zone       |
                                       nova
                                                 |
|           bootable           |
                                       true
                                                 |
|          created_at          |
                              2013-07-25T17:02:12.000000
                                                 |
```

```
|     display_description      |                                      None                                      |
|         display_name         |                                  my-new-volume                                 |
|              id              |                  573e024d-5235-49ce-8332-be1576d323f8                          |
|           metadata           |                                       {}                                       |
|    os-vol-host-attr:host     |                                 devstack-grizzly                               |
| os-vol-tenant-attr:tenant_id |                  66265572db174a7aa66eba661f58eb9e                              |
|             size             |                                       8                                        |
|         snapshot_id          |                                      None                                      |
|         source_volid         |                                      None                                      |
|            status            |                                    in-use                                      |
|    volume_image_metadata     | {u'kernel_id': u'df430cc2-3406-4061-b635-
a51c16e488ac', u'image_id': u'397e713c-b95b-4186-ad46-6126863ea0a9', u'ramdisk_id':
 u'3cf852bd-2332-48f4-9ae4-7d926d50945e', u'image_name': u'cirros-0.3.1-x86_64-uec'} |
|         volume_type          |                                      None                                      |
+------------------------------+------------------------------------------------------------------------------------------------------------------------------
+
```

The output shows that the volume is attached to the server with ID `84c6e57d-a6b1-44b6-81eb-fcb36afd31b5`, is in the nova availability zone, and is bootable.

Resize a volume

1. To resize your volume, you must first detach it from the server.

   To detach the volume from your server, pass the server ID and volume ID to the command:

   ```
   $ nova volume-detach 84c6e57d-a6b1-44b6-81eb-fcb36afd31b5
    573e024d-5235-49ce-8332-be1576d323f8
   ```

   The **volume-detach** command does not return any output.

2. List volumes:

   ```
   $ cinder list
   ```

   ```
   +--------------------------------------+-----------+-----------------+------+-------------
   +----------+-------------+
   |                  ID                  |   Status  |   Display Name  | Size | Volume Type |
    Bootable | Attached to |
   +--------------------------------------+-----------+-----------------+------+-------------
   +----------+-------------+
   | 573e024d-5235-49ce-8332-be1576d323f8 | available |  my-new-volume  |  8   |     None    |
    true    |             |
   | bd7cf584-45de-44e3-bf7f-f7b50bf235e3 | available | my-bootable-vol |  8   |     None    |
    true    |             |
   +--------------------------------------+-----------+-----------------+------+-------------
   +----------+-------------+
   ```

Note that the volume is now available.

3. Resize the volume by passing the volume ID and the new size (a value greater than the old one) as parameters:

```
$ cinder extend 573e024d-5235-49ce-8332-be1576d323f8 10
```

The **extend** command does not return any output.

Delete a volume

1. To delete your volume, you must first detach it from the server.

To detach the volume from your server and check for the list of existing volumes, see steps 1 and 2 mentioned in the section called "Resize a volume" [86].

2. Delete the volume:

```
$ cinder delete my-new-volume
```

The delete command does not return any output.

3. List the volumes again, and note that the status of your volume is `deleting`:

```
$ cinder list
```

```
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
|                  ID                  |   Status  |   Display Name  | Size | Volume Type |
 Bootable | Attached to |
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
| 573e024d-5235-49ce-8332-be1576d323f8 |  deleting |  my-new-volume  |  8   |     None    |
 true   |             |
| bd7cf584-45de-44e3-bf7f-f7b50bf235e3 | available | my-bootable-vol |  8   |     None    |
 true   |             |
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
```

When the volume is fully deleted, it disappears from the list of volumes:

