SUSE OpenStack Cloud 8

Installing with Cloud Lifecycle Manager

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Contents

Installation Overview

Before beginning your installation, you should prepare thoroughly. Several resources are available to assist you.

- Work through the information in the *Book* "Planning an Installation with Cloud Lifecycle Manager". *Planning an Installation with Cloud Lifecycle Manager* covers prerequisites, considerations, and choices that are necessary to install your cloud successfully.
- Study the example configurations in the table below offered by SUSE OpenStack Cloud 8. These example configurations are a key aspect of installing SUSE OpenStack Cloud with the least amount of time and effort.
- Familiarize yourself with Git. Git is a version control system for tracking and managing changes to your cloud configuration, even with installation methods (such as the Install UI) that do not require direct interaction with version control. For more information about Git, see *Chapter 10, Using Git for Configuration Management*.
- Additional information that will help with your cloud installation.
  - *Chapter 23, Troubleshooting the Installation*
  - *Chapter 26, Cloud Verification*
  - *Chapter 32, Other Common Post-Installation Tasks*

Name	Location
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.1 "Entry-Scale Cloud"*	`~/openstack/examples/entry-scale-kvm`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.2 "Entry Scale Cloud with Metering and Monitoring Services"*	`~/openstack/examples/entry-scale-kvm-mml`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configura-*	`~/openstack/examples/entry-scale-esx-kvm`

Name	Location
tions", Section 9.4 "ESX Examples", Section 9.4.1 "Single-Region Entry-Scale Cloud with a Mix of KVM and ESX Hypervisors"	
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.4 "ESX Examples", Section 9.4.2 "Single-Region Entry-Scale Cloud with Metering and Monitoring Services, and a Mix of KVM and ESX Hypervisors"*	`~/openstack/examples/entry-scale-esx-kvm-mml`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.5 "Swift Examples", Section 9.5.1 "Entry-scale Swift Model"*	`~/openstack/examples/entry-scale-swift`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.6 "Ironic Examples", Section 9.6.1 "Entry-Scale Cloud with Ironic Flat Network"*	`~/openstack/examples/entry-scale-ironic-flat-network`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.6 "Ironic Examples", Section 9.6.2 "Entry-Scale Cloud with Ironic Multi-Tenancy"*	`~/openstack/examples/entry-scale-ironic-multi-tenancy`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.3 "Single-Region Mid-Size Model"*	`~/openstack/examples/mid-scale-kvm`

I Pre-Installation

1 Overview

To ensure that your environment meets the requirements of the cloud model you choose, see the check list in *Chapter 2, Pre-Installation Checklist*.

After you have decided on a configuration to choose for your cloud and you have gone through the pre-installation steps, you will have two options for installation:

- You can use a graphical user interface (GUI) that runs in your Web browser.
- You can install via the command line that gives you the flexibility and full control of SUSE OpenStack Cloud 8.

Using the GUI

You should use the GUI if:

- You are not planning to deploy availability zones or use L3 segmentation in your initial deployment.
- You are satisfied with the tuned SUSE-default OpenStack configuration.

Instructions for GUI installation are in *Chapter 9, Installing with the Install UI*.

Note

Reconfiguring your cloud can only be done via the command line. The GUI installer is for initial installation only.

Using the Command Line

You should use the command line if:

- You are installing a complex or large-scale cloud.
- You need to use availability zones or the server groups functionality of the cloud model. For more information, see the *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 5 "Input Model"*.
- You want to customize the cloud configuration beyond the tuned defaults that SUSE provides out of the box.
- You need more extensive customizations than are possible using the GUI.

Instructions for installing via the command line are in *Chapter 12, Installing Mid-scale and Entry-scale KVM*.

Note

Ardana is an open-source project and a generalized lifecycle management framework. Cloud Lifecycle Manager is based on Ardana, and delivers the lifecycle management functionality required by SUSE OpenStack Cloud 8. Due to this relationship, some Cloud Lifecycle Manager commands refer to Ardana.

2 Pre-Installation Checklist

Important

The formatting of this page facilitates printing it out and using it to record details of your setup.

This checklist is focused on the Entry-scale KVM model but you can alter it to fit the example configuration you choose for your cloud.

2.1 BIOS and IPMI Settings

Ensure that the following BIOS and IPMI settings are applied to each bare-metal server:

#	Item
	Choose either UEFI or Legacy BIOS in the BIOS settings
	Verify the Date and Time settings in the BIOS. **Note** SUSE OpenStack Cloud installs and runs with UTC, not local time.
	Ensure that Wake-on-LAN is disabled in the BIOS
	Ensure that the NIC port to be used for PXE installation has PXE enabled in the BIOS
	Ensure that all other NIC ports have PXE disabled in the BIOS
	Ensure all hardware in the server not directly used by SUSE OpenStack Cloud is disabled

2.2 Network Setup and Configuration

Before installing SUSE OpenStack Cloud, the following networks must be provisioned and tested. The networks are not installed or managed by the Cloud. You must install and manage the networks as documented in *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations"*.

Note that if you want a pluggable IPAM driver, it must be specified at install time. Only with a clean install of SUSE OpenStack Cloud 8 can you specify a different IPAM driver. If upgrading, you must use the default driver. More information can be found in *Book "Operations Guide", Chapter 9 "Managing Networking", Section 9.3 "Networking Service Overview", Section 9.3.7 "Using IPAM Drivers in the Networking Service"*.

Use these checklists to confirm and record your network configuration information.

Router

The IP router used with SUSE OpenStack Cloud must support the updated of its ARP table through gratuitous ARP packets.

PXE Installation Network

When provisioning the IP range, allocate sufficient IP addresses to cover both the current number of servers and any planned expansion. Use the following table to help calculate the requirements:

Instance	Description	IPs
Deployer O/S		1
Controller server O/S (x3)		3
Compute servers (2nd thru 100th)	single IP per server	
block storage host servers	single IP per server	

#	Item	Value
	Network is untagged	
	No DHCP servers other than SUSE OpenStack Cloud are on the network	
	Switch PVID used to map any "internal" VLANs to untagged	

#	Item	Value
	Routable to the IPMI network	
	IP CIDR	
	IP Range (Usable IPs)	begin: end:
	Default IP Gateway	

Management Network

The management network is the backbone used for the majority of SUSE OpenStack Cloud management communications. Control messages are exchanged between the Controllers, Compute hosts, and Cinder backends through this network. In addition to the control flows, the management network is also used to transport Swift and iSCSI based Cinder block storage traffic between servers.

When provisioning the IP Range, allocate sufficient IP addresses to cover both the current number of servers and any planned expansion. Use the following table to help calculate the requirements:

Instance	Description	IPs
Controller server O/S (x3)		3
Controller VIP		1
Compute servers (2nd through 100th)	single IP per server	
VM servers	single IP per server	
VIP per cluster		

#	Item	Value
	Network is untagged	
	No DHCP servers other than SUSE OpenStack Cloud are on the network	

#	Item	Value
	Switch PVID used to map any "internal" VLANs to untagged	
	IP CIDR	
	IP Range (Usable IPs)	begin: end:
	Default IP Gateway	
	VLAN ID	

IPMI Network

The IPMI network is used to connect the IPMI interfaces on the servers that are assigned for use with implementing the cloud. This network is used by Cobbler to control the state of the servers during baremetal deployments.

#	Item	Value
	Network is untagged	
	Routable to the Management Network	
	IP Subnet	
	Default IP Gateway	

External API Network

The External network is used to connect OpenStack endpoints to an external public network such as a company's intranet or the public internet in the case of a public cloud provider.

When provisioning the IP Range, allocate sufficient IP addresses to cover both the current number of servers and any planned expansion. Use the following table to help calculate the requirements.

Instance	Description	IPs
Controller server O/S (x3)		3
Controller VIP		1

#	Item	Value
	VLAN Tag assigned:	
	IP CIDR	
	IP Range (Usable IPs)	begin: end:
	Default IP Gateway	
	VLAN ID	

External VM Network

The External VM network is used to connect cloud instances to an external public network such as a company's intranet or the public internet in the case of a public cloud provider. The external network has a predefined range of Floating IPs which are assigned to individual instances to enable communications to and from the instance to the assigned corporate intranet/internet. There should be a route between the External VM and External API networks so that instances provisioned in the cloud, may access the Cloud API endpoints, using the instance floating IPs.

#	Item	Value
	VLAN Tag assigned:	
	IP CIDR	
	IP Range (Usable IPs)	begin: end:
	Default IP Gateway	
	VLAN ID	

2.3 Cloud Lifecycle Manager

This server contains the SUSE OpenStack Cloud installer, which is based on Git, Ansible, and Cobbler.

#	Item	Value
	Disk Requirement: Single 8GB disk needed per the *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 2 "Hardware and Software Support Matrix"*	
	Section 3.5.2, "Installing the SUSE OpenStack Cloud Extension"	
	Ensure your local DNS nameserver is placed into your `/etc/resolv.conf` file	
	Install and configure NTP for your environment	
	Ensure your NTP server(s) is placed into your `/etc/ntp.conf` file	
	NTP time source:	

2.4 Information for the `nic_mappings.yml` Input File

Log on to each type of physical server you have and issue platform-appropriate commands to identify the `bus-address` and `port-num` values that may be required. For example, run the following command:

```
sudo lspci -D | grep -i net
```

and enter this information in the space below. Use this information for the `bus-address` value in your `nic_mappings.yml` file.

NIC Adapter PCI Bus Address Output

NIC Adapter PCI Bus Address Output

To find the `port-num` use:

```
cat /sys/class/net/<device name>/dev_port
```

where the 'device-name' is the name of the device **currently mapped** to this address, not necessarily the name of the device **to be mapped**. Enter the information for your system in the space below.

Network Device Port Number Output

2.5 Control Plane

The Control Plane consists of at least three servers in a highly available cluster that host the core SUSE OpenStack Cloud services including Nova, Keystone, Glance, Cinder, Heat, Neutron, Swift, Ceilometer, and Horizon. Additional services include mariadb, ip-cluster, apache2, rabbitmq, memcached, zookeeper, kafka, storm, monasca, logging, and cmc.

Note

To mitigate the “split-brain” situation described in *Book “Operations Guide”, Chapter 15 “Troubleshooting Issues”, Section 15.4 “Network Service Troubleshooting”* it is recommended that you have HA network configuration with Multi-Chassis Link Aggregation (MLAG) and NIC bonding configured for all the controllers to deliver system-level redundancy as well network-level resiliency. Also reducing the ARP timeout on the TOR switches will help.

TABLE 2.1: CONTROL PLANE 1

#	Item	Value
	Disk Requirement: 3x 512 GB disks (or enough space to create three logical drives with that amount of space)	
	Ensure the disks are wiped	
	MAC address of first NIC	
	A second NIC, or a set of bonded NICs are required	
	IPMI IP address	
	IPMI Username/Password	

TABLE 2.2: CONTROL PLANE 2

#	Item	Value
	Disk Requirement: 3x 512 GB disks (or enough space to create three logical drives with that amount of space)	
	Ensure the disks are wiped	
	MAC address of first NIC	
	A second NIC, or a set of bonded NICs are required	
	IPMI IP address	
	IPMI Username/Password	

TABLE 2.3: CONTROL PLANE 3

#	Item	Value
	Disk Requirement: 3x 512 GB disks (or enough space to create three logical drives with that amount of space)	
	Ensure the disks are wiped	

#	Item	Value
	MAC address of first NIC	
	A second NIC, or a set of bonded NICs are required	
	IPMI IP address	
	IPMI Username/Password	

2.6 Compute Hosts

One or more KVM Compute servers will be used as the compute host targets for instances.

#	Item
	Disk Requirement: 2x 512 GB disks (or enough space to create three logical drives with that amount of space)
	A NIC for PXE boot and a second NIC, or a NIC for PXE and a set of bonded NICs are required
	Ensure the disks are wiped

Table to record your Compute host details:

ID	NIC MAC Address	IPMI Username/Password	IMPI IP Address	CPU/Mem/Disk

2.7 Storage Hosts

Three or more servers with local disk volumes to provide Cinder block storage resources.

Note

The cluster created from block storage nodes must allow for quorum. In other words, the node count of the cluster must be 3, 5, 7, or another odd number.

#	Item
	Disk Requirement: 3x 512 GB disks (or enough space to create three logical drives with that amount of space) The block storage appliance deployed on a host is expected to consume ~40 GB of disk space from the host root disk for ephemeral storage to run the block storage virtual machine.
	A NIC for PXE boot and a second NIC, or a NIC for PXE and a set of bonded NICs are required
	Ensure the disks are wiped

Table to record your block storage host details:

ID	NIC MAC Address	IPMI Username/Password	IPMI IP Address	CPU/Mem/Disk	Data Volume

2.8 Additional Comments

This section is for any additional information that you deem necessary.

3 Installing the Cloud Lifecycle Manager server

This chapter will show how to install the Cloud Lifecycle Manager from scratch. It will run on SUSE Linux Enterprise Server 12 SP3, include the SUSE OpenStack Cloud extension, and, optionally, the Subscription Management Tool (SMT) server.

3.1 Registration and Online Updates

Registering SUSE Linux Enterprise Server 12 SP3 during the installation process is required for getting product updates and for installing the SUSE OpenStack Cloud extension. Refer to https://documentation.suse.com/sles/12-SP5/single-html/SLES-deployment/#sec-i-yast2-conf-manual-cc for further instructions.

After a successful registration you will be asked whether to add the update repositories. If you agree, the latest updates will automatically be installed, ensuring that your system is on the latest patch level after the initial installation. We strongly recommend adding the update repositories immediately. If you choose to skip this step you need to perform an online update later, before starting the installation.

Note: SUSE Login Required

To register a product, you need to have a SUSE login. If you do not have such a login, create it at http://www.suse.com/.

3.2 Starting the Operating System Installation

Important

Installing SUSE Linux Enterprise Server for SUSE OpenStack Cloud requires the following steps, which are different from the default SUSE Linux Enterprise Server installation process.

Note

For an overview of a default SUSE Linux Enterprise Server installation, refer to https://documentation.suse.com/sles/12-SP5/single-html/SLES-installquick/#art-sle-installquick.

Start the installation by booting into the SUSE Linux Enterprise Server 12 SP3 installation system.

3.3 Partitioning

Create a custom partition setup using the *Expert Partitioner*. The following setup is required:

- Two partitions are needed: one for boot, EFI or UEFI, and one for everything else.
- If the system is using a UEFI BIOS, there must be a UEFI boot partition.
- An LVM setup with no encryption is recommended, Btrfs will work. The file system must contain:
  - a volume group named `ardana-vg` on the first disk (`/dev/sda`)
  - a volume named `root` with a size of 50GB and an ext4 filesystem
- no separate mount point for `/home`
- no swap partition or file (No swap is a general OpenStack recommendation. Some services such as rabbit and cassandra do not perform well with swapping.)

3.4 Creating a User

Setting up Cloud Lifecycle Manager requires a regular user which you can set up during the installation. You are free to choose any available user name except for `ardana`, because the `ardana` user is reserved by SUSE OpenStack Cloud.

3.5 Installation Settings

With *Installation Settings*, you need to adjust the software selection for your Cloud Lifecycle Manager setup. For more information refer to the https://documentation.suse.com/sles/12-SP5/single-html/SLES-deployment/#sec-i-yast2-proposal.

Important: Additional Installation Settings

The default firewall must be disabled, as SUSE OpenStack Cloud enables its own firewall during deployment.

SSH must be enabled.

Set `text` as the *Default systemd target*.

3.5.1 Software Selection

Installing a minimal base system is sufficient to set up the Administration Server. The following patterns are the minimum required:

- *Base System*
- *Minimal System (Appliances)*
- *Meta Package for Pattern cloud-ardana* (in case you have chosen to install the SUSE OpenStack Cloud Extension)
- *Subscription Management Tool* (optional, also see *Tip: Installing a Local SMT Server (Optional)*)
- *YaST2 configuration packages*

Tip: Installing a Local SMT Server (Optional)

If you do not have a SUSE Manager or SMT server in your organization, or are planning to manually update the repositories required for deployment of the SUSE OpenStack Cloud nodes, you need to set up an SMT server on the Administration Server. Choose the pattern *Subscription Management Tool* in addition to the patterns listed above to install the SMT server software.

3.5.2 Installing the SUSE OpenStack Cloud Extension

SUSE OpenStack Cloud is an extension to SUSE Linux Enterprise Server. Installing it during the SUSE Linux Enterprise Server installation is the easiest and recommended way to set up the Cloud Lifecycle Manager. To get access to the extension selection dialog, you need to register SUSE Linux Enterprise Server 12 SP3 during the installation. After a successful registration, the SUSE Linux Enterprise Server 12 SP3 installation continues with the *Extension & Module Selection*. Choose *SUSE OpenStack Cloud 8* and provide the registration key you obtained by purchasing SUSE OpenStack Cloud. The registration and the extension installation require an Internet connection.

If you do not have Internet access or are not able to register during installation, then once Internet access is available for the Cloud Lifecycle Manager do the following steps:

1. `tux >` sudo SUSEConnect -r *`SLES_REGISTRATION_CODE`*

2. List repositories to verify:

```
ardana > zypper lr
```

3. Refresh the repositories:

```
tux > sudo zypper ref
```

Alternatively, install the SUSE OpenStack Cloud after the SUSE Linux Enterprise Server 12 SP3 installation via *YaST* › *Software* › *Add-On Products*. For details, refer to https://documentation.suse.com/sles/12-SP5/single-html/SLES-deployment/#sec-add-ons-extensions.

4 Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)

One way to provide the repositories needed to set up the nodes in SUSE OpenStack Cloud is to install a Subscription Management Tool (SMT) server on the Cloud Lifecycle Manager server, and then mirror all repositories from SUSE Customer Center via this server. Installing an SMT server on the Cloud Lifecycle Manager server is optional. If your organization already provides an SMT server or a SUSE Manager server that can be accessed from the Cloud Lifecycle Manager server, skip this step.

Important: Use of SMT Server and Ports

When installing an SMT server on the Cloud Lifecycle Manager server, use it exclusively for SUSE OpenStack Cloud. To use the SMT server for other products, run it outside of SUSE OpenStack Cloud. Make sure it can be accessed from the Cloud Lifecycle Manager for mirroring the repositories needed for SUSE OpenStack Cloud.

When the SMT server is installed on the Cloud Lifecycle Manager server, Cloud Lifecycle Manager provides the mirrored repositories on port `79`.

4.1 SMT Installation

If you have not installed the SMT server during the initial Cloud Lifecycle Manager server installation as suggested in *Section 3.5.1, “Software Selection”*, run the following command to install it:

```
sudo zypper in -t pattern smt
```

4.2 SMT Configuration

No matter whether the SMT server was installed during the initial installation or in the running system, it needs to be configured with the following steps.

Note: Prerequisites

To configure the SMT server, a SUSE account is required. If you do not have such an account, register at http://www.suse.com/ ↗. All products and extensions for which you want to mirror updates with the SMT server should be registered at the SUSE Customer Center (http://scc.suse.com/ ↗).

If you did not register with the SUSE Customer Center during installation, then at this point you will need to register in order to proceed. Ensure that the Cloud Lifecycle Manager has external network access and then run the following command:

```
tux > sudo SUSEConnect -r
    SLES_REGISTRATION_CODE
```

1. Configuring the SMT server requires you to have your mirroring credentials (user name and password) and your registration e-mail address at hand. To access them, proceed as follows:

   a. Open a Web browser and log in to the SUSE Customer Center at http://scc.suse.com/ ↗.

   b. Click your name to see the e-mail address which you have registered.

   c. Click *Organization* › *Organization Credentials* to obtain your mirroring credentials (user name and password).

2. Start *YaST* › *Network Services* › *SMT Configuration Wizard*.

3. Activate *Enable Subscription Management Tool Service (SMT)*.

4. Enter the *Customer Center Configuration* data as follows:

   Use Custom Server: Do *not* activate this option
   User: The user name you retrieved from the SUSE Customer Center
   Password: The password you retrieved from the SUSE Customer Center
   Check your input with *Test*. If the test does not return `success`, check the credentials you entered.

5. Enter the e-mail address you retrieved from the SUSE Customer Center at *SCC E-Mail Used for Registration*.

6. *Your SMT Server URL* shows the HTTP address of your server. Usually it should not be necessary to change it.