```
$ cinder list
```

```
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
|                  ID                  |   Status  |   Display Name  | Size | Volume Type |
 Bootable | Attached to |
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
| bd7cf584-45de-44e3-bf7f-f7b50bf235e3 | available | my-bootable-vol |  8   |     None    |
 true   |             |
+--------------------------------------+-----------+-----------------+------+-------------
+----------+-------------+
```

Transfer a volume

You can transfer a volume from one owner to another by using the **cinder transfer*** commands. The volume donor, or original owner, creates a transfer request and sends the created transfer ID and authorization key to the volume recipient. The volume recipient, or new owner, accepts the transfer by using the ID and key.

Note

The procedure for volume transfer is intended for tenants (both the volume donor and recipient) within the same cloud.

Use cases include:

- Create a custom bootable volume or a volume with a large data set and transfer it to the end customer.
- For bulk import of data to the cloud, the data ingress system creates a new Block Storage volume, copies data from the physical device, and transfers device ownership to the end user.

Create a volume transfer request

1. While logged in as the volume donor, list available volumes:

```
$ cinder list
```

```
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
|                  ID                  |   Status  | Display Name | Size |
 Volume Type | Bootable | Attached to |
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
| 72bfce9f-cacf-477a-a092-bf57a7712165 |   error   |     None     |  1   |
     None    |  false   |             |
| a1cdace0-08e4-4dc7-b9dc-457e9bcfe25f | available |     None     |  1   |
     None    |  false   |             |
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
```

2. As the volume donor, request a volume transfer authorization code for a specific volume:

```
$ cinder transfer-create volumeID
```

The volume must be in an 'available' state or the request will be denied. If the transfer request is valid in the database (that is, it has not expired or been deleted), the volume is placed in an `awaiting transfer` state. For example:

```
$ cinder transfer-create a1cdace0-08e4-4dc7-b9dc-457e9bcfe25f
```

```
+------------+--------------------------------------+
|  Property  |                Value                 |
+------------+--------------------------------------+
|  auth_key  |           b2c8e585cbc68a80           |
| created_at |      2013-10-14T15:20:10.121458      |
|     id     | 6e4e9aa4-bed5-4f94-8f76-df43232f44dc |
|    name    |                 None                 |
| volume_id  | a1cdace0-08e4-4dc7-b9dc-457e9bcfe25f |
+------------+--------------------------------------+
```

Note

Optionally, you can specify a name for the transfer by using the `--display-name` *displayName* parameter.

3. Send the volume transfer ID and authorization key to the new owner (for example, by email).

4. View pending transfers:

```
$ cinder transfer-list
```

```
+--------------------------------------
+--------------------------------------+------+
|               ID                     |             VolumeID
    | Name |
+--------------------------------------
+--------------------------------------+------+
| 6e4e9aa4-bed5-4f94-8f76-df43232f44dc | a1cdace0-08e4-4dc7-
b9dc-457e9bcfe25f | None |
+--------------------------------------
+--------------------------------------+------+
```

5. After the volume recipient, or new owner, accepts the transfer, you can see that the transfer is no longer available:

```
$ cinder transfer-list
```

```
+----+-----------+------+
| ID | Volume ID | Name |
+----+-----------+------+
+----+-----------+------+
```

Accept a volume transfer request

1. As the volume recipient, you must first obtain the transfer ID and authorization key from the original owner.

2. Display the transfer request details using the ID:

```
$ cinder transfer-show transferID
```

For example:

```
$ cinder transfer-show 6e4e9aa4-bed5-4f94-8f76-df43232f44dc
```

```
+------------+--------------------------------------+
|  Property  |                Value                 |
+------------+--------------------------------------+
| created_at |      2013-10-14T15:20:10.000000      |
|     id     | 6e4e9aa4-bed5-4f94-8f76-df43232f44dc |
|    name    |                 None                 |
| volume_id  | a1cdace0-08e4-4dc7-b9dc-457e9bcfe25f |
+------------+--------------------------------------+
```

3. Accept the request:

```
$ cinder transfer-accept transferID authKey
```

For example:

```
$ cinder transfer-accept 6e4e9aa4-bed5-4f94-8f76-df43232f44dc
 b2c8e585cbc68a80
```

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

```
|  Property |               Value                |
+-----------+------------------------------------+
|     id    | 6e4e9aa4-bed5-4f94-8f76-df43232f44dc |
|    name   |                None                |
| volume_id | a1cdace0-08e4-4dc7-b9dc-457e9bcfe25f |
+-----------+------------------------------------+
```

Note

If you do not have a sufficient quota for the transfer, the transfer is refused.

Delete a volume transfer

1. List available volumes and their statuses:

```
$ cinder list
```

```
+--------------------------------------+------------------+--------------
+------+-------------+----------+-------------+
|                  ID                  |       Status      | Display Name
 | Size | Volume Type | Bootable | Attached to |
+--------------------------------------+------------------+--------------
+------+-------------+----------+-------------+
| 72bfce9f-cacf-477a-a092-bf57a7712165 |       error       |     None
 |  1   |     None    |  false   |             |
| a1cdace0-08e4-4dc7-b9dc-457e9bcfe25f | awaiting-transfer |     None
 |  1   |     None    |  false   |             |
+--------------------------------------+------------------+--------------
+------+-------------+----------+-------------+
```

2. Find the matching transfer ID:

```
$ cinder transfer-list
```

```
+--------------------------------------
+--------------------------------------+------+
|               ID                     |             VolumeID
    | Name |
+--------------------------------------
+--------------------------------------+------+
| a6da6888-7cdf-4291-9c08-8c1f22426b8a | a1cdace0-08e4-4dc7-
b9dc-457e9bcfe25f | None |
+--------------------------------------
+--------------------------------------+------+
```

3. Delete the volume:

```
$ cinder transfer-delete transferID
```

For example:

```
$ cinder transfer-delete a6da6888-7cdf-4291-9c08-8c1f22426b8a
```

4. The transfer list is now empty and the volume is again available for transfer:

```
$ cinder transfer-list
```

```
+----+-----------+------+
| ID | Volume ID | Name |
```

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

```
$ cinder list
```

```
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
|                  ID                  |   Status  | Display Name | Size |
 Volume Type | Bootable | Attached to |
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
| 72bfce9f-cacf-477a-a092-bf57a7712165 |   error   |     None     |  1   |
     None    |  false   |             |
| a1cdace0-08e4-4dc7-b9dc-457e9bcfe25f | available |     None     |  1   |
     None    |  false   |             |
+--------------------------------------+-----------+--------------+------
+-------------+----------+-------------+
```

Set a volume to read-only access

To give multiple users shared, secure access to the same data, you can set a volume to read-only access.

Run this command to set a volume to read-only access:

```
$ cinder read-only-mode-update VOLUME BOOLEAN
```

Where *VOLUME* is the ID of the target volume and *BOOLEAN* is a flag that enables read-only or read/write access to the volume.

Valid values for *BOOLEAN* are:

- `true`. Sets the read-only flag in the volume. When you attach the volume to an instance, the instance checks for this flag to determine whether to restrict volume access to read-only.
- `false`. Sets the volume to read/write access.

3. OpenStack Python SDK

Table of Contents

Use the OpenStack Python Software Development Kit (SDK) to write Python automation scripts that create and manage resources in your OpenStack cloud. The SDK implements Python bindings to the OpenStack API, which enables you to perform automation tasks in Python by making calls on Python objects rather than making REST calls directly. All OpenStack command-line tools are implemented using the Python SDK.

Install the OpenStack SDK

Each OpenStack project has its own Python library. These libraries are bundled with the command-line clients. For example, the Python bindings for the Compute API are bundled with the python-novaclient package.

For details about how to install the clients, see install the OpenStack command-line clients.

Authentication

You must authenticate against an OpenStack endpoint before you can use OpenStack services. Each project uses a slightly different syntax for doing authentication.

You must typically authenticate against a specific version of a service. For example, a client might need to authenticate against the Identity Service v2.0.

Python scripts that use the OpenStack SDK must have access to the credentials contained in the OpenStack RC file. Because credentials are sensitive information, do not include them in your scripts. This guide assumes that users source the `openrc.sh` file and access the credentials by using the environment variables in the Python scripts.

Authenticate against an Identity Service endpoint

To authenticate against the Identity Service v2.0 endpoint, instantiate a keystoneclient.v_20.client.Client object:

```
from os import environ as env
import keystoneclient.v2_0.client as ksclient
keystone = ksclient.Client(auth_url=env['OS_AUTH_URL'],
                           username=env['OS_USERNAME'],
                           password=env['OS_PASSWORD'],
                           tenant_name=env['OS_TENANT_NAME'],
                           region_name=env['OS_REGION_NAME'])
```

After you instantiate a `Client` object, you can retrieve the token by accessing its `auth_token` attribute object:

```
import keystoneclient.v2_0.client as ksclient
keystone = ksclient.Client(...)
print keystone.auth_token
```

If the OpenStack cloud is configured to use public-key infrastructure (PKI) tokens, the Python script output looks something like this:

```
MIIQUQYJKoZIhvcNAQcCoIIQQjCCED4CAQExCTAHBgUrDgMCGjCCDqcGCSqGSIb3DQEHAaCCDpgE
gg6UeyJhY2Nlc3MiOiB7InRva2VuIjogeyJpc3N1ZWRfYXQiOiAiMjAxMy0xMC0yMFQxNjo1NjoyNi
4zNTg2MjUiLCAiZXhwaXJlcyI6ICIyMDEzLTEwLTIxVDE2OjU2OjI2WiIsICJpZCI6ICJwbGFjZWhv
...
R3g14FJ0BxtTPbo6WarZ+sA3PZwdgIDyGNI-0Oqv-8ih4gJC9C6wBCel1dUXJ0Mn7BN-SfuxkooVk6
e090bcKjTWet3CC8IEj7a6LyLRVTdvmKGA5-pgp2mS5fb3G2mIad4Zeeb-zQn9V3Xf9WUGxuiVu1Hn
fhuUpJT-s9mU7+WEC3-8qkcBjEpqVCvMpmM4INI=
```

Note

This example shows a subset of a PKI token. A complete token is over 5000 characters long.

Authenticate against an Image Service endpoint

To authenticate against an Image Service endpoint, instantiate a glanceclient.v2.client.Client object:

```
from os import environ as env
import glanceclient.v2.client as glclient
import keystoneclient.v2_0.client as ksclient

keystone = ksclient.Client(auth_url=env['OS_AUTH_URL'],
                           username=env['OS_USERNAME'],
                           password=env['OS_PASSWORD'],
                           tenant_name=env['OS_TENANT_NAME'],
                           region_name=env['OS_REGION_NAME'])
glance_endpoint = keystone.service_catalog.url_for(service_type='image')
glance = glclient.Client(glance_endpoint, token=keystone.auth_token)
```

Authenticate against a Compute endpoint

To authenticate against a Compute endpoint, instantiate a novaclient.v_1_1.client.Client object:

```
from os import environ as env
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(auth_url=env['OS_AUTH_URL'],
                       username=env['OS_USERNAME'],
                       api_key=env['OS_PASSWORD'],
                       project_id=env['OS_TENANT_NAME'],
                       region_name=env['OS_REGION_NAME'])
```

Alternatively, you can instantiate a `novaclient.client.Client` object and pass the version number:

```
from os import environ as env
import novaclient
nova = novaclient.client.Client("1.1", auth_url=env['OS_AUTH_URL'],
                                username=env['OS_USERNAME'],
                                api_key=env['OS_PASSWORD'],
                                project_id=env['OS_TENANT_NAME'],
                                region_name=env['OS_REGION_NAME'])
```

If you authenticate against an endpoint that uses a custom authentication back-end, you must load the authentication plug-in and pass it to the constructor.

The Rackspace Public Cloud is an OpenStack deployment that uses a custom authentication back-end. To authenticate against this cloud, you must install the rackspace-novaclient library that contains the Rackspace authentication plug-in, called `rackspace`. The following Python code shows the additional modifications required to instantiate a `Client` object that can authenticate against the Rackspace custom authentication back-end.