7. Select *Next* to proceed to step two of the *SMT Configuration Wizard*.

8. Enter a *Database Password for SMT User* and confirm it by entering it once again.

9. Enter one or more e-mail addresses to which SMT status reports are sent by selecting *Add*.

10. Select *Next* to save your SMT configuration. When setting up the database you will be prompted for the MariaDB root password. If you have not already created one then create it in this step. Note that this is the global MariaDB root password, not the database password for the SMT user you specified before.
    The SMT server requires a server certificate at `/etc/pki/trust/anchors/YaST-CA.pem`. Choose *Run CA Management*, provide a password and choose *Next* to create such a certificate. If your organization already provides a CA certificate, *Skip* this step and import the certificate via *YaST* › *Security and Users* › *CA Management* after the SMT configuration is done. See https://documentation.suse.com/sles/12-SP5/single-html/SLES-security/#cha-security-yast-ca for more information.
    After you complete your configuration a synchronization check with the SUSE Customer Center will run, which may take several minutes.

4.3 Setting up Repository Mirroring on the SMT Server

The final step in setting up the SMT server is configuring it to mirror the repositories needed for SUSE OpenStack Cloud. The SMT server mirrors the repositories from the SUSE Customer Center. Make sure to have the appropriate subscriptions registered in SUSE Customer Center with the same e-mail address you specified when configuring SMT.

4.3.1 Adding Mandatory Repositories

Mirroring the SUSE Linux Enterprise Server 12 SP3 and SUSE OpenStack Cloud 8 repositories is mandatory. Run the following commands as user `root` to add them to the list of mirrored repositories:

```
for REPO in SLES12-SP3-{Pool,Updates} SUSE-OpenStack-Cloud-8-{Pool,Updates}; do
```

```
  smt-repos $REPO sle-12-x86_64 -e
done
```

4.3.2 Updating the Repositories

New repositories added to SMT must be updated immediately by running the following command as user `root`:

```
smt-mirror -L /var/log/smt/smt-mirror.log
```

This command will download several GB of patches. This process may last up to several hours. A log file is written to `/var/log/smt/smt-mirror.log`. After this first manual update the repositories are updated automatically via cron job. A list of all repositories and their location in the file system on the Cloud Lifecycle Manager server can be found at *Table 5.2, “SMT Repositories Hosted on the Administration Server”*.

4.4 For More Information

For detailed information about SMT refer to the Subscription Management Tool manual at https://documentation.suse.com/sles/12-SP5/single-html/SLES-smt/ .

5 Software Repository Setup

Software repositories containing products, extensions, and the respective updates for all software need to be available to all nodes in SUSE OpenStack Cloud in order to complete the deployment. These can be managed manually, or they can be hosted on the Cloud Lifecycle Manager server. In this configuration step, these repositories are made available on the Cloud Lifecycle Manager server. There are two types of repositories:

Product Media Repositories: Product media repositories are copies of the installation media. They need to be directly copied to the Cloud Lifecycle Manager server, “loop-mounted” from an iso image, or mounted from a remote server via NFS. Affected are SUSE Linux Enterprise Server 12 SP3 and SUSE OpenStack Cloud 8. These are static repositories; they do not change or receive updates. See *Section 5.1, “Copying the Product Media Repositories”* for setup instructions.

Update and Pool Repositories: Update and Pool repositories are provided by the SUSE Customer Center. They contain all updates and patches for the products and extensions. To make them available for SUSE OpenStack Cloud they need to be mirrored from the SUSE Customer Center. Their content is regularly updated, so they must be kept in synchronization with SUSE Customer Center. For these purposes, SUSE provides the Subscription Management Tool (SMT). See *Section 5.2, “Update and Pool Repositories”* for setup instructions.

5.1 Copying the Product Media Repositories

The files in the product repositories for SUSE OpenStack Cloud do not change, therefore they do not need to be synchronized with a remote source. If you have installed the product media from a downloaded ISO image, the product repositories will automatically be made available to the client nodes and these steps can be skipped. These steps can also be skipped if you prefer to install from the Pool repositories provided by SUSE Customer Center. Otherwise, it is sufficient to either copy the data (from a remote host or the installation media), to mount the product repository from a remote server via `NFS`, or to loop mount a copy of the installation images.

If you choose to install from the product media rather than from the SUSE Customer Center repositories, the following product media needs to reside in the specified directories:

TABLE 5.1: LOCAL PRODUCT REPOSITORIES FOR SUSE OPENSTACK CLOUD

Repository	Directory
SUSE OpenStack Cloud 8 DVD #1	`/srv/www/suse-12.3/x86_64/repos/Cloud`

The data can be copied by a variety of methods:

Copying from the Installation Media

We recommend using **`rsync`** for copying. If the installation data is located on a removable device, make sure to mount it first (for example, after inserting the DVD1 in the Administration Server and waiting for the device to become ready):

SUSE OpenStack Cloud 8 DVD#1

```
mkdir -p /srv/www/suse-12.3/x86_64/repos/Cloud
mount /dev/dvd /mnt
rsync -avP /mnt/ /srv/www/suse-12.3/x86_64/repos/Cloud/
umount /mnt
```

Copying from a Remote Host

If the data is provided by a remote machine, log in to that machine and push the data to the Administration Server (which has the IP address `192.168.245.10` in the following example):

SUSE OpenStack Cloud 8 DVD#1

```
mkdir -p /srv/www/suse-12.3/x86_64/repos/Cloud
rsync -avPz /data/SUSE-OPENSTACK-CLOUD//DVD1/ 192.168.245.10:/srv/www/suse-12.3/
x86_64/repos/Cloud/
```

Mounting from an NFS Server

If the installation data is provided via NFS by a remote machine, mount the respective shares as follows. To automatically mount these directories either create entries in `/etc/fstab` or set up the automounter.

SUSE OpenStack Cloud 8 DVD#1

```
mkdir -p /srv/www/suse-12.3/x86_64/repos/Cloud/
mount -t nfs nfs.example.com:/exports/SUSE-OPENSTACK-CLOUD/DVD1/ /srv/www/suse-12.3/
x86_64/repos/Cloud
```

5.2 Update and Pool Repositories

Update and Pool Repositories are required on the Cloud Lifecycle Manager server to set up and maintain the SUSE OpenStack Cloud nodes. They are provided by SUSE Customer Center and contain all software packages needed to install SUSE Linux Enterprise Server 12 SP3 and the extensions (pool repositories). In addition, they contain all updates and patches (update repositories).

The repositories can be made available on the Cloud Lifecycle Manager server using one or more of the following methods:

- *Section 5.2.1, " Repositories Hosted on an SMT Server Installed on the Cloud Lifecycle Manager "*
- *Section 5.2.2, "Alternative Ways to Make the Repositories Available"*

5.2.1 Repositories Hosted on an SMT Server Installed on the Cloud Lifecycle Manager

When all update and pool repositories are managed by an SMT server installed on the Cloud Lifecycle Manager server (see *Chapter 4, Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)*), the Cloud Lifecycle Manager automatically detects all available repositories. No further action is required.

5.2.2 Alternative Ways to Make the Repositories Available

If you want to keep your SUSE OpenStack Cloud network as isolated from the company network as possible, or your infrastructure does not allow accessing a SUSE Manager or an SMT server, you can alternatively provide access to the required repositories by one of the following methods:

- Mount the repositories from a remote server.
- Synchronize the repositories from a remote server (for example via `rsync` and cron).
- Manually synchronize the update repositories from removable media.

The repositories must be made available at the default locations on the Cloud Lifecycle Manager server as listed in *Table 5.3, "Repository Locations on the Cloud Lifecycle Manager server"*.

5.3 Repository Locations

The following tables show the locations of all repositories that can be used for SUSE OpenStack Cloud.

TABLE 5.2: SMT REPOSITORIES HOSTED ON THE ADMINISTRATION SERVER

Repository	Directory
Mandatory Repositories	
SLES12-SP3-Pool	/srv/www/htdocs/repo/SUSE/Products/SLE-SERVER/12-SP3/x86_64/product/
SLES12-SP3-Updates	/srv/www/htdocs/repo/SUSE/Updates/SLE-SERVER/12-SP3/x86_64/update/
SUSE-OpenStack-Cloud-8-Pool	/srv/www/htdocs/repo/SUSE/Products/OpenStack-Cloud/8/x86_64/product/
SUSE-OpenStack-Cloud-8-Updates	/srv/www/htdocs/repo/SUSE/Updates/OpenStack-Cloud/8/x86_64/update/

The following table shows the required repository locations to use when manually copying, synchronizing, or mounting the repositories.

TABLE 5.3: REPOSITORY LOCATIONS ON THE CLOUD LIFECYCLE MANAGER SERVER

Channel	Directory on the Administration Server
Mandatory Repositories	
SLES12-SP3-Pool	/srv/www/suse-12.3/x86_64/repos/SLES12-SP3-Pool/
SLES12-SP3-Updates	/srv/www/suse-12.3/x86_64/repos/SLES12-SP3-Updates/
SUSE-OpenStack-Cloud-8-Pool	/srv/www/suse-12.3/x86_64/repos/SUSE-OpenStack-Cloud-8-Pool/
SUSE-OpenStack-Cloud-8-Updates	/srv/www/suse-12.3/x86_64/repos/SUSE-OpenStack-Cloud-8-Updates

6 Boot from SAN and Multipath Configuration

6.1 Introduction

For information about supported hardware for multipathing, see *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 2 "Hardware and Software Support Matrix", Section 2.2 "Supported Hardware Configurations"*.

> **Important**
>
> When exporting a LUN to a node for boot from SAN, you should ensure that *LUN 0* is assigned to the LUN and configure any setup dialog that is necessary in the firmware to consume this LUN 0 for OS boot.

> **Important**
>
> Any hosts that are connected to 3PAR storage must have a `host persona` of `2-generic-alua` set on the 3PAR. Refer to the 3PAR documentation for the steps necessary to check this and change if necessary.

iSCSI boot from SAN is not supported. For more information on the use of Cinder with multipath, see *Section 22.1.3, "Multipath Support"*.

To allow SUSE OpenStack Cloud 8 to use volumes from a SAN, you have to specify configuration options for both the installation and the OS configuration phase. In all cases, the devices that are utilized are devices for which multipath is configured.

6.2 Install Phase Configuration

For FC connected nodes and for FCoE nodes where the network processor used is from the Emulex family such as for the 650FLB, the following changes need to be made.

1. In each stanza of the `servers.yml` insert a line stating `boot-from-san: true`

```
- id: controller2
```

```
      ip-addr: 192.168.10.4
      role: CONTROLLER-ROLE
      server-group: RACK2
      nic-mapping: HP-DL360-4PORT
```

This uses the disk `/dev/mapper/mpatha` as the default device on which to install the OS.

2. In the disk input models, specify the devices that will be used via their multipath names (which will be of the form `/dev/mapper/mpatha`, `/dev/mapper/mpathb`, etc.).

```
    volume-groups:
      - name: ardana-vg
        physical-volumes:

          # NOTE: 'sda_root' is a templated value. This value is checked in
          # os-config and replaced by the partition actually used on sda
          #for example sda1 or sda5
          - /dev/mapper/mpatha_root

...
      - name: vg-comp
        physical-volumes:
          - /dev/mapper/mpathb
```

Instead of using Cobbler, you need to provision a baremetal node manually using the following procedure.

1. Assign a static IP to the node.

   a. Use the **`ip addr`** command to list active network interfaces on your system:

```
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eno1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen
 1000
    link/ether f0:92:1c:05:89:70 brd ff:ff:ff:ff:ff:ff
    inet 10.13.111.178/26 brd 10.13.111.191 scope global eno1
       valid_lft forever preferred_lft forever
    inet6 fe80::f292:1cff:fe05:8970/64 scope link
       valid_lft forever preferred_lft forever
3: eno2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen
 1000
```

```
    link/ether f0:92:1c:05:89:74 brd ff:ff:ff:ff:ff:ff
```

b. Identify the network interface that matches the MAC address of your server and edit the corresponding configuration file in `/etc/sysconfig/network-scripts`. For example, for the `eno1` interface, open the `/etc/sysconfig/network-scripts/ifcfg-eno1` file and edit *`IPADDR`* and *`NETMASK`* values to match your environment. Note that the *`IPADDR`* is used in the corresponding stanza in `servers.yml`. You may also need to set `BOOTPROTO` to `none`:

```
TYPE=Ethernet
BOOTPROTO=none
DEFROUTE=yes
PEERDNS=yes
PEERROUTES=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_PEERDNS=yes
IPV6_PEERROUTES=yes
IPV6_FAILURE_FATAL=no
NAME=eno1
UUID=36060f7a-12da-469b-a1da-ee730a3b1d7c
DEVICE=eno1
ONBOOT=yes
NETMASK=255.255.255.192
IPADDR=10.13.111.14
```

c. Reboot the SLES node and ensure that it can be accessed from the Cloud Lifecycle Manager.

2. Add the `ardana` user and home directory:

```
root # useradd -m -d /var/lib/ardana -U ardana
```

3. Allow the user `ardana` to run **`sudo`** without a password by creating the `/etc/sudoers.d/ardana` file with the following configuration:

```
ardana ALL=(ALL) NOPASSWD:ALL
```

4. When you start installation using the Cloud Lifecycle Manager, or if you are adding a SLES node to an existing cloud, you need to copy the Cloud Lifecycle Manager public key to the SLES node to enable passwordless SSH access. One way of doing this is to copy the file `~/.ssh/authorized_keys` from another node in the cloud to the same location on

the SLES node. If you are installing a new cloud, this file will be available on the nodes after running the `bm-reimage.yml` playbook. Ensure that there is global read access to the file `/var/lib/ardana/.ssh/authorized_keys`.
Use the following command to test passwordless SSH from the deployer and check the ability to remotely execute sudo commands:

```
ssh stack@SLES_NODE_IP "sudo tail -5 /var/log/messages"
```

6.2.1 Deploying the Cloud

1. Run the configuration processor:

```
tux > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

For automated installation, you can specify the required parameters. For example, the following command disables encryption by the configuration processor:

```
    ansible-playbook -i hosts/localhost config-processor-run.yml \
    -e encrypt="" -e rekey=""
```

2. Use the following playbook below to create a deployment directory:

```
tux > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

3. To ensure that all existing non-OS partitions on the nodes are wiped prior to installation, you need to run the `wipe_disks.yml` playbook. The `wipe_disks.yml` playbook is only meant to be run on systems immediately after running `bm-reimage.yml`. If used for any other case, it may not wipe all of the expected partitions.
This step is not required if you are using clean machines.
Before you run the `wipe_disks.yml` playbook, you need to make the following changes in the deployment directory.

   - In the `~/scratch/ansible/next/ardana/ansible/roles/diskconfig/tasks/get_disk_info.yml` file, locate the following line:

```
shell: ls -1 /dev/mapper/ | grep "mpath" | grep -v
 {{ wipe_disks_skip_partition }}$ | grep -v {{ wipe_disks_skip_partition }}
[0-9]
```

Replace it with:

```
shell: ls -1 /dev/mapper/ | grep "mpath"  | grep -v
 {{ wipe_disks_skip_partition }}$ | grep -v {{ wipe_disks_skip_partition }}
[0-9] | grep -v {{ wipe_disks_skip_partition }}_part[0-9]
```

- In the `~/scratch/ansible/next/ardana/ansible/roles/multipath/tasks/install.yml` file, set the `multipath_user_friendly_names` variable value to `yes` for all occurrences.

Run the `wipe_disks.yml` playbook:

```
tux > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml
```

If you have used an encryption password when running the configuration processor, use the command below, and enter the encryption password when prompted:

```
ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml --ask-vault-pass
```

4. Run the `site.yml` playbook:

```
tux > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts site.yml
```

If you have used an encryption password when running the configuration processor, use the command below, and enter the encryption password when prompted:

```
ansible-playbook -i hosts/verb_hosts site.yml --ask-vault-pass
```

The step above runs `osconfig` to configure the cloud and `ardana-deploy` to deploy the cloud. Depending on the number of nodes, this step may take considerable time to complete.

6.3 QLogic FCoE restrictions and additional configurations

If you are using network cards such as Qlogic Flex Fabric 536 and 630 series, there are additional OS configuration steps to support the importation of LUNs as well as some restrictions on supported configurations.

The restrictions are:

- Only one network card can be enabled in the system.
- The FCoE interfaces on this card are dedicated to FCoE traffic. They cannot have IP addresses associated with them.
- NIC mapping cannot be used.

In addition to the configuration options above, you also need to specify the FCoE interfaces for install and for os configuration. There are 3 places where you need to add additional configuration options for fcoe-support:

- In `servers.yml`, which is used for configuration of the system during OS install, FCoE interfaces need to be specified for each server. In particular, the mac addresses of the FCoE interfaces need to be given, *not* the symbolic name (for example, `eth2`).

```
- id: compute1
  ip-addr: 10.245.224.201
  role: COMPUTE-ROLE
  server-group: RACK2
  mac-addr: 6c:c2:17:33:4c:a0
  ilo-ip: 10.1.66.26
  ilo-user: linuxbox
  ilo-password: linuxbox123
  boot-from-san: True
  fcoe-interfaces:
     - 6c:c2:17:33:4c:a1
     - 6c:c2:17:33:4c:a9
```

Important

NIC mapping cannot be used.

- For the osconfig phase, you will need to specify the `fcoe-interfaces` as a peer of `network-interfaces` in the `net_interfaces.yml` file:

```
- name: CONTROLLER-INTERFACES
  fcoe-interfaces:
    - name: fcoe
      devices:
         - eth2
         - eth3
  network-interfaces:
```

```
      - name: eth0
        device:
            name: eth0
        network-groups:
          - EXTERNAL-API
          - EXTERNAL-VM
          - GUEST
          - MANAGEMENT
```

Important

The MAC addresses specified in the `fcoe-interfaces` stanza in `servers.yml` must correspond to the symbolic names used in the `fcoe-interfaces` stanza in `net_interfaces.yml`.

Also, to satisfy the FCoE restriction outlined in *Section 6.3, "QLogic FCoE restrictions and additional configurations"* above, there can be no overlap between the devices in `fcoe-interfaces` and those in `network-interfaces` in the `net_interfaces.yml` file. In the example, `eth2` and `eth3` are `fcoe-interfaces` while `eth0` is in `network-interfaces`.

- As part of the initial install from an iso, additional parameters need to be supplied on the kernel command line:

```
multipath=true partman-fcoe/interfaces=<mac address1>,<mac address2> disk-detect/
fcoe/enable=true --- quiet
```

Since NIC mapping is not used to guarantee order of the networks across the system the installer will remap the network interfaces in a deterministic fashion as part of the install. As part of the installer dialogue, if DHCP is not configured for the interface, it is necessary to confirm that the appropriate interface is assigned the ip address. The network interfaces may not be at the names expected when installing via an ISO. When you are asked to apply an IP address to an interface, press `Alt`–`F2` and in the console window, run the command **`ip a`** to examine the interfaces and their associated MAC addresses. Make a note of the interface name with the expected MAC address and use this in the subsequent dialog. Press `Alt`–`F1` to return to the installation screen. You should note that the names of the interfaces may have changed after the installation completes. These names are used consistently in any subsequent operations.

Therefore, even if FCoE is not used for boot from SAN (for example for cinder), then it is recommended that `fcoe-interfaces` be specified as part of install (without the multipath or disk detect options). Alternatively, you need to run `osconfig-fcoe-reorder.yml` before `site.yml` or `osconfig-run.yml` is invoked to reorder the networks in a similar manner to the installer. In this case, the nodes will need to be manually rebooted for the network reorder to take effect. Run `osconfig-fcoe-reorder.yml` in the following scenarios:

- If you have used a third-party installer to provision your bare-metal nodes
- If you are booting from a local disk (that is one that is not presented from the SAN) but you want to use FCoE later, for example, for cinder.

To run the command:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts osconfig-fcoe-reorder.yml
```

If you do not run `osconfig-fcoe-reorder.yml`, you will encounter a failure in `osconfig-run.yml`.

If you are booting from a local disk, the LUNs that will be imported over FCoE will not be visible before `site.yml` or `osconfig-run.yml` has been run. However, if you need to import the LUNs before this, for instance, in scenarios where you need to run `wipe_disks.yml` (run this only after first running `bm-reimage.yml`), then you can run the `fcoe-enable` playbook across the nodes in question. This will configure FCoE and import the LUNs presented to the nodes.

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/verb_hosts fcoe-enable.yml
```

6.4 Installing the SUSE OpenStack Cloud 8 ISO for Nodes That Support Boot From SAN

1. During manual installation of SUSE Linux Enterprise Server 12 SP3, select the desired SAN disk and create an LVM partitioning scheme that meets SUSE OpenStack Cloud requirements, that is it has an `ardana-vg` volume group and an `ardana-vg-root` logical volume. For further information on partitioning, see *Section 3.3, “Partitioning”*.
2. After the installation is completed and the system is booted up, open the file `/etc/multipath.conf` and edit the defaults as follows:

   ```
   defaults {
       user_friendly_names yes
       bindings_file "/etc/multipath/bindings"
   ```

```
}
```

3. Open the `/etc/multipath/bindings` file and map the expected device name to the SAN disk selected during installation. In SUSE OpenStack Cloud, the naming convention is `mpatha`, `mpathb`, and so on. For example:

```
mpatha-part1    360000000030349030-part1
mpatha-part2    360000000030349030-part2
mpatha-part3    360000000030349030-part3

mpathb-part1    360000000030349000-part1
mpathb-part2    360000000030349000-part2
```

4. Reboot the machine to enable the changes.

II Cloud Installation

7 Overview

Before starting the installation, review the sample configurations offered by SUSE OpenStack Cloud in *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations"*. SUSE OpenStack Cloud ships with highly tuned example configurations for each of these cloud models:

Name	Location
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.1 "Entry-Scale Cloud"*	`~/openstack/examples/entry-scale-kvm`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.2 "Entry Scale Cloud with Metering and Monitoring Services"*	`~/openstack/examples/entry-scale-kvm-mml`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.4 "ESX Examples", Section 9.4.1 "Single-Region Entry-Scale Cloud with a Mix of KVM and ESX Hypervisors"*	`~/openstack/examples/entry-scale-esx-kvm`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.4 "ESX Examples", Section 9.4.2 "Single-Region Entry-Scale Cloud with Metering and Monitoring Services, and a Mix of KVM and ESX Hypervisors"*	`~/openstack/examples/entry-scale-esx-kvm-mml`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.5 "Swift Examples", Section 9.5.1 "Entry-scale Swift Model"*	`~/openstack/examples/entry-scale-swift`

Name	Location
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.6 "Ironic Examples", Section 9.6.1 "Entry-Scale Cloud with Ironic Flat Network"*	`~/openstack/examples/entry-scale-ironic-flat-network`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.6 "Ironic Examples", Section 9.6.2 "Entry-Scale Cloud with Ironic Multi-Tenancy"*	`~/openstack/examples/entry-scale-ironic-multi-tenancy`
Book "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.3 "Single-Region Mid-Size Model"*	`~/openstack/examples/mid-scale-kvm`

There are two methods for installation to choose from:

- You can use a GUI that runs in your Web browser.
- You can install via the command line that gives you the flexibility and full control of SUSE OpenStack Cloud 8.

Using the GUI

You should use the GUI if:

- You are not planning to deploy availability zones, L3 segmentation, or server groups functionality in your initial deployment.
- You are satisfied with the tuned SUSE-default OpenStack configuration.

Instructions for GUI installation are in *Chapter 9, Installing with the Install UI*.

Note

Reconfiguring your cloud can only be done via the command line. The GUI installer is for initial installation only.

Using the Command Line

You should use the command line if:

- You are installing a complex or large-scale cloud.
- You are planning to deploy availability zones, L3 segmentation, or server groups functionality. For more information, see the *Book* “Planning an Installation with Cloud Lifecycle Manager”, *Chapter 5 “Input Model”*.
- You want to customize the cloud configuration beyond the tuned defaults that SUSE provides out of the box.
- You need more extensive customizations than are possible using the GUI.

Instructions for installing via the command line are in *Chapter 12, Installing Mid-scale and Entry-scale KVM*.

8 Preparing for Stand-Alone Deployment

8.1 Cloud Lifecycle Manager Installation Alternatives

The Cloud Lifecycle Manager can be installed on a Control Plane or on a stand-alone server.

- Installing the Cloud Lifecycle Manager on a Control Plane is done during the process of deploying your Cloud. Your Cloud and the Cloud Lifecycle Manager are deployed together.
- With a standalone Cloud Lifecycle Manager, you install the deployer first and then deploy your Cloud in a separate process. Either the Install UI or command line can be used to deploy a stand-alone Cloud Lifecycle Manager.

Each method is suited for particular needs. The best choice depends on your situation.

Stand-alone Deployer

- + Compared to a Control Plane deployer, a stand-alone deployer is easier to backup and redeploy in case of disaster
- + Separates cloud management from components being managed
- + Does not use Control Plane resources
- - Another server is required (less of a disadvantage if using a VM)
- - Installation may be more complex than a Control Plane Cloud Lifecycle Manager

Control Plane Deployer

- + Installation is usually simpler than installing a stand-alone deployer
- + Requires fewer servers or VMs
- - Could contend with workloads for resources
- - Harder to redeploy in case of failure compared to stand-alone deployer
- - There is a risk to the Cloud Lifecycle Manager when updating or modifying controllers
- - Runs on one of the servers that is deploying or managing your Cloud

Summary

- A Control Plane Cloud Lifecycle Manager is best for small, simple Cloud deployments.
- With a larger, more complex cloud, a stand-alone deployer provides better recoverability and the separation of manager from managed components.

8.2 Installing a Stand-Alone Deployer

If you do not intend to install a stand-alone deployer, proceed to installing the Cloud Lifecycle Manager on a Control Plane.

- Instructions for GUI installation are in *Chapter 9, Installing with the Install UI*.
- Instructions for installing via the command line are in *Chapter 12, Installing Mid-scale and Entry-scale KVM*.

8.2.1 Before You Start

1. Review the *Chapter 2, Pre-Installation Checklist* about recommended pre-installation tasks.
2. Prepare the Cloud Lifecycle Manager node. The Cloud Lifecycle Manager must be accessible either directly or via `ssh`, and have SUSE Linux Enterprise Server 12 SP3 installed. All nodes must be accessible to the Cloud Lifecycle Manager. If the nodes do not have direct access to online Cloud subscription channels, the Cloud Lifecycle Manager node will need to host the Cloud repositories.

    a. If you followed the installation instructions for Cloud Lifecycle Manager server (see *Chapter 3, Installing the Cloud Lifecycle Manager server*), SUSE OpenStack Cloud software should already be installed. Double-check whether SUSE Linux Enterprise and SUSE OpenStack Cloud are properly registered at the SUSE Customer Center by starting YaST and running *Software › Product Registration*.
    If you have not yet installed SUSE OpenStack Cloud, do so by starting YaST and running *Software › Product Registration › Select Extensions*. Choose *SUSE OpenStack Cloud* and follow the on-screen instructions. Make sure to register SUSE OpenStack Cloud during the installation process and to install the software pattern `patterns-cloud-ardana`.

    ```
    tux > sudo zypper -n in patterns-cloud-ardana
    ```

b. Ensure the SUSE OpenStack Cloud media repositories and updates repositories are made available to all nodes in your deployment. This can be accomplished either by configuring the Cloud Lifecycle Manager server as an SMT mirror as described in *Chapter 4, Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)* or by syncing or mounting the Cloud and updates repositories to the Cloud Lifecycle Manager server as described in *Chapter 5, Software Repository Setup*.

c. Configure passwordless **`sudo`** for the user created when setting up the node (as described in *Section 3.4, "Creating a User"*). Note that this is *not* the user `ardana` that will be used later in this procedure. In the following we assume you named the user `cloud`. Run the command **`visudo`** as user `root` and add the following line to the end of the file:

```
CLOUD ALL = (root) NOPASSWD:ALL
```

Make sure to replace *`CLOUD`* with your user name choice.

d. Set the password for the user `ardana`:

```
tux > sudo passwd ardana
```

e. Become the user `ardana`:

```
tux > su - ardana
```

f. Place a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and rename it to `sles12sp3.iso`.

g. Install the templates, examples, and working model directories:

```
ardana > /usr/bin/ardana-init
```

8.2.2 Configuring for a Stand-Alone Deployer

The following steps are necessary to set up a stand-alone deployer whether you will be using the Install UI or command line.

1. Copy the SUSE OpenStack Cloud Entry-scale KVM example input model to a stand-alone input model. This new input model will be edited so that it can be used as a stand-alone Cloud Lifecycle Manager installation.

```
tux > cp -r ~/openstack/examples/entry-scale-kvm/* \
~/openstack/examples/entry-scale-kvm-stand-alone-deployer
```

2. Change to the new directory

```
tux > cd ~/openstack/examples/entry-scale-kvm-stand-alone-deployer
```

3. Edit the cloudConfig.yml file to change the name of the input model. This will make the model available both to the Install UI and to the command line installation process. Change `name: entry-scale-kvm` to `name: entry-scale-kvm-stand-alone-deployer`

4. Change to the `data` directory.

5. Make the following edits to your configuration files.

Important

The indentation of each of the input files is important and will cause errors if not done correctly. Use the existing content in each of these files as a reference when adding additional content for your Cloud Lifecycle Manager.

- Update `control_plane.yml` to add the Cloud Lifecycle Manager.
- Update `server_roles.yml` to add the Cloud Lifecycle Manager role.
- Update `net_interfaces.yml` to add the interface definition for the Cloud Lifecycle Manager.
- Create a `disks_lifecycle_manager.yml` file to define the disk layout for the Cloud Lifecycle Manager.
- Update `servers.yml` to add the dedicated Cloud Lifecycle Manager node.

`Control_plane.yml`: The snippet below shows the addition of a single node cluster into the control plane to host the Cloud Lifecycle Manager service.

Important

In addition to adding the new cluster, you also have to remove the Cloud Lifecycle Manager component from the `cluster1` in the examples.

```
clusters:
  - name: cluster0
    cluster-prefix: c0
    server-role: LIFECYCLE-MANAGER-ROLE
    member-count: 1
    allocation-policy: strict
    service-components:
      - lifecycle-manager
      - ntp-client
  - name: cluster1
    cluster-prefix: c1
    server-role: CONTROLLER-ROLE
    member-count: 3
    allocation-policy: strict
    service-components:
      - ntp-server
```

This specifies a single node of role `LIFECYCLE-MANAGER-ROLE` hosting the Cloud Lifecycle Manager.

`Server_roles.yml`: The snippet below shows the insertion of the new server roles definition:

```
server-roles:

   - name: LIFECYCLE-MANAGER-ROLE
     interface-model: LIFECYCLE-MANAGER-INTERFACES
     disk-model: LIFECYCLE-MANAGER-DISKS

   - name: CONTROLLER-ROLE
```

This defines a new server role which references a new interface-model and disk-model to be used when configuring the server.

`net-interfaces.yml`: The snippet below shows the insertion of the network-interface info:

```
- name: LIFECYCLE-MANAGER-INTERFACES
  network-interfaces:
    - name: BOND0
      device:
         name: bond0
      bond-data:
         options:
             mode: active-backup
```

```
            miimon: 200
            primary: hed3
        provider: linux
        devices:
            - name: hed3
            - name: hed4
    network-groups:
        - MANAGEMENT
```

This assumes that the server uses the same physical networking layout as the other servers in the example.

`disks_lifecycle_manager.yml`: In the examples, disk-models are provided as separate files (this is just a convention, not a limitation) so the following should be added as a new file named `disks_lifecycle_manager.yml`:

```
---
  product:
    version: 2

  disk-models:
  - name: LIFECYCLE-MANAGER-DISKS
    # Disk model to be used for Cloud Lifecycle Managers nodes
    # /dev/sda_root is used as a volume group for /, /var/log and /var/crash
    # sda_root is a templated value to align with whatever partition is really used
    # This value is checked in os config and replaced by the partition actually
 used
    # on sda e.g. sda1 or sda5

    volume-groups:
      - name: ardana-vg
        physical-volumes:
          - /dev/sda_root

      logical-volumes:
      # The policy is not to consume 100% of the space of each volume group.
      # 5% should be left free for snapshots and to allow for some flexibility.
          - name: root
            size: 80%
            fstype: ext4
            mount: /
          - name: crash
            size: 15%
            mount: /var/crash
            fstype: ext4
            mkfs-opts: -O large_file
        consumer:
```

```
              name: os
```

`Servers.yml`: The snippet below shows the insertion of an additional server used for hosting the Cloud Lifecycle Manager. Provide the address information here for the server you are running on, that is, the node where you have installed the SUSE OpenStack Cloud ISO.

```
servers:
   # NOTE: Addresses of servers need to be changed to match your environment.
   #
   #       Add additional servers as required

   #Lifecycle-manager
   - id: lifecycle-manager
     ip-addr: YOUR IP ADDRESS HERE
     role: LIFECYCLE-MANAGER-ROLE
     server-group: RACK1
     nic-mapping: HP-SL230-4PORT
     mac-addr: 8c:dc:d4:b5:c9:e0
     # ipmi information is not needed

   # Controllers
   - id: controller1
     ip-addr: 192.168.10.3
     role: CONTROLLER-ROLE
```

With the stand-alone input model complete, you are ready to proceed to installing the stand-alone deployer with either the Install UI or the command line.

9 Installing with the Install UI

SUSE OpenStack Cloud comes with a GUI-based installation wizard for first-time cloud installations. It will guide you through the configuration process and deploy your cloud based on the custom configuration you provide. The Install UI will start with a set of example cloud configurations for you to choose from. Based on your cloud choice, you can refine your configuration to match your needs using Install UI widgets. You can also directly edit your model configuration files.

> **Note**
>
> The Install UI is only for initial deployments. It will not function properly after your cloud has been deployed successfully, whether it was from the CLI or with the Install UI.

When you are satisfied with your configuration and the Install UI has validated your configuration successfully, you can then deploy the cloud into your environment. Deploying the cloud will version-control your configuration into a git repository and provide you with live progress of your deployment.

With the Install UI, you have the option of provisioning SLES12-SP3 to IPMI-capable machines described in your configuration files. Provisioning machines with the Install UI will also properly configure them for Ansible access.

The Install UI is designed to make the initial installation process simpler, more accurate, and faster than manual installation.

9.1 Before You Start

1. Review the *Chapter 2, Pre-Installation Checklist* about recommended pre-installation tasks.
2. Prepare the Cloud Lifecycle Manager node. The Cloud Lifecycle Manager must be accessible either directly or via `ssh`, and have SUSE Linux Enterprise Server 12 SP3 installed. All nodes must be accessible to the Cloud Lifecycle Manager. If the nodes do not have direct access to online Cloud subscription channels, the Cloud Lifecycle Manager node will need to host the Cloud repositories.

a. If you followed the installation instructions for Cloud Lifecycle Manager server (see *Chapter 3, Installing the Cloud Lifecycle Manager server*), SUSE OpenStack Cloud software should already be installed. Double-check whether SUSE Linux Enterprise and SUSE OpenStack Cloud are properly registered at the SUSE Customer Center by starting YaST and running *Software* › *Product Registration*.

   If you have not yet installed SUSE OpenStack Cloud, do so by starting YaST and running *Software* › *Product Registration* › *Select Extensions*. Choose *SUSE OpenStack Cloud* and follow the on-screen instructions. Make sure to register SUSE OpenStack Cloud during the installation process and to install the software pattern `patterns-cloud-ardana`.

   ```
   tux > sudo zypper -n in patterns-cloud-ardana
   ```

b. Ensure the SUSE OpenStack Cloud media repositories and updates repositories are made available to all nodes in your deployment. This can be accomplished either by configuring the Cloud Lifecycle Manager server as an SMT mirror as described in *Chapter 4, Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)* or by syncing or mounting the Cloud and updates repositories to the Cloud Lifecycle Manager server as described in *Chapter 5, Software Repository Setup*.

c. Configure passwordless **`sudo`** for the user created when setting up the node (as described in *Section 3.4, "Creating a User"*). Note that this is *not* the user `ardana` that will be used later in this procedure. In the following we assume you named the user `cloud`. Run the command **`visudo`** as user `root` and add the following line to the end of the file:

   ```
   CLOUD ALL = (root) NOPASSWD:ALL
   ```

   Make sure to replace *`CLOUD`* with your user name choice.

d. Set the password for the user `ardana`:

   ```
   tux > sudo passwd ardana
   ```

e. Become the user `ardana`:

   ```
   tux > su - ardana
   ```

f. Place a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and rename it to `sles12sp3.iso`.

g. Install the templates, examples, and working model directories:

```
ardana > /usr/bin/ardana-init
```

9.2 Preparing to Run the Install UI

Before you launch the Install UI to install your cloud, do the following:

1. Gather the following details from the servers that will make up your cloud:
   - Server names
   - IP addresses
   - Server roles
   - PXE MAC addresses
   - PXE IP addresses
   - PXE interfaces
   - IPMI IP address, username, password
2. Choose an input model from *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations"*. No action other than an understanding of your needs is necessary at this point. In the Install UI you will indicate which input model you wish to deploy.
3. Before you use the Install UI to install your cloud, you may install the operating system, SLES, on your nodes (servers) if you choose. Otherwise, the Install UI will install it for you. If you are installing the operating system on all nodes yourself, you must do so using the SLES image included in the SUSE OpenStack Cloud 8 package.

In SUSE OpenStack Cloud 8, a local git repository is used to track configuration changes; the Configuration Processor (CP) uses this repository. Use of a git workflow means that your configuration history is maintained, making rollbacks easier and keeping a record of previous configuration settings. The git repository also provides a way for you to merge changes that you pull down as “upstream” updates (that is, updates from SUSE). It also allows you to manage your own configuration changes.

The git repository is installed by the Cloud Lifecycle Manager on the Cloud Lifecycle Manager node.

Using the Install UI does not require the use of the git repository. After the installation, it may be useful to know more about *Chapter 10, Using Git for Configuration Management*.

9.3 Optional: Creating a CSV File to Import Server Data

Before beginning the installation, you can create a CSV file with your server information to import directly into the Install UI to avoid entering it manually on the *Assign Servers* page.

The following table shows the fields needed for your CSV file.

Field	Required	Required for OS Provisioning	Aliases
Server ID	Yes	Yes	server_id, id
IP Address	Yes	Yes	ip, ip_address, ip_addr
MAC Address	Yes	Yes	mac, mac_address, mac_addr
IPMI IP Address	No	Yes	ipmi_ip, ipmi_ip_address
IPMI User	No	Yes	ipmi_user, user
IPMI Password	No	Yes	ipmi_password, password
Server Role	No	No	server_role, role
Server Group	No	No	server_group, group
NIC Mapping	No	No	server_nic_map, nic_map, nic_mapping

The aliases are all the valid names that can be used in the CSV file for the column header for a given field. Field names are not case sensitive. You can use either ` ` (space) or `-` (hyphen) in place of underscore for a field name.

An example CSV file could be:

```
id,ip-addr,mac-address,server-group,nic-mapping,server-role,ipmi-ip,ipmi-user
controller1,192.168.110.3,b2:72:8d:ac:7c:6f,RACK1,HP-DL360-4PORT,CONTROLLER-ROLE,192.168.109.3,admin
myserver4,10.2.10.24,00:14:22:01:23:44,AZ1,,,,
```

9.4 Optional: Importing Certificates for SUSE Manager and HPE OneView

If you intend to use SUSE Manager or HPE OneView to add servers, certificates for those services must be accessible to the Install UI.

Use the following steps to import a SUSE Manager certificate.

1. Retrieve the `.pem` file from the SUSE Manager.

   ```
   curl -k https://SUSE_MANAGER_IP:PORT/pub/RHN-ORG-TRUSTED-SSL-CERT > PEM_NAME.pem
   ```

2. Copy the `.pem` file to the proper location on the Cloud Lifecycle Manager.

   ```
   cd /etc/pki/trust/anchors
   sudo cp ~/PEM_NAME.pem .
   ```

3. Install the certificate.

   ```
   sudo update-ca-certificates
   ```

4. Add *`SUSE Manager host IP address`* if *`SUSE Manager.test.domain`* is not reachable by DNS.

   ```
   sudo vi /etc/hosts
   ```

   Add *`SUSE Manager host IP address`* *`SUSE Manager.test.domain`*. For example:

   ```
   10.10.10.10 SUSE Manager.test.domain
   ```

Use the following steps to import an HPE OneView certificate.

1. Retrieve the `sessionID`.

```
curl -k -H "X-Api-Version:500" -H "Content-Type: application/json" \
-d '{"userName":ONEVIEW_USER, "password":ONEVIEW_PASSWORD, \
"loginMsgAck":"true"}' https://ONEVIEW_MANAGER_URL:PORT/rest/login-sessions
```

The response will be similar to:

```
{"partnerData":{},"sessionID":"LTYxNjA1O1NjkxMHcI1b2ypaGPscErUOHrl7At3-odHPmR"}
```

2. Retrieve a Certificate Signing Request (CSR) using the `sessionID` from *Step 1*.

```
curl -k -i -H "X-Api-Version:500" -H sessionID \
ONEVIEW_MANAGER_URL/rest/certificates/ca \
> CA_NAME.csr
```

3. Follow instructions in the HPE OneView User Guide to validate the CSR and obtain a signed certificate (`CA_NAME .crt`).