```
import novaclient.auth_plugin
import novaclient.v1_1.client as nvclient
from os import environ as env
auth_system = 'rackspace'
auth_plugin = novaclient.auth_plugin.load_plugin('rackspace')
nova = nvclient.Client(auth_url=env['OS_AUTH_URL'],
                       username=env['OS_USERNAME'],
                       api_key=env['OS_PASSWORD'],
                       project_id=env['OS_TENANT_NAME'],
                       region_name=env['OS_REGION_NAME'],
                       auth_system='rackspace',
                       auth_plugin=auth_plugin)
```

If you set the `OS_AUTH_SYSTEM` environment variable, check for this variable in your Python script to determine whether you need to load a custom authentication back-end:

```
import novaclient.auth_plugin
import novaclient.v1_1.client as nvclient
from os import environ as env
auth_system = os.get('OS_AUTH_SYSTEM')
if auth_system and auth_system != "keystone":
  auth_plugin = novaclient.auth_plugin.load_plugin(auth_system)
else:
  auth_plugin = None
nova = nvclient.Client(auth_url=env['OS_AUTH_URL'],
                       username=env['OS_USERNAME'],
                       api_key=env['OS_PASSWORD'],
                       project_id=env['OS_TENANT_NAME'],
                       region_name=env['OS_REGION_NAME'],
                       auth_system=auth_system,
                       auth_plugin=auth_plugin)
```

Authenticate against a Networking endpoint

To authenticate against a Networking endpoint, instantiate a `neutronclient.v_2_0.client.Client` object:

```
from os import environ as env
from neutronclient.v2_0 import client as neutronclient
neutron = neutronclient.Client(auth_url=env['OS_AUTH_URL'],
                               username=env['OS_USERNAME'],
                               password=env['OS_PASSWORD'],
                               tenant_name=env['OS_TENANT_NAME'],
                               region_name=env['OS_REGION_NAME'])
```

You can also authenticate by explicitly specifying the endpoint and token:

```
from os import environ as env
import keystoneclient.v2_0.client as ksclient
from neutronclient.v2_0 import client as neutronclient
keystone = ksclient.Client(auth_url=env['OS_AUTH_URL'],
                           username=env['OS_USERNAME'],
                           password=env['OS_PASSWORD'],
                           tenant_name=env['OS_TENANT_NAME'],
                           region_name=env['OS_REGION_NAME'])
endpoint_url = keystone.service_catalog.url_for(service_type='network')
token = keystone.auth_token
neutron = neutronclient.Client(endpoint_url=endpoint_url, token=token)
```

Manage images

List images

To list the available images, call the `glanceclient.v2.images.Controller.list` method:

```
import glanceclient.v2.client as glclient
glance = glclient.Client(...)
images = glance.images.list()
```

The `images` method returns a Python generator, as shown in the following interaction with the Python interpreter:

```
>>> images = glance.images.list()
>>> images
<generator object list at 0x105e9c2d0>
>>> list(images)
[{u'checksum': u'f8a2eeee2dc65b3d9b6e63678955bd83',
  u'container_format': u'ami',
  u'created_at': u'2013-10-20T14:28:10Z',
  u'disk_format': u'ami',
  u'file': u'/v2/images/dbc9b2db-51d7-403d-b680-3f576380b00c/file',
  u'id': u'dbc9b2db-51d7-403d-b680-3f576380b00c',
  u'kernel_id': u'c002c82e-2cfa-4952-8461-2095b69c18a6',
  u'min_disk': 0,
  u'min_ram': 0,
  u'name': u'cirros-0.3.1-x86_64-uec',
  u'protected': False,
  u'ramdisk_id': u'4c1c9b4f-3fe9-425a-a1ec-1d8fd90b4db3',
  u'schema': u'/v2/schemas/image',
  u'size': 25165824,
  u'status': u'active',
  u'tags': [],
```