4. Copy the `.crt` file to the proper location on the Cloud Lifecycle Manager.

```
cd /etc/pki/trust/anchors
sudo cp ~/data/CA_NAME.crt .
```

5. Install the certificate.

```
sudo update-ca-certificates
```

6. Follow instructions in your HPE OneView User Guide to import the `CA_NAME`.crt certificate into HPE OneView.

7. Add `HPE OneView host IP address` if `HPE OneView.test.domain` is not reachable by DNS.

```
sudo vi /etc/hosts
```

Add `HPE OneView host IP address` `HPE OneView.test.domain` For example:

```
10.84.84.84  HPE OneView.test.domain
```

9.5 Running the Install UI

> **Important**
>
> The Install UI must run continuously without stopping for authentication at any step. When using the Install UI it is required to launch the Cloud Lifecycle Manager with the following command:
>
> ```
> ARDANA_INIT_AUTO=1 /usr/bin/ardana-init
> ```

Deploying the cloud to your servers will reconfigure networking and firewall rules on your cloud servers. To avoid problems with these networking changes when using the Install UI, we recommend you run a browser directly on your Cloud Lifecycle Manager node and point it to `http://localhost:3000`.

If you cannot run a browser on the Cloud Lifecycle Manager node to perform the install, you can run a browser from a Linux-based computer in your **MANAGEMENT** network. However, firewall rules applied during cloud deployment will block access to the Install UI. To avoid blocking the connection, you can use the Install UI via an SSH tunnel to the Cloud Lifecycle Manager server. This will allow SSH connections through the **MANAGEMENT** network when you reach the "Review Configuration Files" step of the install process.

To open an SSH tunnel from your Linux-based computer in your **MANAGEMENT** network to the Cloud Lifecycle Manager:

1. Open a new terminal and enter the following command:

   ```
   ssh -N -L 8080:localhost:3000 ardana@MANAGEMENT IP address of Cloud Lifecycle
    Manager
   ```

   The user name and password should be what was set in *Section 3.5.2, "Installing the SUSE OpenStack Cloud Extension"*. There will be no prompt after you have logged in.

2. Leave this terminal session open to keep the SSH tunnel open and running. This SSH tunnel will forward connections from your Linux-based computer directly to the Cloud Lifecycle Manager, bypassing firewall restrictions.

3. On your local computer (the one you are tunneling from), point your browser to `http://localhost:8080`.

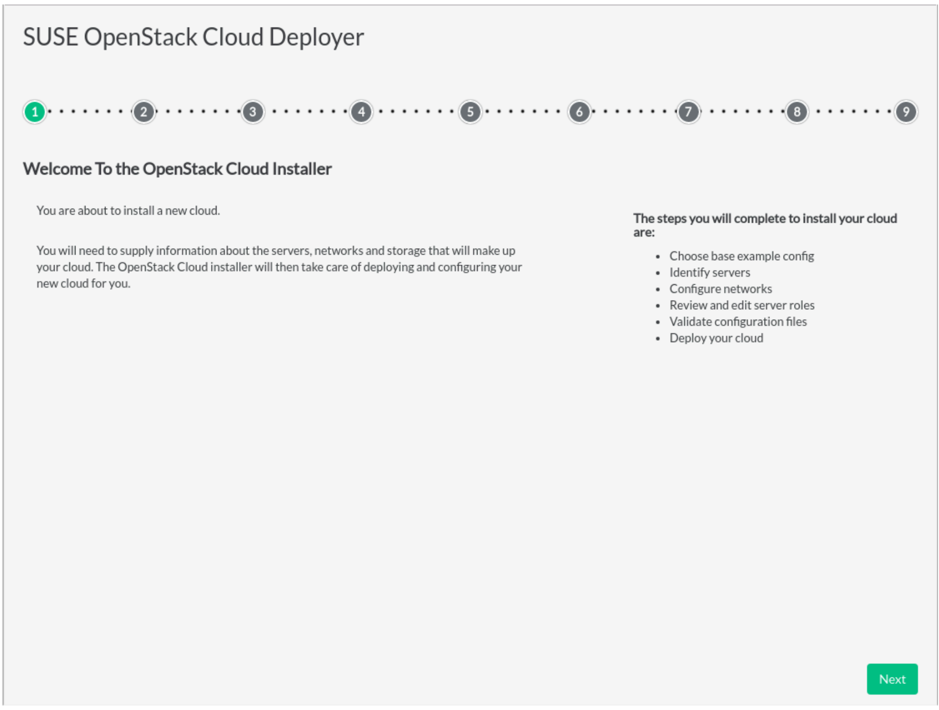
4. If the connection is interrupted, refresh your browser.

Important

If you use an SSH tunnel to connect to the Install UI, there is an important note in the "Review Configuration Files" step about modifying `firewall_rules.yml` to allow SSH connections on the **MANAGEMENT** network.

Overview

The first page of the Install UI shows the general installation process and a reminder to gather some information before beginning. Clicking the *Next* button brings up the *Model Selection* page.



Choose an OpenStack Cloud Model

The input model choices are displayed on this page. Details of each model can be seen on the right by clicking the model name on the left. If you have already decided some aspects of your cloud environment, models can be filtered using the dropdown selections. Narrowing a parameter affects the range of choices of models and changes other dropdown choices to only those that are compatible.

Selecting a model will determine the base template from which the cloud will be deployed. Models can be adjusted later in the process, though selecting the closest match to your requirements reduces the effort required to deploy your cloud.

Warning

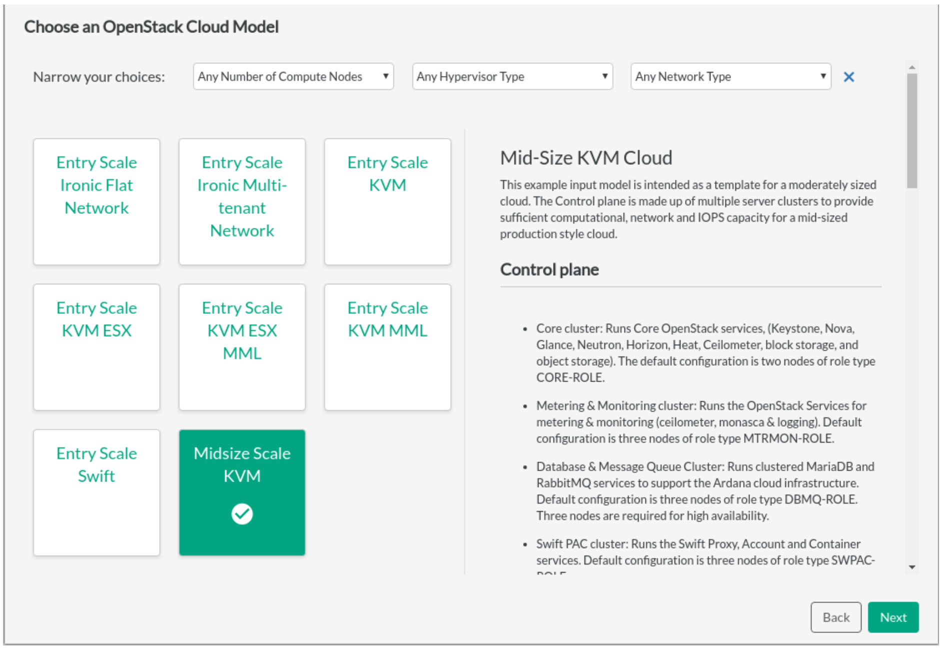
If you select any ESX model, extra manual steps are required to avoid configuration failures. While installing an ESX model with the Install UI, you will be asked for interfaces related to ESX and OVSvApp. Those interfaces must be defined before being entered in the Install UI. Instructions are available at *Section 15.3, "Overview of ESXi and OVSvApp"*.

Note

Installing a Stand-alone Deployer

If you are using the Install UI to install a stand-alone deployer, select that model, which was created previously in *Chapter 8, Preparing for Stand-Alone Deployment*.

Continue with the remaining Install UI steps to finish installing the stand-alone deployer.

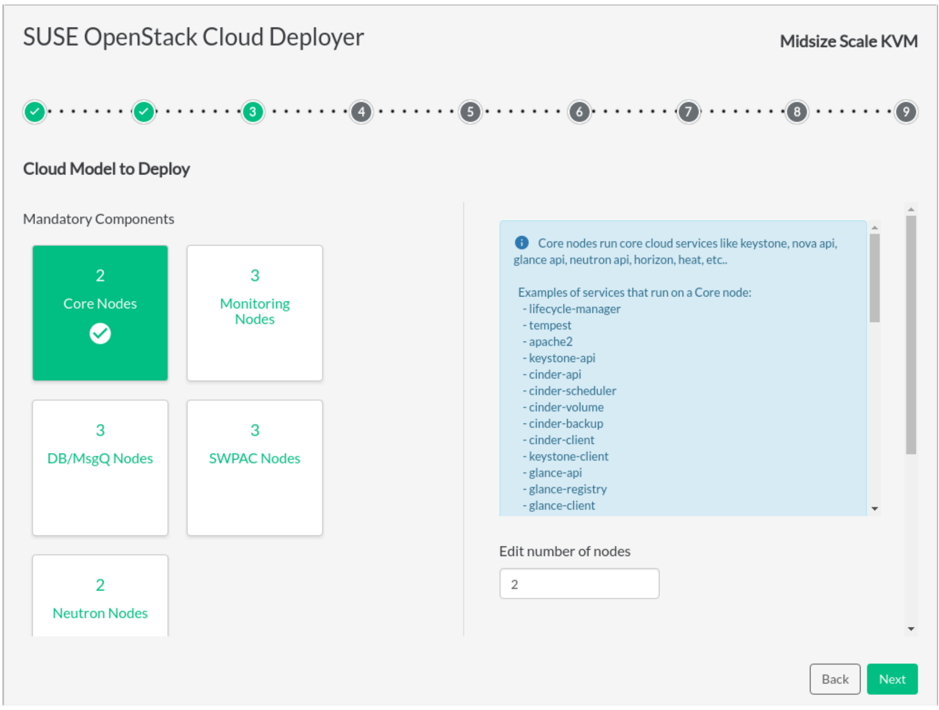


Cloud Model to Deploy

Based on the cloud example selected on the previous page, more detail is shown about that cloud configuration and the components that will be deployed. If you go back and select a different model, the deployment process restarts from the beginning. Any configuration changes you have made will be deleted.

- *Mandatory components* have assigned quantities. We strongly suggest not changing those quantities to avoid potential problems later in the installation process.
- *Additional components* can be adjusted within the parameters shown.

The number of nodes (servers) dedicated to each server role can be adjusted. Most input models are designed to support High Availability and to distribute OpenStack services appropriately.



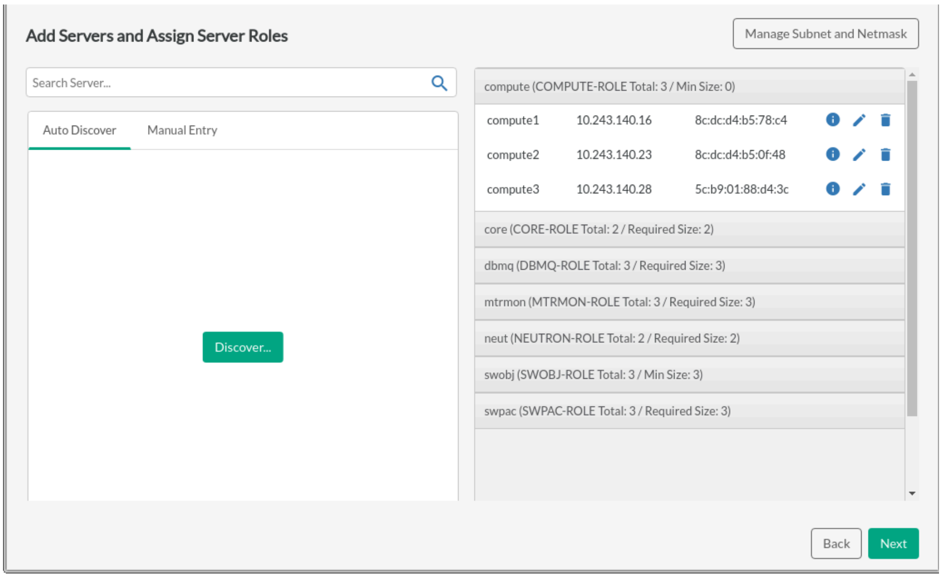
Adding Servers and Assigning Server Roles

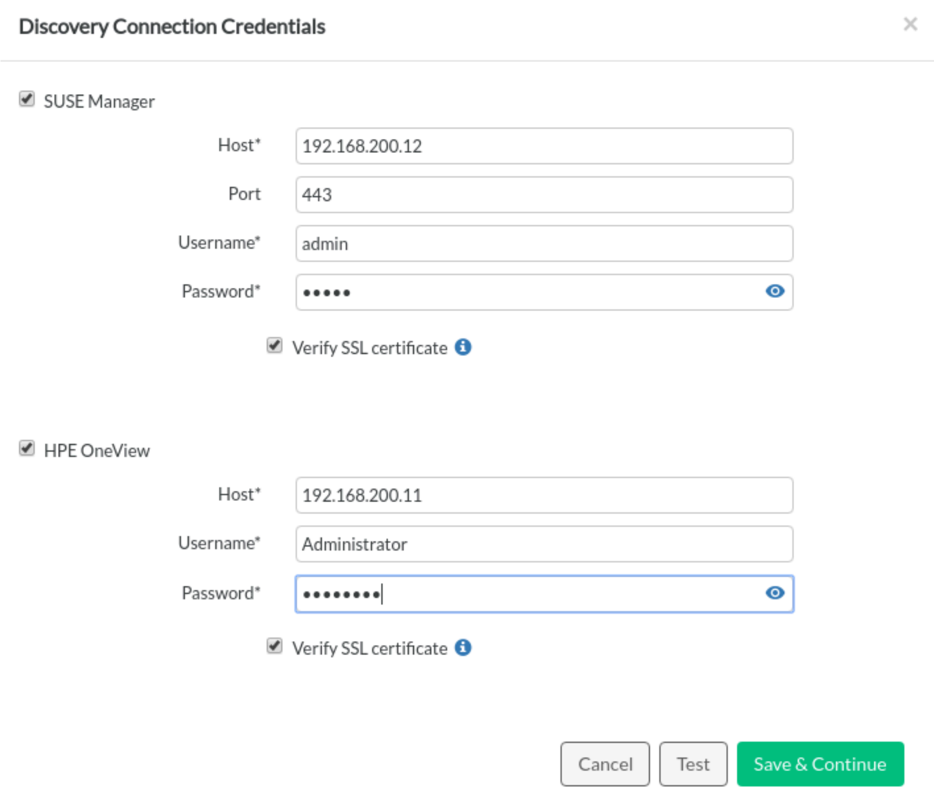
This page provides more detail about the number and assignment of each type of node based on the information from the previous page (any changes must be made there).

Components that do not meet the required parameters will be shown in red in the accordion bar. Missing required fields and duplicate server names will also be red, as will the accordion bar. The *Next* button will be disabled.

Servers may be discovered using SUSE Manager, HPE OneView, or both. Ensure that the certificates are accessible, as described in *Section 9.4, "Optional: Importing Certificates for SUSE Manager and HPE OneView"*. Clicking the *Discover* button will prompt for access credentials to the system management software to be used for discovery. Certificates can be verified by checking *Verify SSL certificate*. After validating credentials, Discovery will retrieve a list of known servers from SUSE Manager and/or HPE OneView and allow access to server details on those management platforms.

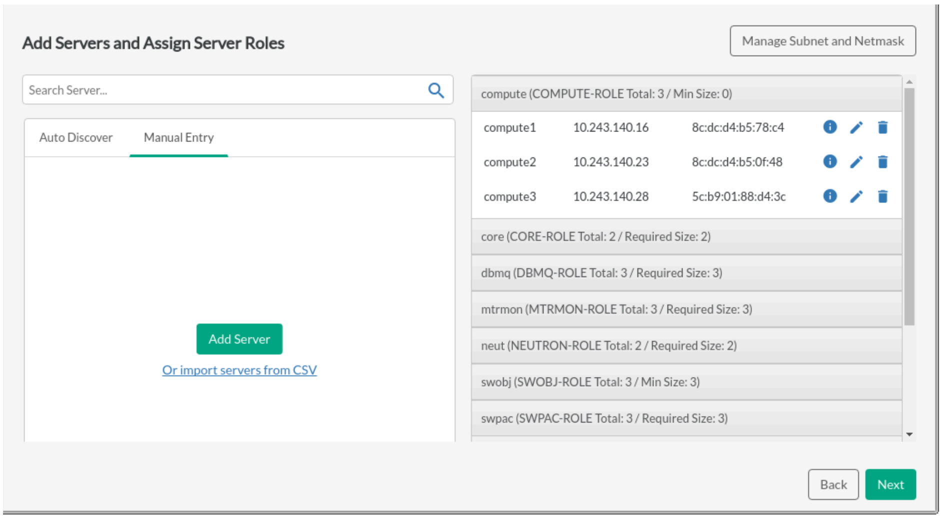
You can drag and drop to move servers from the left to the right in order to assign server roles, from right to left, or up and down in the accordion bar.

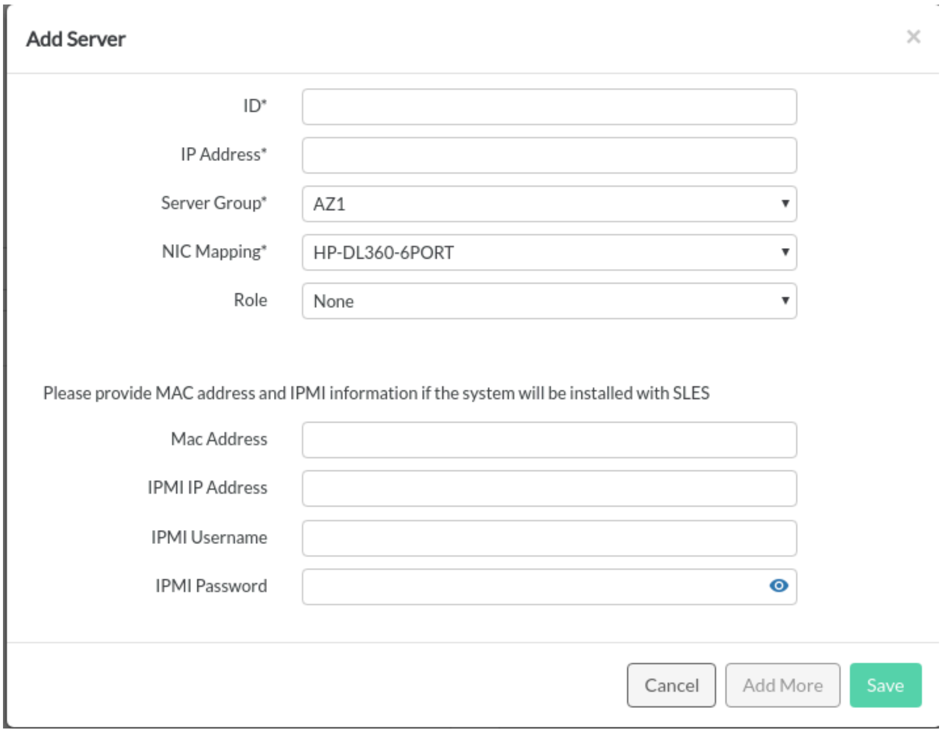




Server information may also be entered manually or imported via CSV in the *Manual Entry* tab. The format for CSV entry is described in *Section 9.3, "Optional: Creating a CSV File to Import Server Data"*. The server assignment list includes placeholder server details that can be edited to reflect real hardware, or can be removed and replaced with discovered or manually added systems.

For more information about server roles, see *Book* "Planning an Installation with Cloud Lifecycle Manager"*, Chapter 5 "Input Model", Section 5.2 "Concepts", Section 5.2.4 "Server Roles"*.

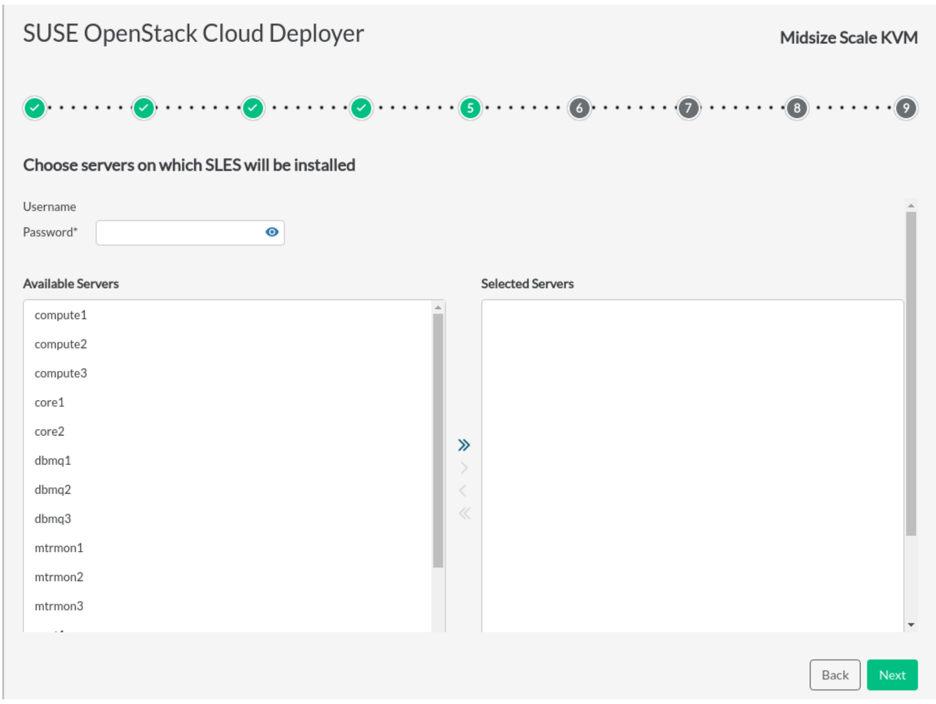


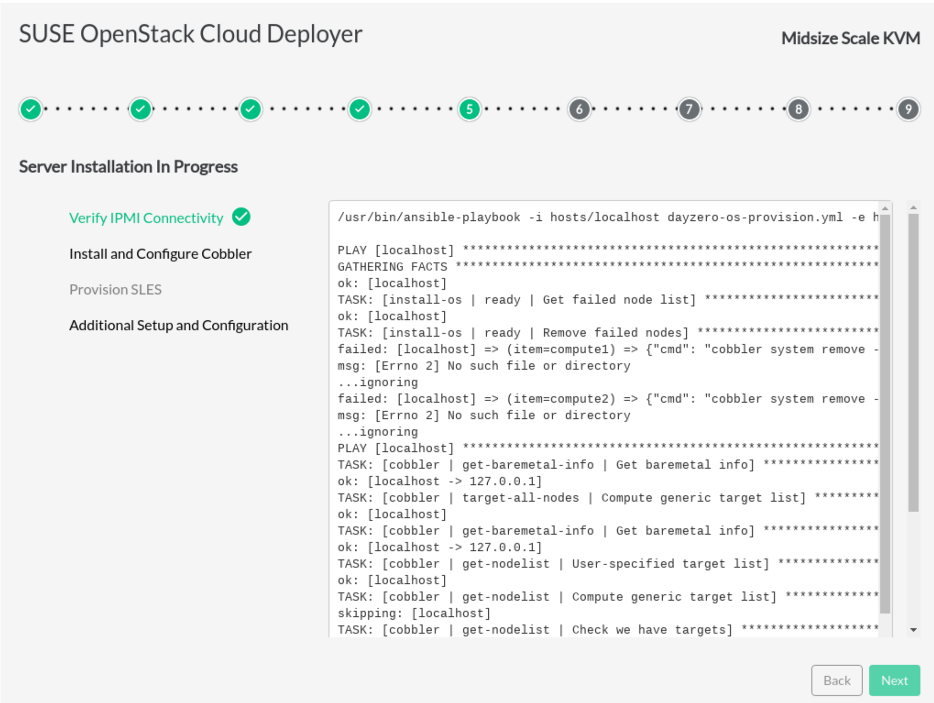


Subnet and netmask values should be set on this page as they may impact the IP addresses being assigned to various servers.

Choose servers on which SLES will be installed

If an OS has not previously been installed on the servers that make up the cloud configuration, the OS installation page allows for Cobbler to deploy SLES on servers in the cloud configuration. Enter password, select servers and click *Install* to deploy SLES to these servers. An installation log and progress indicators will be displayed.


SUSE OpenStack Cloud Deployer
Midsize Scale KVM
Choose servers on which SLES will be installed
Username
Password*
Available Servers
Selected Servers
compute1
compute2
compute3
core1
core2
dbmq1
dbmq2
dbmq3
mtrmon1
mtrmon2
mtrmon3
Back
Next


SUSE OpenStack Cloud Deployer
Midsize Scale KVM
Server Installation In Progress
Verify IPMI Connectivity
Install and Configure Cobbler
Provision SLES
Additional Setup and Configuration
/usr/bin/ansible-playbook -i hosts/localhost dayzero-os-provision.yml -e h
PLAY [localhost]
GATHERING FACTS
ok: [localhost]
TASK: [install-os | ready | Get failed node list]
ok: [localhost]
TASK: [install-os | ready | Remove failed nodes]
failed: [localhost] => (item=compute1) => {"cmd": "cobbler system remove -
msg: [Errno 2] No such file or directory
...ignoring
failed: [localhost] => (item=compute2) => {"cmd": "cobbler system remove -
msg: [Errno 2] No such file or directory
...ignoring
PLAY [localhost]
TASK: [cobbler | get-baremetal-info | Get baremetal info]
ok: [localhost -> 127.0.0.1]
TASK: [cobbler | target-all-nodes | Compute generic target list]
ok: [localhost]
TASK: [cobbler | get-baremetal-info | Get baremetal info]
ok: [localhost -> 127.0.0.1]
TASK: [cobbler | get-nodelist | User-specified target list]
ok: [localhost]
TASK: [cobbler | get-nodelist | Compute generic target list]
skipping: [localhost]
TASK: [cobbler | get-nodelist | Check we have targets]
Back
Next

Server and Role Summary

When the OS installation is complete, a Server and Server Role Summary page is displayed. It shows which servers have been assigned to each role, and provides an opportunity to edit the server configurations. Various cloud components can be configured by clicking on the *Manage Cloud Settings* button. Incorrect information will be shown in red.

Below is the list of what can be changed within the Install UI, followed by a list of customizations that can only be changed by directly editing the files on the *Review Configuration Files* page. Anything changed directly in the files themselves during the Install UI process will be overwritten by values you have entered with the Install UI.

Changes to the following items can be made:

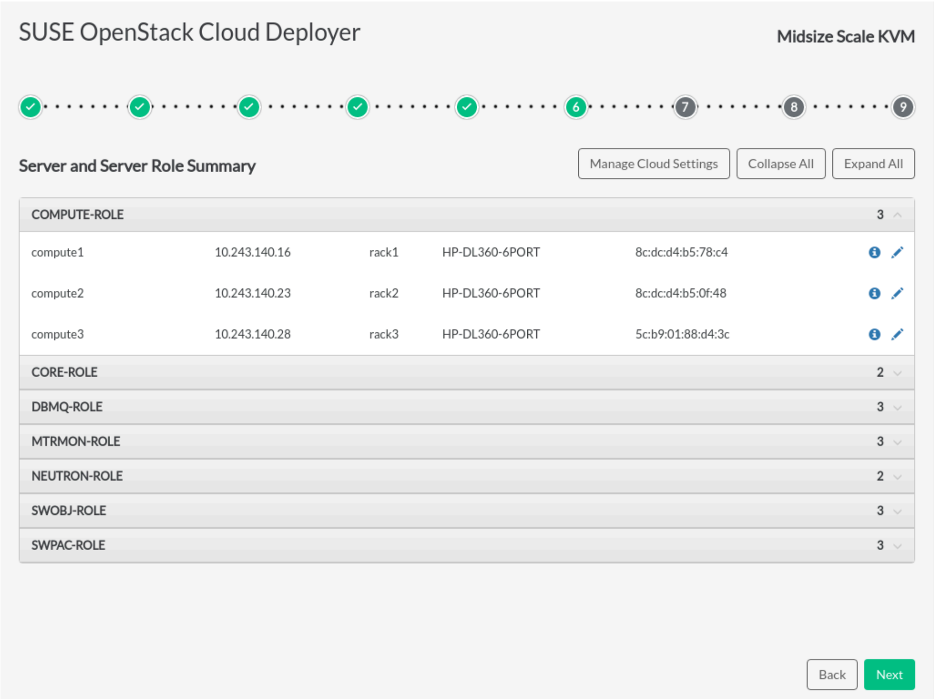
- servers (including SLES installation configuration)
- networks
- disk models
- interface models
- NIC mappings
- NTP servers
- name servers
- tags in network groups

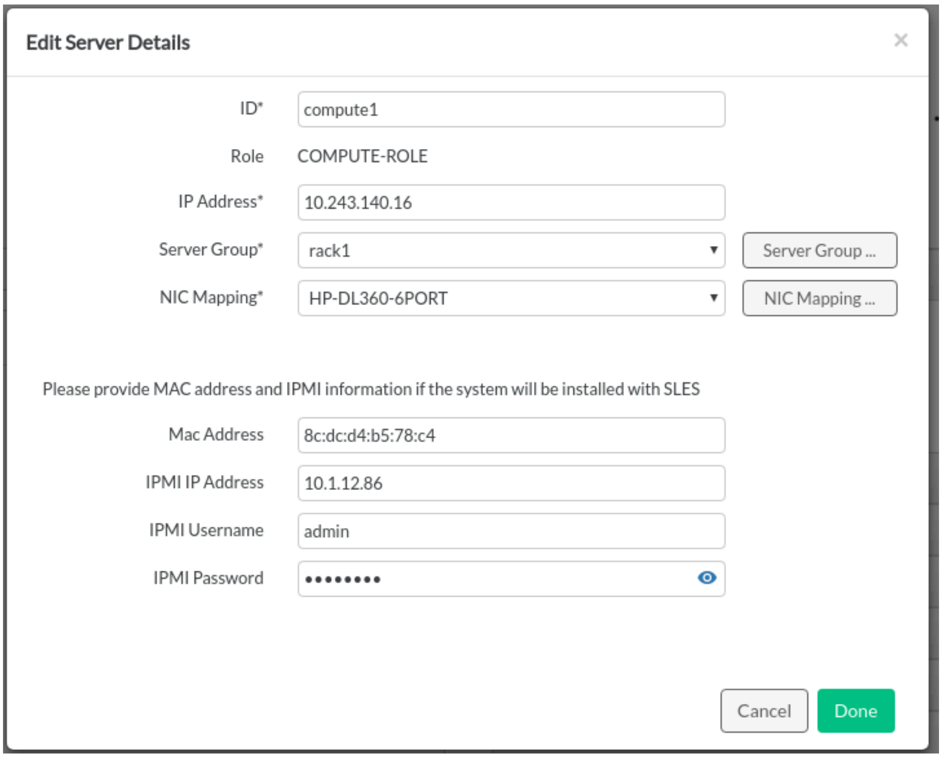
Changes to the following items can only be made by manually editing the associated `.yml` files on the *Review Configuration* page of the Install UI:

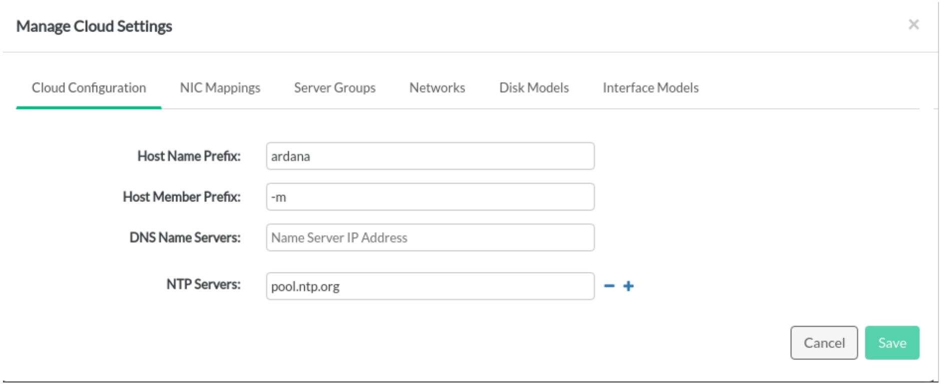
- server groups
- server roles
- network groups
- firewall rules
- DNS, SMTP, firewall settings (`cloudConfig.yml`)
- control planes

Important

Directly changing files may cause the configuration to fail validation. During the process of installing with the Install UI, any changes should be made with the tools provided within the Install UI.

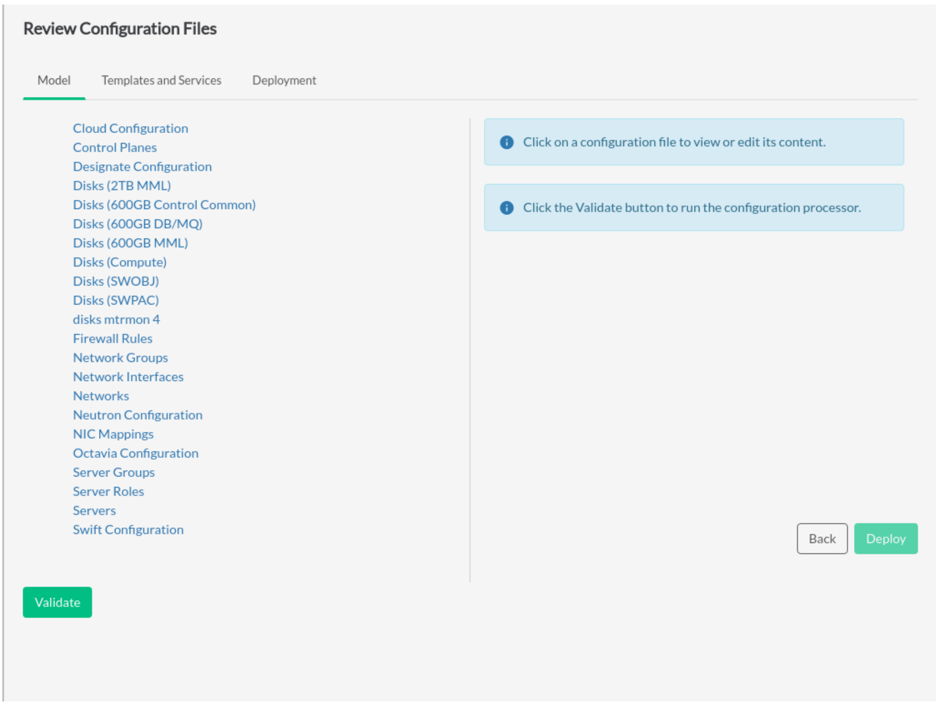






Review Configuration Files

Advanced editing of the cloud configuration can be done on the `Review Configuration Files` page. Individual `.yml` and `.j2` files can be edited directly with the embedded editor in the *Model* and *Templates and Services* tabs. The *Deployment* tab contains the items *Wipe Data Disks*, *Encryption Key* and *Verbosity Level*.



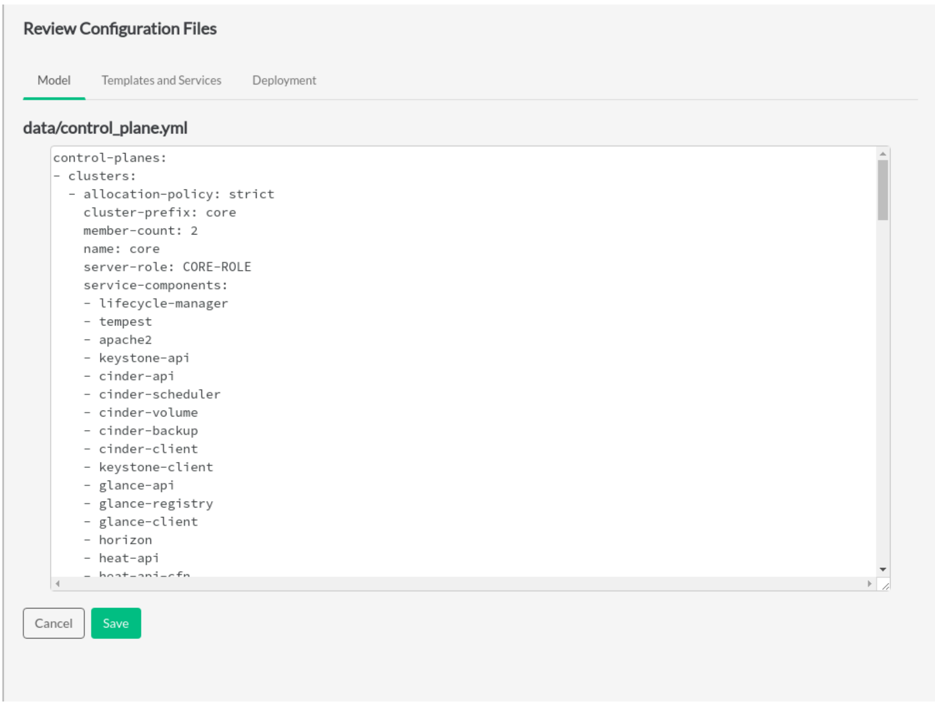
Important

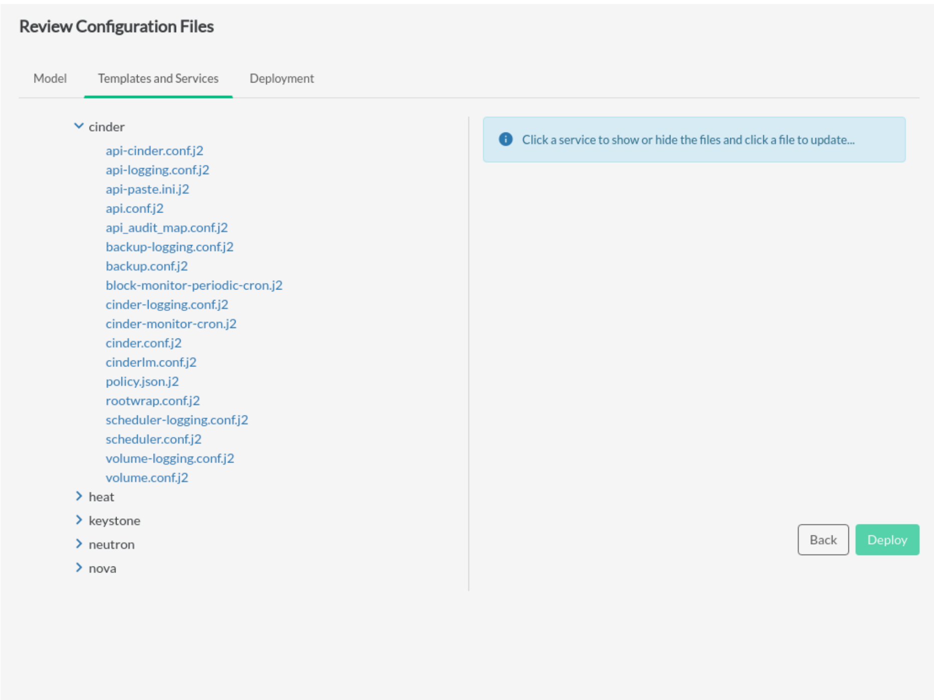
If you are using an SSH tunnel to connect to the Install UI, you will need to make an extra modification here to allow SSH connections through the firewall:

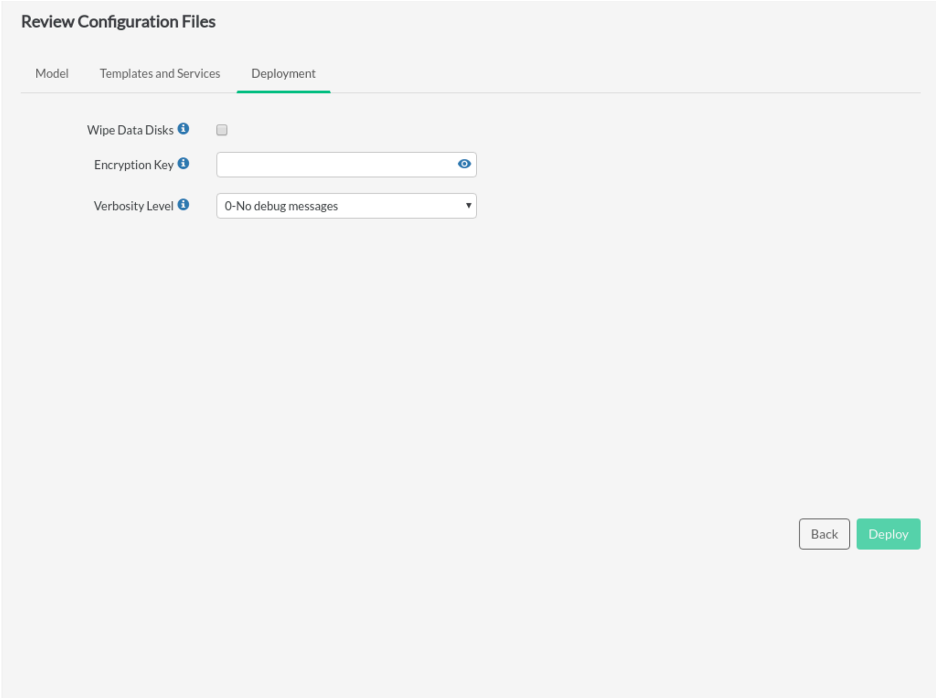
1. While on the Review Configuration Files page, click on the *Model* tab.
2. Click *Firewall Rules*.
3. Uncomment the `SSH` section (remove the `#` at the beginning of the line for the `- name: SSH` section).
4. If you do not have such a `- name: SSH` section, manually add the following under the `firewall-rules:` section:

```
name: SSH
network-groups:
- MANAGEMENT
rules:
- type: allow
  remote-ip-prefix: 0.0.0.0/0
  port-range-min: 22
  port-range-max: 22
```

```
protocol: tcp
```







Important

Manual edits to your configuration files outside of the Install UI may not be reflected in the Install UI. If you make changes to any files directly, refresh the browser to make sure changes are seen by the Install UI.