```
 u'updated_at': u'2013-10-20T14:28:11Z',
 u'visibility': u'public'},
{u'checksum': u'69c33642f44ca552ba4bb8b66ad97e85',
 u'container_format': u'ari',
 u'created_at': u'2013-10-20T14:28:09Z',
 u'disk_format': u'ari',
 u'file': u'/v2/images/4c1c9b4f-3fe9-425a-a1ec-1d8fd90b4db3/file',
 u'id': u'4c1c9b4f-3fe9-425a-a1ec-1d8fd90b4db3',
 u'min_disk': 0,
 u'min_ram': 0,
 u'name': u'cirros-0.3.1-x86_64-uec-ramdisk',
 u'protected': False,
 u'schema': u'/v2/schemas/image',
 u'size': 3714968,
 u'status': u'active',
 u'tags': [],
 u'updated_at': u'2013-10-20T14:28:10Z',
 u'visibility': u'public'},
{u'checksum': u'c352f4e7121c6eae958bc1570324f17e',
 u'container_format': u'aki',
 u'created_at': u'2013-10-20T14:28:08Z',
 u'disk_format': u'aki',
 u'file': u'/v2/images/c002c82e-2cfa-4952-8461-2095b69c18a6/file',
 u'id': u'c002c82e-2cfa-4952-8461-2095b69c18a6',
 u'min_disk': 0,
 u'min_ram': 0,
 u'name': u'cirros-0.3.1-x86_64-uec-kernel',
 u'protected': False,
 u'schema': u'/v2/schemas/image',
 u'size': 4955792,
 u'status': u'active',
 u'tags': [],
 u'updated_at': u'2013-10-20T14:28:09Z',
 u'visibility': u'public'}]
```

Get image by ID

To retrieve an image object from its ID, call the `glanceclient.v2.images.Controller.get` method:

```
import glanceclient.v2.client as glclient
image_id = 'c002c82e-2cfa-4952-8461-2095b69c18a6'
glance = glclient.Client(...)
image = glance.images.get(image_id)
```

Get image by name

The Image Service Python bindings do not support the retrieval of an image object by name. However, the Compute Python bindings enable you to get an image object by name. To get an image object by name, call the `novaclient.v1_1.images.ImageManager.find` method:

```
import novaclient.v1_1.client as nvclient
name = "cirros"
nova = nvclient.Client(...)
image = nova.images.find(name=name)
```

Upload an image

To upload an image, call the `glanceclient.v2.images.ImageManager.create` method:

```
import glanceclient.v2.client as glclient
imagefile = "/tmp/myimage.img"
glance = glclient.Client(...)
with open(imagefile) as fimage:
  glance.images.create(name="myimage", is_public=True, disk_format="qcow2",
                       container_format="bare", data=fimage)
```

Configure access and security for instances

Add a keypair

To generate a keypair, call the `novaclient.v1_1.keypairs.KeypairManager.create` method:

```
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(...)
keypair_name = "staging"
keypair = nova.keypairs.create(name=keypair_name)
print keypair.private_key
```

The Python script output looks something like this:

```
-----BEGIN RSA PRIVATE KEY-----
MIIEowIBAAKCAQEA8XkaMqInSPfy0hMfWO+OZRtIgrQAbQkNcaNHmv2GN2G6xZlb\nuBRux5Xk/6SZ
ABaNPm1nRWm/ZDHnxCsFTcAl2LYOQXx3Cl2qKNY4r2di4G48GAkd\n7k5lDP2RgQatUM8npO0CD9PU
...
mmrceYYK08/lQ7JKLmVkdzdQKt77+v1oBBuHiykLfI6h1m77NRDw9r8cV\nzczYeoALifpjTPMkKS8
ECfDCuDn/vc9K1He8CRaJHf8AMLQLM3MN
-----END RSA PRIVATE KEY-----
```

You will typically write the private key to a file in order to use it later. The file must be readable and writeable by only the file owner, otherwise the ssh client will refuse to read the private key file. It is safest to create the file with the appropriate permissions, as shown in the following example:

```
import novaclient.v1_1.client as nvclient
import os
nova = nvclient.Client(...)
keypair_name = "staging"
private_key_filename = "/home/alice/id-staging"
keypair = nova.keypairs.create(name=keypair_name)