Before performing the deployment, the configuration must be validated by clicking the *Validate* button below the list of configuration files on the *Model* tab. This ensures the configuration will be successful **before** the actual configuration process runs and possibly fails. The *Validate* button also commits any changes. If there are issues with the validation, the configuration processor will provide detailed information about the causes. When validation completes successfully, a message will be displayed that the model is valid. If either validation or commit fail, the *Next* button is disabled.

Clicking the *Deploy* button starts the actual deployment process.

Cloud Deployment in Progress

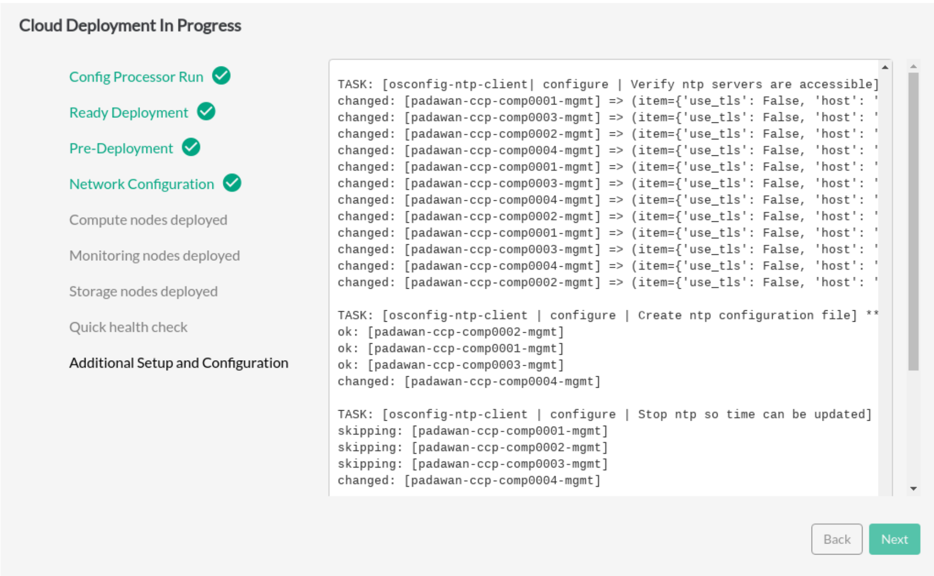
General progress steps are shown on the left. Detailed activity is shown on the right.

To start the deployment process, the Install UI runs scripts and playbooks based on the actual final configuration. Completed operations are green, black means in process, gray items are not started yet.

The log stream on the right shows finished states. If there are any failures, the log stream will show the errors and the *Next* button will be disabled. The *Back* and *Next* buttons are disabled during the deployment process.

The log files in `~/ardana/.ansible/ansible.log` and `/var/cache/ardana_installer/` have debugging information.

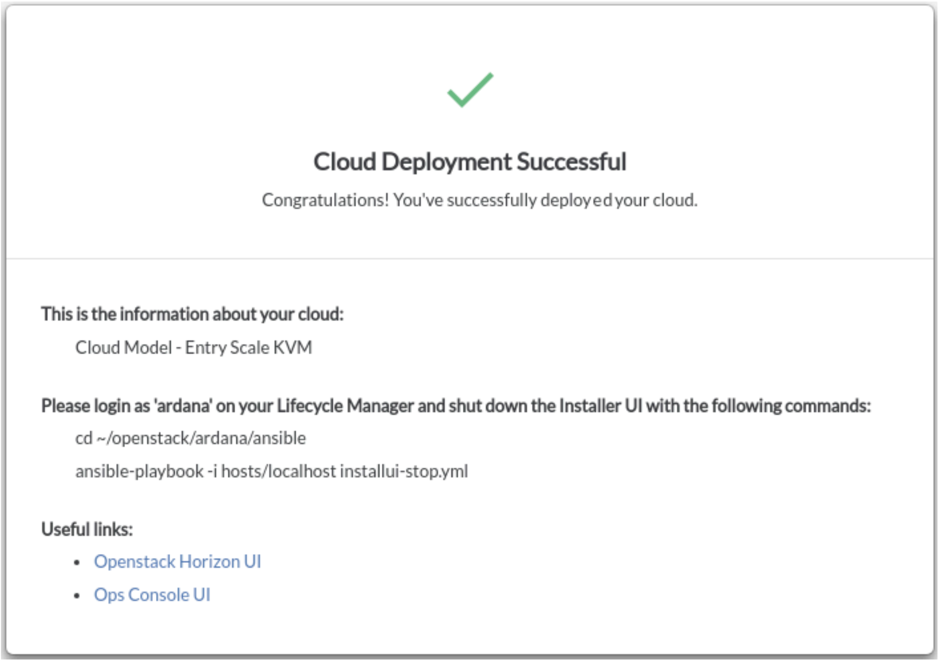
- `/var/cache/ardana_installer/log/ardana-service/ardana-service.log` is created and used during the deployment step.
- Each of the time-stamped files in `/var/cache/ardana_installer/log/ardana-service/logs/*.log` shows the output of a single Ansible playbook run invoked during the UI installation process and the log output for each of those runs.
- The `~/ardana/.ansible/ansible.log` file is the output of all Ansible playbook runs. This includes the logs from `/var/cache/ardana_installer/log/ardana-service/logs/*.log`.



When the deployment process is complete, all items on the left will be green. Some deployments will not include all steps shown if they do not apply to the selected input model. In such a situation, those unneeded steps will remain gray.

The *Next* button will be enabled when deployment is successful.

Clicking *Next* will display the `Cloud Deployment Successful` page with information about the deployment, including the chosen input model and links to cloud management tools.



After installation is complete, shutdown the Install UI by logging into the Cloud Lifecycle Manager and running the following commands:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost installui-stop.yml
```

After deployment, continue to *Chapter 26, Cloud Verification* and *Chapter 32, Other Common Post-Installation Tasks*.

To understand cloud configuration more thoroughly and to learn how to make changes later, see:

- *Book* “Planning an Installation with Cloud Lifecycle Manager”, *Chapter 5 “Input Model”*
- *Chapter 10, Using Git for Configuration Management*

10 Using Git for Configuration Management

In SUSE OpenStack Cloud 8, a local git repository is used to track configuration changes; the Configuration Processor (CP) uses this repository. Use of a git workflow means that your configuration history is maintained, making rollbacks easier and keeping a record of previous configuration settings. The git repository also provides a way for you to merge changes that you pull down as "upstream" updates (that is, updates from SUSE). It also allows you to manage your own configuration changes.

The git repository is installed by the Cloud Lifecycle Manager on the Cloud Lifecycle Manager node.

10.1 Initialization on a new deployment

On a system new to SUSE OpenStack Cloud 8, the Cloud Lifecycle Manager will prepare a git repository under `~/openstack`. The Cloud Lifecycle Manager provisioning runs the `ardana-init-deployer` script automatically. This calls `ansible-playbook -i hosts/localhost git-00-initialise.yml`.

As a result, the `~/openstack` directory is initialized as a git repo (if it is empty). It is initialized with four empty branches:

ardana

This holds the upstream source code corresponding to the contents of the `~/openstack` directory on a pristine installation. Every source code release that is downloaded from SUSE is applied as a fresh commit to this branch. This branch contains no customization by the end user.

site

This branch begins life as a copy of the first `ardana` drop. It is onto this branch that you commit your configuration changes. It is the branch most visible to the end user.

ansible

This branch contains the variable definitions generated by the CP that our main ansible playbooks need. This includes the `verb_hosts` file that describes to ansible what servers are playing what roles. The `ready-deployment` playbook takes this output and assembles a `~/scratch` directory containing the ansible playbooks together with the variable definitions in this branch. The result is a working ansible directory `~/scratch/ansible/next/ardana/ansible` from which the main deployment playbooks may be successfully run.

cp-persistent

This branch contains the persistent state that the CP needs to maintain. That state is mostly the assignment of IP addresses and roles to particular servers. Some operational procedures may involve editing the contents of this branch: for example, retiring a machine from service or repurposing it.

Two temporary branches are created and populated at run time:

staging-ansible

This branch hosts the most recent commit that will be appended to the Ansible branch.

staging-cp-persistent

This branch hosts the most recent commit that will be appended to the cp-persistent branch.

> **Note**
>
> The information above provides insight into the workings of the configuration processor and the git repository. However, in practice you can simply follow the steps below to make configuration changes.

10.2 Updating any configuration, including the default configuration

When you need to make updates to a configuration you must:

1. Check out the `site` branch. You may already be on that branch. If so, git will tell you that and the command will leave you there.

```
git checkout site
```

2. Edit the YAML file or files that contain the configuration you want to change.

3. Commit the changes to the `site` branch.

```
git add -A
git commit -m "your commit message goes here in quotes"
```

If you want to add a single file to your git repository, you can use the command below, as opposed to using **`git add -A`**.

```
git add PATH_TO_FILE
```

For example, if you made a change to your **`servers.yml`** file and wanted to only commit that change, you would use this command:

```
git add ~/openstack/my_cloud/definition/data/servers.yml
```

4. To produce the required configuration processor output from those changes. Review the output files manually if required, run the configuration processor:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml
```

5. Ready the deployment area

```
ansible-playbook -i hosts/localhost ready-deployment.yml
```

6. Run the deployment playbooks from the resulting scratch directory.

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts site.yml
```

10.3 Resolving Git merge conflicts

When you make changes, SUSE OpenStack Cloud attempts to incorporate new or updated configuration information on top of your existing environment. However, with some changes to your environment, SUSE OpenStack Cloud cannot automatically determine whether to keep your changes or drop them in favor of the new or updated configurations. This will result in `merge conflicts`, and it will be up to you to manually resolve the conflicts before you can proceed. This is common, but it can be confusing. Git provides a way to resolve these situations.

This section gives an overview of how to approach the issue of merge conflicts, showing general procedures for determining where the conflict is occurring, alternative methods for resolution, and a fallback procedure for the case where the resolution goes wrong and you need to start changes from the beginning.

For a general overview of how SUSE OpenStack Cloud uses Git, see the introductory article *Chapter 10, Using Git for Configuration Management*. In particular, note how the `site` branch is the one most used by the end-user, while the `ardana` branch contains the "upstream" source code corresponding to the contents of the `~/openstack` directory on a pristine fresh installation.

10.3.1 Identifying the occurrence of a `merge conflict`

If you get a `merge conflict`, you will observe output similar to the following on the console:

```
Auto-merging ardana/ansible/roles/nova-compute-esx/defaults/main.yml
Auto-merging ardana/ansible/roles/nova-common/templates/nova.conf.j2
CONFLICT (content): Merge conflict in ardana/ansible/roles/nova-common/templates/
nova.conf.j2
Auto-merging ardana/ansible/roles/nova-cli/tasks/availability_zones.yml
Auto-merging ardana/ansible/roles/nova-api/templates/api-paste.ini.j2
```

10.3.2 Examining Conflicts

Use `git status` to discover the source of the problem:

```
...
        new file:   tech-preview/entry-scale-kvm-mml/data/swift/rings.yml
        modified:   tech-preview/mid-scale/README.md
        modified:   tech-preview/mid-scale/data/control_plane.yml

Unmerged paths:
  (use "git add/rm <file>..." as appropriate to mark resolution)

        both modified:   ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

Edit the file `ardana/ansible/roles/nova-common/templates/nova.conf.j2` to see the conflict markers:

```
[neutron]
admin_auth_url = {{ neutron_admin_auth_url }}
admin_password = {{ neutron_admin_password }}
admin_tenant_name = {{ neutron_admin_tenant_name }}
admin_username = {{ neutron_admin_username }}
<<<<<<<HEAD
metadata_proxy_shared_secret = top_secret_password111
=======
metadata_proxy_shared_secret = {{ neutron_metadata_proxy_shared_secret }}
>>>>>>> ardana
neutron_auth_strategy = keystone
neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
service_metadata_proxy = True
```

This indicates that SUSE OpenStack Cloud 8is trying to set the value of `metadata_proxy_shared_secret` to be `{{ neutron_metadata_proxy_shared_secret }}` whereas previously you have set its value to `top_secret_password111`.

10.3.3 Examining differences between your current version and the previous upstream version

Typically, the previous upstream version will be the last-but-one commit on the `ardana` branch. This version will have been created during the initial installation of your cloud (or perhaps during a previous upgrade or configuration change). So in total, there are three significant versions of the file:

- The previous "upstream" version on the `ardana` branch.
- Your current version on the `site` branch.
- The new "upstream" version on the `ardana` branch.

You can identify the commit number of the previous "upstream" version using `git merge-base`.

```
tux > git merge-base ardana site
2eda1df48e2822533c50f80f5bfd7a9d788bdf73
```

And then use `git log` to see where this commit occurs in the history of the `ardana` branch.

```
tux > git log ardana --
commit 22cfa83f3526baf30b3697e971a712930f86f611
Author: Openstack git user <openstack@example.com>
Date:   Mon Jan 18 00:30:33 2018 +0000

    New drop

commit 2eda1df48e2822533c50f80f5bfd7a9d788bdf73
Author: Openstack git user <openstack@example.com>
Date:   Sun Jan 17 19:14:01 2018 +0000

    New drop
```

In this instance, we can see that the relevant commit is in fact the last-but-one commit. We can use the simplified name `ardana^1` to identify that commit.

```
tux > git diff ardana^1 HEAD -- ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

In the diff output, you should be able to see how you changed the value for `metadata_proxy_shared_secret` from `unset` to `top_secret_password111`:

```
tux > diff --git a/ardana/ansible/roles/nova-common/templates/nova.conf.j2 b/ardana/
ansible/roles/nova-common/templates/nova.conf.j2
```

```
index 597a982..05cb07c 100644
--- a/ardana/ansible/roles/nova-common/templates/nova.conf.j2
+++ b/ardana/ansible/roles/nova-common/templates/nova.conf.j2
@@ -132,7 +132,7 @@ admin_auth_url = {{ neutron_admin_auth_url }}
 admin_password = {{ neutron_admin_password }}
 admin_tenant_name = {{ neutron_admin_tenant_name }}
 admin_username = {{ neutron_admin_username }}
-metadata_proxy_shared_secret = unset
+metadata_proxy_shared_secret = top_secret_password111
 neutron_auth_strategy = keystone
 neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
 service_metadata_proxy = True
```

10.3.4 Examining differences between your current version and the new upstream version

To compare your change with the new upstream version from SUSE OpenStack Cloud 8 on the `ardana` branch you can use `git diff HEAD ardana -- <<path/to/file>>`:

```
tux > git diff HEAD ardana -- ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

In the extract of output below, you can see your value `top_secret_password111` and the new value `{{ neutron_metadata_proxy_shared_secret }}` that SUSE OpenStack Cloud 8 wants to set.

```
..
 admin_username = {{ neutron_admin_username }}
-metadata_proxy_shared_secret = top_secret_password111
+metadata_proxy_shared_secret = {{ neutron_metadata_proxy_shared_secret }}
 neutron_auth_strategy = keystone
 neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
```

10.3.5 Examining differences between the new upstream version and the previous upstream version

To compare the new upstream version from SUSE OpenStack Cloud 8 with the previous upstream version from your initial install (or previous change):

```
tux > git diff $(git merge-base ardana HEAD) ardana -- ardana/ansible/roles/nova-common/
templates/nova.conf.j2
```

In the extract of output below, you can see the new upstream value `{{ neutron_metadata_proxy_shared_secret }}` that SUSE OpenStack Cloud 8 wants to set and the previous upstream value `unset`.

```
 admin_password = {{ neutron_admin_password }}
 admin_tenant_name = {{ neutron_admin_tenant_name }}
 admin_username = {{ neutron_admin_username }}
-metadata_proxy_shared_secret = unset
+metadata_proxy_shared_secret = {{ neutron_metadata_proxy_shared_secret }}
 neutron_auth_strategy = keystone
 neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
```

10.3.6 Using `stage markers` to view clean versions of files (without conflict markers)

You can use the `git show` command with stage markers to view files without having conflict markers embedded in them. Stage 1 is the previous upstream version (**:1**), stage 2 is your current version (**:2**) while stage 3 is the new upstream version (**:3**).

Stage 1

```
tux > git show :1:ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

```
...
admin_username = {{ neutron_admin_username }}
metadata_proxy_shared_secret = unset
neutron_auth_strategy = keystone
neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
...
```

Stage 2

```
tux > git show :2:ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

```
...
admin_username = {{ neutron_admin_username }}
metadata_proxy_shared_secret = top_secret_password111
neutron_auth_strategy = keystone
neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
...
```

Stage 3

```
tux > git show :3:ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

```
...
admin_username = {{ neutron_admin_username }}
metadata_proxy_shared_secret = {{ neutron_metadata_proxy_shared_secret }}
neutron_auth_strategy = keystone
neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
...
```

10.3.7 Resolving the conflict

There are two approaches to resolving the conflict:

1. Edit the merged file containing the conflict markers, keeping the change you want to preserve and removing the conflict markers and any changes you want to discard.
2. Take the new upstream version of the file and re-apply any changes you would like to keep from your current version.

10.3.8 Resolving the conflict - editing the file containing the conflict markers

Edit the file `ardana/ansible/roles/nova-common/templates/nova.conf.j2` and if you want to maintain your change, then delete the lines in bold below:

```
[neutron]
admin_auth_url = {{ neutron_admin_auth_url }}
admin_password = {{ neutron_admin_password }}
admin_tenant_name = {{ neutron_admin_tenant_name }}
admin_username = {{ neutron_admin_username }}
<<<<<<<HEAD
metadata_proxy_shared_secret = top_secret_password111
=======
metadata_proxy_shared_secret = {{ neutron_metadata_proxy_shared_secret }}
>>>>>>> ardana
neutron_auth_strategy = keystone
neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
service_metadata_proxy = True
```

Your file should now look like this:

```
[neutron]
admin_auth_url = {{ neutron_admin_auth_url }}
admin_password = {{ neutron_admin_password }}
```

```
admin_tenant_name = {{ neutron_admin_tenant_name }}
admin_username = {{ neutron_admin_username }}
metadata_proxy_shared_secret = top_secret_password111
neutron_auth_strategy = keystone
neutron_ca_certificates_file = /etc/ssl/certs/ca-certificates.crt
service_metadata_proxy = True
```

10.3.9 Resolving the conflict - re-applying your changes to new upstream version

Create a copy of the new upstream version (see Stage 3 above) in your working directory:

```
tux > git show :3:ardana/ansible/roles/nova-common/templates/nova.conf.j2 > \
ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

Now edit the file `ardana/ansible/roles/nova-common/templates/nova.conf.j2` and manually re-apply the changes you want.

10.3.10 Completing the merge procedure

You may want to check that the changes you have applied are correct. Compare the new upstream version with the version in your working directory:

```
tux > git diff ardana -- ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

If you are happy with the resolution, you can stage your changes using:

```
tux > git add ardana/ansible/roles/nova-common/templates/nova.conf.j2
```

Apply the above steps to all the merge conflicts you encounter, and when you have them resolved to your satisfaction, complete the merge:

```
git commit -m "complete merge"
```

10.3.11 Recovering from Errors

If you make a mistake during the resolution process, you can return your working directory to a clean copy of the `site` branch using:

```
tux > git reset --hard
```

If the new upstream version contains files that did not exist in the previous version, these files will be left behind - you can see them using `git status`. To clean up these files, remove them and then reset:

```
tux > git rm -rf ardana
tux > git reset --hard
```

Alternatively, you can use `git stash` to save these files to a transient stash queue.

11 Installing a Stand-Alone Cloud Lifecycle Manager

11.1 Important Notes

- For information about when to use the GUI installer and when to use the command line (CLI), see *Chapter 1, Overview*.
- Review the *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 2 "Hardware and Software Support Matrix"* that we have listed.
- Review the release notes to make yourself aware of any known issues and limitations.
- The installation process can occur in different phases. For example, you can install the control plane only and then add Compute nodes afterwards if you would like.
- If you run into issues during installation, we have put together a list of *Chapter 23, Troubleshooting the Installation* you can reference.
- Make sure all disks on the system(s) are wiped before you begin the install. (For Swift, refer to *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 11 "Modifying Example Configurations for Object Storage using Swift", Section 11.6 "Swift Requirements for Device Group Drives"*.)
- There is no requirement to have a dedicated network for OS-install and system deployment, this can be shared with the management network. More information can be found in *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations"*.
- The terms deployer and Cloud Lifecycle Manager are used interchangeably. They refer to the same nodes in your cloud environment.
- When running the Ansible playbook in this installation guide, if a runbook fails you will see in the error response to use the `--limit` switch when retrying a playbook. This should be avoided. You can simply re-run any playbook without this switch.
- DVR is not supported with ESX compute.

- When you attach a Cinder volume to the VM running on the ESXi host, the volume will not get detected automatically. Make sure to set the image metadata **vmware_adapter-type=lsiLogicsas** for image before launching the instance. This will help to discover the volume change appropriately.
- The installation process will create several OpenStack roles. Not all roles will be relevant for a cloud with Swift only, but they will not cause problems.

11.2 Before You Start

1. Review the *Chapter 2, Pre-Installation Checklist* about recommended pre-installation tasks.
2. Prepare the Cloud Lifecycle Manager node. The Cloud Lifecycle Manager must be accessible either directly or via `ssh`, and have SUSE Linux Enterprise Server 12 SP3 installed. All nodes must be accessible to the Cloud Lifecycle Manager. If the nodes do not have direct access to online Cloud subscription channels, the Cloud Lifecycle Manager node will need to host the Cloud repositories.

    a. If you followed the installation instructions for Cloud Lifecycle Manager server (see *Chapter 3, Installing the Cloud Lifecycle Manager server*), SUSE OpenStack Cloud software should already be installed. Double-check whether SUSE Linux Enterprise and SUSE OpenStack Cloud are properly registered at the SUSE Customer Center by starting YaST and running *Software* › *Product Registration*.
    If you have not yet installed SUSE OpenStack Cloud, do so by starting YaST and running *Software* › *Product Registration* › *Select Extensions*. Choose *SUSE OpenStack Cloud* and follow the on-screen instructions. Make sure to register SUSE OpenStack Cloud during the installation process and to install the software pattern `patterns-cloud-ardana`.

    ```
    tux > sudo zypper -n in patterns-cloud-ardana
    ```

    b. Ensure the SUSE OpenStack Cloud media repositories and updates repositories are made available to all nodes in your deployment. This can be accomplished either by configuring the Cloud Lifecycle Manager server as an SMT mirror as described in *Chapter 4, Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)* or by syncing or mounting the Cloud and updates repositories to the Cloud Lifecycle Manager server as described in *Chapter 5, Software Repository Setup*.

c. Configure passwordless **sudo** for the user created when setting up the node (as described in *Section 3.4, "Creating a User"*). Note that this is *not* the user `ardana` that will be used later in this procedure. In the following we assume you named the user `cloud`. Run the command **visudo** as user `root` and add the following line to the end of the file:

```
CLOUD ALL = (root) NOPASSWD:ALL
```

Make sure to replace *`CLOUD`* with your user name choice.

d. Set the password for the user `ardana`:

```
tux > sudo passwd ardana
```

e. Become the user `ardana`:

```
tux > su - ardana
```

f. Place a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and rename it to `sles12sp3.iso`.

g. Install the templates, examples, and working model directories:

```
ardana > /usr/bin/ardana-init
```

11.3 Configuring Your Environment

1. You have already configured an input model for a stand-alone deployer in a previous step (*Chapter 8, Preparing for Stand-Alone Deployment*). Now that input model needs to be moved into the setup directory.

```
ardana > cp -r ~/openstack/examples/entry-scale-kvm-stand-alone-deployer/* \
~/openstack/my_cloud/definition/
```

2. *(Optional)* You can use the `ardanaencrypt.py` script to encrypt your IPMI passwords. This script uses OpenSSL.

   a. Change to the Ansible directory:

```
ardana > cd ~/openstack/ardana/ansible
```

b. Enter the encryption key into the following environment variable:

```
ardana > export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>
```

c. Run the python script below and follow the instructions. Enter a password that you want to encrypt.

```
ardana > ./ardanaencrypt.py
```

d. Take the string generated and place it in the `ilo-password` field in your `~/openstack/my_cloud/definition/data/servers.yml` file, remembering to enclose it in quotes.

e. Repeat the above for each server.

> **Note**
>
> Before you run any playbooks, remember that you need to export the encryption key in the following environment variable: `export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>`

3. Commit your configuration to the local git repo (*Chapter 10, Using Git for Configuration Management*), as follows:

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "My config or other commit message"
```

> **Important**
>
> This step needs to be repeated any time you make changes to your configuration files before you move on to the following steps. See *Chapter 10, Using Git for Configuration Management* for more information.

11.4 Running the Configuration Processor

Once you have your configuration files setup, you need to run the configuration processor to complete your configuration.

When you run the configuration processor, you will be prompted for two passwords. Enter the first password to make the configuration processor encrypt its sensitive data, which consists of the random inter-service passwords that it generates and the ansible `group_vars` and `host_vars` that it produces for subsequent deploy runs. You will need this password for subsequent Ansible deploy and configuration processor runs. If you wish to change an encryption password that you have already used when running the configuration processor then enter the new password at the second prompt, otherwise just press **Enter** to bypass this.

Run the configuration processor with this command:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

For automated installation (for example CI), you can specify the required passwords on the ansible command line. For example, the command below will disable encryption by the configuration processor:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml \
  -e encrypt="" -e rekey=""
```

If you receive an error during this step, there is probably an issue with one or more of your configuration files. Verify that all information in each of your configuration files is correct for your environment. Then commit those changes to Git using the instructions in the previous section before re-running the configuration processor again.

For any troubleshooting information regarding these steps, see *Section 23.2, "Issues while Updating Configuration Files"*.

11.5 Configuring TLS

Important

This section is optional, but recommended, for a SUSE OpenStack Cloud installation.

After you run the configuration processor the first time, the IP addresses for your environment will be generated and populated in the `~/openstack/my_cloud/info/address_info.yml` file. At this point, consider whether to configure TLS and set up an SSL certificate for your environment. Please read *Chapter 29, Configuring Transport Layer Security (TLS)* before proceeding for how to achieve this.

11.6 Deploying the Cloud

1. Use the playbook below to create a deployment directory:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost ready-deployment.yml
```

2. [OPTIONAL] - Run the `wipe_disks.yml` playbook to ensure all of your non-OS partitions on your nodes are completely wiped before continuing with the installation. The `wipe_disks.yml` playbook is only meant to be run on systems immediately after running `bm-reimage.yml`. If used for any other case, it may not wipe all of the expected partitions. If you are using fresh machines this step may not be necessary.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml
```

   If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

```
ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml --ask-vault-pass
```

3. Run the `site.yml` playbook below:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts site.yml
```

   If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

```
ardana > ansible-playbook -i hosts/verb_hosts site.yml --ask-vault-pass
```

   ### Note

   The step above runs `osconfig` to configure the cloud and `ardana-deploy` to deploy the cloud. Therefore, this step may run for a while, perhaps 45 minutes or more, depending on the number of nodes in your environment.

4. Verify that the network is working correctly. Ping each IP in the `/etc/hosts` file from one of the controller nodes.

For any troubleshooting information regarding these steps, see *Section 23.3, "Issues while Deploying the Cloud"*.

11.7 Installing OpenStack Assets on the Stand-alone Deployer

The OpenStack CLI and OpenStack clients will not be installed automatically. If you require access to these clients, you will need to follow the procedure below to add the appropriate software.

1. [OPTIONAL] To confirm that OpenStack clients have not been installed, connect to your stand-alone deployer and try to use the OpenStack CLI:

```
ardana > source ~/keystone.osrc
ardana > openstack project list

-bash: openstack: command not found
```

2. Edit the configuration file containing details of your Control Plane, `~/openstack/my_cloud/definition/data/control_plane.yml`

3. Locate the stanza for the cluster where you want to install the client(s). This will look like the following extract:

```
      clusters:
        - name: cluster0
          cluster-prefix: c0
          server-role: LIFECYCLE-MANAGER-ROLE
          member-count: 1
          allocation-policy: strict
          service-components:
            - ntp-server
            - lifecycle-manager
```

4. Choose the client(s) you wish to install from the following list of available clients:

```
 - barbican-client
 - ceilometer-client
 - cinder-client
 - designate-client
 - glance-client
 - heat-client
```

```
- ironic-client
- keystone-client
- magnum-client
- manila-client
- monasca-client
- neutron-client
- nova-client
- ntp-client
- octavia-client
- openstack-client
- swift-client
```

5. Add the client(s) to the list of `service-components` - in the following example, several OpenStack clients are added to the stand-alone deployer:

```
      clusters:
        - name: cluster0
          cluster-prefix: c0
          server-role: LIFECYCLE-MANAGER-ROLE
          member-count: 1
          allocation-policy: strict
          service-components:
            - ntp-server
            - lifecycle-manager
            - openstack-client
            - ceilometer-client
            - cinder-client
            - designate-client
            - glance-client
            - heat-client
            - ironic-client
            - keystone-client
            - neutron-client
            - nova-client
            - swift-client
            - monasca-client
            - barbican-client
```

6. Commit the configuration changes:

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "Add explicit client service deployment"
```

7. Run the configuration processor, followed by the `ready-deployment` playbook:

```
ardana > cd ~/openstack/ardana/ansible
```

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml -e encrypt=""
 \
  -e rekey=""
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

8. Add the software for the clients using the following command:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts clients-upgrade.yml
```

9. Check that the software has been installed correctly. Using the same test that was unsuccessful before, connect to your stand-alone deployer and try to use the OpenStack CLI:

```
ardana > source ~/keystone.osrc
ardana > openstack project list
```

You should now see a list of projects returned:

```
ardana > openstack project list

+----------------------------------+------------------+
| ID                               | Name             |
+----------------------------------+------------------+
| 076b6e879f324183bbd28b46a7ee7826 | kronos           |
| 0b81c3a9e59c47cab0e208ea1bb7f827 | backup           |
| 143891c2a6094e2988358afc99043643 | octavia          |
| 1d3972a674434f3c95a1d5ed19e0008f | glance-swift     |
| 2e372dc57cac4915bf06bbee059fc547 | glance-check     |
| 383abda56aa2482b95fb9da0b9dd91f4 | monitor          |
| 606dd3b1fa6146668d468713413fb9a6 | swift-monitor    |
| 87db9d1b30044ea199f0293f63d84652 | admin            |
| 9fbb7494956a483ca731748126f50919 | demo             |
| a59d0c682474434a9ddc240ddfe71871 | services         |
| a69398f0f66a41b2872bcf45d55311a7 | swift-dispersion |
| f5ec48d0328d400992c1c5fb44ec238f | cinderinternal   |
+----------------------------------+------------------+
```

11.8 Post-Installation Verification and Administration

We recommend verifying the installation using the instructions in *Chapter 26, Cloud Verification*.

There are also a list of other common post-installation administrative tasks listed in the *Chapter 32, Other Common Post-Installation Tasks* list.

12 Installing Mid-scale and Entry-scale KVM

12.1 Important Notes

- For information about when to use the GUI installer and when to use the command line (CLI), see *Chapter 1, Overview*.
- Review the *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 2 "Hardware and Software Support Matrix"* that we have listed.
- Review the release notes to make yourself aware of any known issues and limitations.
- The installation process can occur in different phases. For example, you can install the control plane only and then add Compute nodes afterwards if you would like.
- If you run into issues during installation, we have put together a list of *Chapter 23, Troubleshooting the Installation* you can reference.
- Make sure all disks on the system(s) are wiped before you begin the install. (For Swift, refer to *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 11 "Modifying Example Configurations for Object Storage using Swift", Section 11.6 "Swift Requirements for Device Group Drives"*.)
- There is no requirement to have a dedicated network for OS-install and system deployment, this can be shared with the management network. More information can be found in *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 9 "Example Configurations"*.
- The terms deployer and Cloud Lifecycle Manager are used interchangeably. They refer to the same nodes in your cloud environment.
- When running the Ansible playbook in this installation guide, if a runbook fails you will see in the error response to use the `--limit` switch when retrying a playbook. This should be avoided. You can simply re-run any playbook without this switch.
- DVR is not supported with ESX compute.

- When you attach a Cinder volume to the VM running on the ESXi host, the volume will not get detected automatically. Make sure to set the image metadata **vmware_adapter-type=lsiLogicsas** for image before launching the instance. This will help to discover the volume change appropriately.

- The installation process will create several OpenStack roles. Not all roles will be relevant for a cloud with Swift only, but they will not cause problems.

12.2 Before You Start

1. Review the *Chapter 2, Pre-Installation Checklist* about recommended pre-installation tasks.

2. Prepare the Cloud Lifecycle Manager node. The Cloud Lifecycle Manager must be accessible either directly or via `ssh`, and have SUSE Linux Enterprise Server 12 SP3 installed. All nodes must be accessible to the Cloud Lifecycle Manager. If the nodes do not have direct access to online Cloud subscription channels, the Cloud Lifecycle Manager node will need to host the Cloud repositories.

   a. If you followed the installation instructions for Cloud Lifecycle Manager server (see *Chapter 3, Installing the Cloud Lifecycle Manager server*), SUSE OpenStack Cloud software should already be installed. Double-check whether SUSE Linux Enterprise and SUSE OpenStack Cloud are properly registered at the SUSE Customer Center by starting YaST and running *Software* › *Product Registration*.
   If you have not yet installed SUSE OpenStack Cloud, do so by starting YaST and running *Software* › *Product Registration* › *Select Extensions*. Choose *SUSE OpenStack Cloud* and follow the on-screen instructions. Make sure to register SUSE OpenStack Cloud during the installation process and to install the software pattern `patterns-cloud-ardana`.

   ```
   tux > sudo zypper -n in patterns-cloud-ardana
   ```

   b. Ensure the SUSE OpenStack Cloud media repositories and updates repositories are made available to all nodes in your deployment. This can be accomplished either by configuring the Cloud Lifecycle Manager server as an SMT mirror as described in *Chapter 4, Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)* or by syncing or mounting the Cloud and updates repositories to the Cloud Lifecycle Manager server as described in *Chapter 5, Software Repository Setup*.

c. Configure passwordless **sudo** for the user created when setting up the node (as described in *Section 3.4, "Creating a User"*). Note that this is *not* the user `ardana` that will be used later in this procedure. In the following we assume you named the user `cloud`. Run the command **visudo** as user `root` and add the following line to the end of the file:

```
CLOUD ALL = (root) NOPASSWD:ALL
```

Make sure to replace *CLOUD* with your user name choice.

d. Set the password for the user `ardana`:

```
tux > sudo passwd ardana
```

e. Become the user `ardana`:

```
tux > su - ardana
```

f. Place a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and rename it to `sles12sp3.iso`.

g. Install the templates, examples, and working model directories:

```
ardana > /usr/bin/ardana-init
```

12.3 Configuring Your Environment

During the configuration phase of the installation you will be making modifications to the example configuration input files to match your cloud environment. You should use the *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 9 "Example Configurations"* documentation for detailed information on how to do this. There is also a `README.md` file included in each of the example directories on the Cloud Lifecycle Manager that has useful information about the models.

In the steps below we show how to set up the directory structure with the example input files as well as use the optional encryption methods for your sensitive data.

1. Set up your configuration files, as follows:

   a. Copy the example configuration files into the required setup directory and edit them to contain the details of your environment.
      For example, if you want to use the SUSE OpenStack Cloud Mid-scale KVM model, you can use this command to copy the files to your cloud definition directory:

      ```
      ardana > cp -r ~/openstack/examples/mid-scale-kvm/* \
      ~/openstack/my_cloud/definition/
      ```

      If you want to use the SUSE OpenStack Cloud Entry-scale KVM model, you can use this command to copy the files to your cloud definition directory:

      ```
      ardana > cp -r ~/openstack/examples/entry-scale-kvm/* \
      ~/openstack/my_cloud/definition/
      ```

   b. Begin inputting your environment information into the configuration files in the `~/openstack/my_cloud/definition` directory.

2. *(Optional)* You can use the `ardanaencrypt.py` script to encrypt your IPMI passwords. This script uses OpenSSL.

   a. Change to the Ansible directory:

      ```
      ardana > cd ~/openstack/ardana/ansible
      ```

   b. Put the encryption key into the following environment variable:

      ```
      export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>
      ```

   c. Run the python script below and follow the instructions. Enter a password that you want to encrypt.

      ```
      ardana > ./ardanaencrypt.py
      ```

   d. Take the string generated and place it in the `ilo-password` field in your `~/openstack/my_cloud/definition/data/servers.yml` file, remembering to enclose it in quotes.

   e. Repeat the above for each server.

> **Note**
>
> Before you run any playbooks, remember that you need to export the encryption key in the following environment variable: `export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>`

3. Commit your configuration to the local git repo (*Chapter 10, Using Git for Configuration Management*), as follows:

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "My config or other commit message"
```

> **Important**
>
> This step needs to be repeated any time you make changes to your configuration files before you move on to the following steps. See *Chapter 10, Using Git for Configuration Management* for more information.

12.4 Provisioning Your Baremetal Nodes

To provision the baremetal nodes in your cloud deployment you can either use the automated operating system installation process provided by SUSE OpenStack Cloud or you can use the 3rd party installation tooling of your choice. We will outline both methods below:

12.4.1 Using Third Party Baremetal Installers

If you do not wish to use the automated operating system installation tooling included with SUSE OpenStack Cloud then the requirements that have to be met using the installation tooling of your choice are:

- The operating system must be installed via the SLES ISO provided on the SUSE Customer Center (https://scc.suse.com/).
- Each node must have SSH keys in place that allows the same user from the Cloud Lifecycle Manager node who will be doing the deployment to SSH to each node without a password.

- Passwordless sudo needs to be enabled for the user.
- There should be a LVM logical volume as `/root` on each node.
- If the LVM volume group name for the volume group holding the `root` LVM logical volume is `ardana-vg`, then it will align with the disk input models in the examples.
- Ensure that `openssh-server`, `python`, `python-apt`, and `rsync` are installed.

If you chose this method for installing your baremetal hardware, skip forward to the step *Running the Configuration Processor*.

12.4.2 Using the Automated Operating System Installation Provided by SUSE OpenStack Cloud

If you would like to use the automated operating system installation tools provided by SUSE OpenStack Cloud, complete the steps below.

12.4.2.1 Deploying Cobbler

This phase of the install process takes the baremetal information that was provided in `servers.yml` and installs the Cobbler provisioning tool and loads this information into Cobbler. This sets each node to `netboot-enabled: true` in Cobbler. Each node will be automatically marked as `netboot-enabled: false` when it completes its operating system install successfully. Even if the node tries to PXE boot subsequently, Cobbler will not serve it. This is deliberate so that you cannot reimage a live node by accident.

The `cobbler-deploy.yml` playbook prompts for a password - this is the password that will be encrypted and stored in Cobbler, which is associated with the user running the command on the Cloud Lifecycle Manager, that you will use to log in to the nodes via their consoles after install. The username is the same as the user set up in the initial dialogue when installing the Cloud Lifecycle Manager from the ISO, and is the same user that is running the cobbler-deploy play.

Note

When imaging servers with your own tooling, it is still necessary to have ILO/IPMI settings for all nodes. Even if you are not using Cobbler, the username and password fields in `servers.yml` need to be filled in with dummy settings. For example, add the following to `servers.yml`:

```
ilo-user: manual
ilo-password: deployment
```

1. Run the following playbook which confirms that there is IPMI connectivity for each of your nodes so that they are accessible to be re-imaged in a later step:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost bm-power-status.yml
   ```

2. Run the following playbook to deploy Cobbler:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost cobbler-deploy.yml
   ```

12.4.2.2 Imaging the Nodes

This phase of the install process goes through a number of distinct steps:

1. Powers down the nodes to be installed
2. Sets the nodes hardware boot order so that the first option is a network boot.
3. Powers on the nodes. (The nodes will then boot from the network and be installed using infrastructure set up in the previous phase)
4. Waits for the nodes to power themselves down (this indicates a successful install). This can take some time.
5. Sets the boot order to hard disk and powers on the nodes.
6. Waits for the nodes to be reachable by SSH and verifies that they have the signature expected.

Deploying nodes has been automated in the Cloud Lifecycle Manager and requires the following:

- All of your nodes using SLES must already be installed, either manually or via Cobbler.
- Your input model should be configured for your SLES nodes, according to the instructions at *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 10 "Modifying Example Configurations for Compute Nodes", Section 10.1 "SLES Compute Nodes"*.
- You should have run the configuration processor and the `ready-deployment.yml` playbook.

Execute the following steps to re-image one or more nodes after you have run the `ready-deployment.yml` playbook.

1. Run the following playbook, specifying your SLES nodes using the nodelist. This playbook will reconfigure Cobbler for the nodes listed.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook prepare-sles-grub2.yml -e \
      nodelist=node1[,node2,node3]
```

2. Re-image the node(s) with the following command:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost bm-reimage.yml \
      -e nodelist=node1[,node2,node3]
```

If a nodelist is not specified then the set of nodes in Cobbler with `netboot-enabled: True` is selected. The playbook pauses at the start to give you a chance to review the set of nodes that it is targeting and to confirm that it is correct.

You can use the command below which will list all of your nodes with the `netboot-enabled: True` flag set:

```
sudo cobbler system find --netboot-enabled=1
```

12.5 Running the Configuration Processor

Once you have your configuration files setup, you need to run the configuration processor to complete your configuration.

When you run the configuration processor, you will be prompted for two passwords. Enter the first password to make the configuration processor encrypt its sensitive data, which consists of the random inter-service passwords that it generates and the ansible `group_vars` and `host_vars` that it produces for subsequent deploy runs. You will need this password for subsequent Ansible deploy and configuration processor runs. If you wish to change an encryption password that you have already used when running the configuration processor then enter the new password at the second prompt, otherwise just press **Enter** to bypass this.

Run the configuration processor with this command:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

For automated installation (for example CI), you can specify the required passwords on the ansible command line. For example, the command below will disable encryption by the configuration processor:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml \
  -e encrypt="" -e rekey=""
```

If you receive an error during this step, there is probably an issue with one or more of your configuration files. Verify that all information in each of your configuration files is correct for your environment. Then commit those changes to Git using the instructions in the previous section before re-running the configuration processor again.