# Create a file for writing that can only be read and written by owner
fp = os.open(private_key_filename, os.O_WRONLY | os.O_CREAT, 0o600)
with os.fdopen(fp, 'w') as f:
    f.write(keypair.private_key)
```

Import a keypair

If you have already generated a keypair with the public key located at `~/.ssh/id_rsa.pub`, pass the contents of the file to the

`novaclient.v1_1.keypairs.KeypairManager.create` method to import the public key to Compute:

```
import novaclient.v1_1.client as nvclient
import os.path
with open(os.path.expanduser('~/.ssh/id_rsa.pub')) as f:
    public_key = f.read()
nova = nvclient.Client(...)
nova.keypairs.create('mykey', public_key)
```

List keypairs

To list keypairs, call the `novaclient.v1_1.keypairs.KeypairManager.list` method:

```
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(...)
keypairs = nova.keypairs.list()
```

Create and manage security groups

To list security groups for the current project, call the `novaclient.v_1.security_groups.SecurityGroupManager.list` method:

```
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(...)
security_groups = nova.security_groups.list()
```

To create a security group with a specified name and description, call the `novaclient.v_1.security_groups.SecurityGroupManager.create` method:

```
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(...)
nova.security_groups.create(name="web", description="Web servers")
```

To delete a security group, call the `novaclient.v_1.security_groups.SecurityGroupManager.delete` method, passing either a novaclient.v1_1.security_groups.SecurityGroup object or group ID as an argument:

```
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(...)
group = nova.security_groups.find(name="web")
nova.security_groups.delete(group)
# The following lines would also delete the group:
# nova.security_groups.delete(group.id)
# group.delete()
```

Create and manage security group rules

Access the security group rules from the `rules` attribute of a novaclient.v1_1.security_groups.SecurityGroup object:

```
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(...)
group = nova.security_groups.find(name="web")
print group.rules
```

To add a rule, to a security group, call the `novaclient.v1_1.security_group_rules.SecurityGroupRuleManager.create` method:

```
import novaclient.v1_1.client as nvclient
nova = nvclient.Client(...)
group = nova.security_groups.find(name="web")
# Add rules for ICMP, tcp/80 and tcp/443
nova.security_group_rules.create(group.id, ip_protocol="icmp",
                                 from_port=-1, to_port=-1)
nova.security_group_rules.create(group.id, ip_protocol="tcp",
                                 from_port=80, to_port=80)
nova.security_group_rules.create(group.id, ip_protocol="tcp",
                                 from_port=443, to_port=443)
```

Appendix A. Community support

Table of Contents

Many resources are available to help you run and use OpenStack. Members of the OpenStack community can 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. Use the following resources to get OpenStack support and troubleshoot your existing installations.

Documentation

For the available OpenStack documentation, see docs.openstack.org.

To provide feedback on documentation, join and use the <openstack-docs@lists.openstack.org> mailing list at OpenStack Documentation Mailing List, or report a bug.

The following books explain how to install an OpenStack cloud and its associated components:

- *Installation Guide for Debian 7.0*
- *Installation Guide for openSUSE and SUSE Linux Enterprise Server*
- *Installation Guide for Red Hat Enterprise Linux, CentOS, and Fedora*
- *Installation Guide for Ubuntu 12.04 (LTS)*

The following books explain how to configure and run an OpenStack cloud:

- *Cloud Administrator Guide*
- *Configuration Reference*
- *Operations Guide*
- *High Availability Guide*
- *Security Guide*
- *Virtual Machine Image Guide*

The following books explain how to use the OpenStack dashboard and command-line clients:

- *API Quick Start*
- *End User Guide*
- *Admin User Guide*
- *Command-Line Interface Reference*

The following documentation provides reference and guidance information for the OpenStack APIs:

- OpenStack API Reference
- *OpenStack Block Storage Service API v2 Reference*
- *OpenStack Compute API v2 and Extensions Reference*
- *OpenStack Identity Service API v2.0 Reference*
- *OpenStack Image Service API v2 Reference*
- *OpenStack Networking API v2.0 Reference*
- *OpenStack Object Storage API v1 Reference*

The *Training Guides* offer software training for cloud administration and management.

ask.openstack.org

During the set up or testing of OpenStack, you might have questions about how a specific task is completed or be in a situation where a feature does not work correctly. Use the ask.openstack.org site to ask questions and get answers. When you visit the http://ask.openstack.org site, scan the recently asked questions to see whether your question has already been answered. If not, ask a new question. Be sure to 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, links to screen shots, and so on.

OpenStack mailing lists

A great way to get answers and insights is to post your question or problematic scenario to the OpenStack mailing list. You can learn from and help others who might have similar issues. To subscribe or view the archives, go to http://lists.openstack.org/cgi-bin/mailman/listinfo/openstack. You might be interested in the other mailing lists for specific projects or development, which you can find on the wiki. A description of all mailing lists is available at http://wiki.openstack.org/MailingLists.

The OpenStack wiki

The OpenStack wiki contains a broad range of topics but some of the information can be difficult to find or is a few pages deep. Fortunately, the wiki search feature enables you to

search by title or content. If you search for specific information, such as about networking or nova, you can find lots of relevant material. More is being added all the time, so be sure to check back often. You can find the search box in the upper right corner of any OpenStack wiki page.

The Launchpad Bugs area

The OpenStack community values your set up and testing efforts and wants your feedback. To log a bug, you must sign up for a Launchpad account at https://launchpad.net/+login. You can view existing bugs and report bugs in the Launchpad Bugs area. Use the search feature to determine whether the bug has already been reported or even better, already fixed. If it still seems like your bug is unreported, 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, links to screen shots, and so on.
- Be sure to include the software and package versions that you are using, especially if you are using a development branch, such as, `"Grizzly release" vs git commit bc79c3ecc55929bac585d04a03475b72e06a3208`.
- Any deployment specific information is helpful, such as Ubuntu 12.04 or multi-node install.

The Launchpad Bugs areas are available here:

- Bugs: OpenStack Block Storage (cinder)
- Bugs: OpenStack Compute (nova)
- Bugs: OpenStack Dashboard (horizon)
- Bugs: OpenStack Identity (keystone)
- Bugs: OpenStack Image Service (glance)
- Bugs: OpenStack Networking (neutron)
- Bugs: OpenStack Object Storage (swift)
- Bugs: Bare Metal (ironic)
- Bugs: Data Processing Service (sahara)
- Bugs: Database Service (trove)
- Bugs: Orchestration (heat)
- Bugs: Telemetry (ceilometer)
- Bugs: Queue Service (marconi)

- Bugs: OpenStack API Documentation (api.openstack.org)
- Bugs: OpenStack Documentation (docs.openstack.org)

The OpenStack IRC channel

The OpenStack community lives and breathes in the #openstack IRC channel on the Freenode network. You can hang out, ask questions, or get immediate feedback for urgent and pressing issues. To install an IRC client or use a browser-based client, go to http://webchat.freenode.net/. You can also use Colloquy (Mac OS X, http://colloquy.info/), 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 paste into the channel. The OpenStack IRC channel is: `#openstack` on `irc.freenode.net`. You can find a list of all OpenStack-related IRC channels at https://wiki.openstack.org/wiki/IRC.

Documentation feedback

To provide feedback on documentation, join and use the `<openstack-docs@lists.openstack.org>` mailing list at OpenStack Documentation Mailing List, or report a bug.

OpenStack distribution packages

The following Linux distributions provide community-supported packages for OpenStack:

- **Debian:** http://wiki.debian.org/OpenStack
- **CentOS, Fedora, and Red Hat Enterprise Linux:** http://openstack.redhat.com/
- **openSUSE and SUSE Linux Enterprise Server:** http://en.opensuse.org/Portal:OpenStack
- **Ubuntu:** https://wiki.ubuntu.com/ServerTeam/CloudArchive