For any troubleshooting information regarding these steps, see *Section 23.2, "Issues while Updating Configuration Files"*.

12.6 Configuring TLS

Important

This section is optional, but recommended, for a SUSE OpenStack Cloud installation.

After you run the configuration processor the first time, the IP addresses for your environment will be generated and populated in the `~/openstack/my_cloud/info/address_info.yml` file. At this point, consider whether to configure TLS and set up an SSL certificate for your environment. Please read *Chapter 29, Configuring Transport Layer Security (TLS)* before proceeding for how to achieve this.

12.7 Deploying the Cloud

1. Use the playbook below to create a deployment directory:

   ```
   cd ~/openstack/ardana/ansible
   ansible-playbook -i hosts/localhost ready-deployment.yml
   ```

2. [OPTIONAL] - Run the `wipe_disks.yml` playbook to ensure all of your non-OS partitions on your nodes are completely wiped before continuing with the installation. The `wipe_disks.yml` playbook is only meant to be run on systems immediately after running `bm-reimage.yml`. If used for any other case, it may not wipe all of the expected partitions. If you are using fresh machines this step may not be necessary.

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible
   ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml
   ```

   If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

   ```
   ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml --ask-vault-pass
   ```

3. Run the `site.yml` playbook below:

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible
   ardana > ansible-playbook -i hosts/verb_hosts site.yml
   ```

   If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

   ```
   ardana > ansible-playbook -i hosts/verb_hosts site.yml --ask-vault-pass
   ```

   ### Note

   The step above runs `osconfig` to configure the cloud and `ardana-deploy` to deploy the cloud. Therefore, this step may run for a while, perhaps 45 minutes or more, depending on the number of nodes in your environment.

4. Verify that the network is working correctly. Ping each IP in the `/etc/hosts` file from one of the controller nodes.

For any troubleshooting information regarding these steps, see *Section 23.3, “Issues while Deploying the Cloud”*.

12.8 Configuring a Block Storage Backend (Optional)

SUSE OpenStack Cloud supports multiple block storage backend options. You can use one or more of these for setting up multiple block storage backends. Multiple volume types are also supported.

Whether you have a single or multiple block storage backends defined in your `cinder.conf.j2` file, you can create one or more volume types using the specific attributes associated with the backend. For more information, see *Section 22.1, “Configuring for 3PAR Block Storage Backend”*.

12.9 Post-Installation Verification and Administration

We recommend verifying the installation using the instructions in *Chapter 26, Cloud Verification*.

There are also a list of other common post-installation administrative tasks listed in the *Chapter 32, Other Common Post-Installation Tasks* list.

13 DNS Service Installation Overview

The SUSE OpenStack Cloud DNS Service supports several different backends for domain name service. The choice of backend must be included in the deployment model before the SUSE OpenStack Cloud install is completed.

Warning

By default any user in the project is allowed to manage a DNS domain. This can be changed by updating the Policy.json file for Designate.

The backends that are available within the DNS Service are separated into two categories, self-contained and external.

TABLE 13.1: DNS BACKENDS

Category	Backend	Description	Recommended For
Self-contained	PowerDNS 3.4.1, BIND 9.9.5	All components necessary will be installed and configured as part of the SUSE OpenStack Cloud install.	POCs and customers who wish to keep cloud and traditional DNS separated.
External	InfoBlox	The authoritative DNS server itself is external to SUSE OpenStack Cloud. Management and configuration is out of scope for the Cloud Lifecycle Manager but remains the responsibility of the customer.	Customers who wish to integrate with their existing DNS infrastructure.

13.1 Installing the DNS Service with BIND

SUSE OpenStack Cloud DNS Service defaults to the BIND back-end if another back-end is not configured for domain name service. BIND will be deployed to one or more control planes clusters. The following configuration example shows how the BIND service is installed.

13.1.1 Configuring the Back-end

Ensure the DNS Service components and the BIND component have been placed on a cluster. BIND can be placed on a cluster separate from the other DNS service components.

```
control-planes:
          - name: control-plane-1
          region-name: region1

          clusters:
          - name: cluster1
          service-components:
          - lifecycle-manager
          - mariadb
          - ip-cluster
          - apache2
          - ...
          - designate-api
          - designate-central
          - designate-pool-manager
          - designate-zone-manager
          - designate-mdns
          - designate-client
          - bind
```

Updating the Input Model

When the back-end is configured, add `bind-ext` to the file `network_groups.yml`.

1. Edit `~/openstack/my_cloud/definition/data/network_groups.yml` to add `bind-ext` to component-endpoints.

   ```
   name: EXTERNAL-API
   hostname-suffix: extapi
   component-endpoints:
   - bind-ext
   ```

2. Save the file.

13.2 Install the DNS Service with PowerDNS

13.2.1 Installing DNS Service with PowerDNS

SUSE OpenStack Cloud DNS Service and **PowerDNS** can be installed together instead of the default **BIND** backend. PowerDNS will be deployed to one or more control planes clusters. The following configuration example shows how the PowerDNS service is installed.

13.2.2 Configure the Backend

To configure the backend for PowerDNS, follow these steps.

1. Ensure the DNS Service components and the PowerDNS component have been placed on a cluster. PowerDNS may be placed on a separate cluster to the other DNS Service components. Ensure the default **bind** component has been removed.

```
control-planes:
          - name: control-plane-1
          region-name: region1

          clusters:
          - name: cluster1
          service-components:
          - lifecycle-manager
          - mariadb
          - ip-cluster
          - apache2
          - ...
          - designate-api
          - designate-central
          - designate-pool-manager
          - designate-zone-manager
          - designate-mdns
          - designate-client
          - powerdns
```

2. Edit the `~/openstack/my_cloud/definitions/data/network_groups.yml` file to include the powerdns-ext.

```
- name: EXTERNAL-API
hostname-suffix: extapi
```

```
component-endpoints:
 - powerdns-ext
load-balancers:
 - provider: ip-cluster
```

3. Edit the `~/openstack/my_cloud/definitions/data/firewall_rules.yml` to allow UDP/TCP access.

```
     - name: DNSudp
      # network-groups lists the network group names that the rules apply to
      network-groups:
      - EXTERNAL-API
      rules:
      - type: allow
        # range of remote addresses in CIDR format that this rule applies to
        remote-ip-prefix:  0.0.0.0/0
        port-range-min: 53
        port-range-max: 53
        protocol: udp

    - name: DNStcp
      # network-groups lists the network group names that the rules apply to
      network-groups:
      - EXTERNAL-API
      rules:
      - type: allow
        # range of remote addresses in CIDR format that this rule applies to
        remote-ip-prefix:  0.0.0.0/0
        port-range-min: 53
        port-range-max: 53
        protocol: tcp
```

Please see *Book "Operations Guide", Chapter 9 "Managing Networking", Section 9.2 "DNS Service Overview", Section 9.2.2 "Designate Initial Configuration"* for post-installation DNS Service configuration.

13.3 Configure DNS Domain and NS Records

To configure the default DNS domain and Name Server records for the default pool, follow these steps.

1. Ensure that `designate_config.yml` file is present in the `~/openstack/my_cloud/definition/data/designate` folder. If the file or folder is not present, create the folder and copy `designate_config.yml` file from one of the example input models (for example, `~/openstack/examples/entry-scale-kvm/data/designate/designate_config.yml`).

2. Modify the **dns_domain** and/or **ns_records** entries in the `designate_config.yml` file.

```
data:
dns_domain: example.org.
ns_records:
    hostname: ns1.example.org.
    priority: 1
    hostname: ns2.example.org.
    priority: 2
```

3. Edit your input model's `control_plane.yml` file to include **DESIGNATE-CONFIG-CP1** in **configuration-data** section.

```
control-planes:
   - name: control-plane-1
     region-name: region1
     lifecycle-manager-target
     configuration-data:
        - DESIGNATE-CONFIG-CP1
        - NEUTRON-CONFIG-CP1
```

4. Continue your cloud deployment by reviewing and committing your changes.

```
$ git add ~/openstack/my_cloud/definition/data/designate/designate_config.yml
$ git commit -m "Adding DNS Domain and NS Records"
```

Note

In an entry-scale model (*Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.1 "Entry-Scale Cloud"*), you will have 3 ns_records since the DNS service runs on all three control planes.

In a mid-scale model (*Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.3 "Single-Region Mid-Size Model"*) or dedicated metering, monitoring and logging model (*Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 9 "Example Configurations", Section 9.3 "KVM Examples", Section 9.3.2 "Entry Scale Cloud with Metering and Monitoring Services"*), the above example would be correct since there are only two controller nodes.

14 Magnum Overview

The SUSE OpenStack Cloud Magnum Service provides container orchestration engines such as Docker Swarm, Kubernetes, and Apache Mesos available as first class resources. SUSE OpenStack Cloud Magnum uses Heat to orchestrate an OS image which contains Docker and Kubernetes and runs that image in either virtual machines or bare metal in a cluster configuration.

14.1 Magnum Architecture

As an OpenStack API service, Magnum provides Container as a Service (CaaS) functionality. Magnum is capable of working with container orchestration engines (COE) such as Kubernetes, Docker Swarm, and Apache Mesos. Some operations work with a User CRUD (Create, Read, Update, Delete) filter.

Components

- **Magnum API**: RESTful API for cluster and cluster template operations.
- **Magnum Conductor**: Performs operations on clusters requested by Magnum API in an asynchronous manner.
- **Magnum CLI**: Command-line interface to the Magnum API.
- **Etcd (planned, currently using public service)**: Remote key/value storage for distributed cluster bootstrap and discovery.
- **Kubemaster (in case of Kubernetes COE)**: One or more VM(s) or baremetal server(s), representing a control plane for Kubernetes cluster.
- **Kubeminion (in case of Kubernetes COE)**: One or more VM(s) or baremetal server(s), representing a workload node for Kubernetes cluster.
- **Octavia VM aka Amphora (in case of Kubernetes COE with enabled load balancer functionality)**: One or more VM(s), created by LBaaS v2, performing request load balancing for Kubemasters.

TABLE 14.1: DATA

Data Name	Confidentiality	Integrity	Availability	Backup?	Description
Session Tokens	Confidential	High	Medium	No	Session tokens not stored.
System Request	Confidential	High	Medium	No	Data in motion or in MQ not stored.
MariaDB Database "Magnum"	Confidential	High	High	Yes	Contains user preferences. Backed up to Swift daily.
etcd data	Confidential	High	Low	No	Kubemaster IPs and cluster info. Only used during cluster bootstrap.

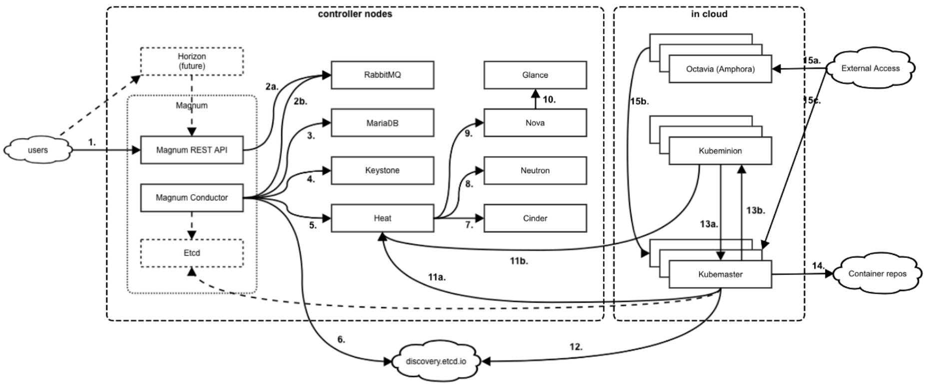


FIGURE 14.1: SERVICE ARCHITECTURE DIAGRAM FOR KUBERNETES

TABLE 14.2: INTERFACES

Interfac	Network	Request	Response	Operation Description
1	**Name:** External-API	**Request:** Manage clusters **Requester:** User	Operation status with or without data	CRUD operations on cluster templates and clusters

Interface	Network	Request	Response	Operation Description
	Protocol: HTTPS	**Credentials:** Keystone token **Authorization:** Manage objects that belong to current project **Listener:** Magnum API	**Credentials:** TLS certificate	
2a	**Name:** Internal-API **Protocol:** AMQP over HTTPS	**Request:** Enqueue messages **Requester:** Magnum API **Credentials:** RabbitMQ username, password **Authorization:** RabbitMQ queue read/write operations **Listener:** RabbitMQ	Operation status **Credentials:** TLS certificate	Notifications issued when cluster CRUD operations requested
2b	**Name:** Internal-API **Protocol:** AMQP over HTTPS	**Request:** Read queued messages **Requester:** Magnum Conductor **Credentials:** RabbitMQ username, password **Authorization:** RabbitMQ queue read/write operations **Listener:** RabbitMQ	Operation status **Credentials:** TLS certificate	Notifications issued when cluster CRUD operations requested
3	**Name:** Internal-API	**Request:** Persist data in MariaDB	Operation status with or without data	Persist cluster/cluster template data, read persisted data

Interface	Network	Request	Response	Operation Description
	Protocol: MariaDB over HTTPS	**Requester:** Magnum Conductor **Credentials:** MariaDB username, password **Authorization:** Magnum database **Listener:** MariaDB	**Credentials:** TLS certificate	
4	**Name:** Internal-API **Protocol:** HTTPS	**Request:** Create per-cluster user in dedicated domain, no role assignments initially **Requester:** Magnum Conductor **Credentials:** Trustee domain admin username, password **Authorization:** Manage users in dedicated Magnum domain **Listener:** Keystone	Operation status with or without data **Credentials:** TLS certificate	Magnum generates user record in a dedicated Keystone domain for each cluster
5	**Name:** Internal-API **Protocol:** HTTPS	**Request:** Create per-cluster user stack **Requester:** Magnum Conductor **Credentials:** Keystone token **Authorization:** Limited to scope of authorized user	Operation status with or without data **Credentials:** TLS certificate	Magnum creates Heat stack for each cluster

Interface	Network	Request	Response	Operation Description
		Listener: Heat		
6	**Name:** External Network **Protocol:** HTTPS	**Request:** Bootstrap a cluster in public discovery https://discovery.etcd.io/ **Requester:** Magnum Conductor **Credentials:** Unguessable URL over HTTPS. URL is only available to software processes needing it. **Authorization:** Read and update **Listener:** Public discovery service	Cluster discovery URL **Credentials:** TLS certificate	Create key/value registry of specified size in public storage. This is used to stand up a cluster of kubernetes master nodes (refer to interface call #12).
7	**Name:** Internal-API **Protocol:** HTTPS	**Request:** Create Cinder volumes **Requester:** Heat Engine **Credentials:** Keystone token **Authorization:** Limited to scope of authorized user **Listener:** Cinder API	Operation status with or without data **Credentials:** TLS certificate	Heat creates Cinder volumes as part of stack.
8	**Name:** Internal-API **Protocol:** HTTPS	**Request:** Create networks, routers, load balancers **Requester:** Heat Engine **Credentials:** Keystone token	Operation status with or without data **Credentials:** TLS certificate	Heat creates networks, routers, load balancers as part of the stack.

Interface	Network	Request	Response	Operation Description
		Authorization: Limited to scope of authorized user **Listener:** Neutron API		
9	**Name:** Internal-API **Protocol:** HTTPS	**Request:** Create Nova VMs, attach volumes **Requester:** Heat Engine **Credentials:** Keystone token **Authorization:** Limited to scope of authorized user **Listener:** Nova API	Operation status with or without data **Credentials:** TLS certificate	Heat creates Nova VMs as part of the stack.
10	**Name:** Internal-API **Protocol:** HTTPS	**Request:** Read pre-configured Glance image **Requester:** Nova **Credentials:** Keystone token **Authorization:** Limited to scope of authorized user **Listener:** Glance API	Operation status with or without data **Credentials:** TLS certificate	Nova uses pre-configured image in Glance to bootstrap VMs.
11a	**Name:** External-API **Protocol:** HTTPS	**Request:** Heat notification **Requester:** Cluster member (VM or Ironic node) **Credentials:** Keystone token **Authorization:** Limited to scope of authorized user **Listener:** Heat API	Operation status with or without data **Credentials:** TLS certificate	Heat uses OS::Heat::WaitCondition resource. VM is expected to call Heat notification URL upon completion of certain bootstrap operation.

Interface	Network	Request	Response	Operation Description
11b	**Name:** External-API **Protocol:** HTTPS	**Request:** Heat notification **Requester:** Cluster member (VM or Ironic node) **Credentials:** Keystone token **Authorization:** Limited to scope of authorized user **Listener:** Heat API	Operation status with or without data **Credentials:** TLS certificate	Heat uses OS::Heat::WaitCondition resource. VM is expected to call Heat notification URL upon completion of certain bootstrap operation.
12	**Name:** External-API **Protocol:** HTTPS	**Request:** Update cluster member state in a public registry at https://discovery.etcd.io **Requester:** Cluster member (VM or Ironic node) **Credentials:** Unguessable URL over HTTPS only available to software processes needing it. **Authorization:** Read and update **Listener:** Public discovery service	Operation status **Credentials:** TLS certificate	Update key/value pair in a registry created by interface call #6.
13a	**Name:** VxLAN encapsulated private	**Request:** Various communications inside Kubernetes cluster **Requester:** Cluster member (VM or Ironic node) **Credentials:** Tenant specific	Tenant specific **Credentials:** TLS certificate	Various calls performed to build Kubernetes clusters, deploy applications and put workload

Interface	Network	Request	Response	Operation Description
	network on the Guest network **Protocol:** HTTPS	**Authorization:** Tenant specific **Listener:** Cluster member (VM or Ironic node)		
13b	**Name:** VxLAN encapsulated private network on the Guest network **Protocol:** HTTPS	**Request:** Various communications inside Kubernetes cluster **Requester:** Cluster member (VM or Ironic node) **Credentials:** Tenant specific **Authorization:** Tenant specific **Listener:** Cluster member (VM or Ironic node)	Tenant specific **Credentials:** TLS certificate	Various calls performed to build Kubernetes clusters, deploy applications and put workload
14	**Name:** Guest/External	**Request:** Download container images **Requester:** Cluster member (VM or Ironic node) **Credentials:** None	Container image data **Credentials:** TLS certificate	Kubernetes makes calls to external repositories to download pre-packed container images

Interface	Network	Request	Response	Operation Description
	Protocol: HTTPS	**Authorization:** None **Listener:** External		
15a	**Name:** External/EXT_VM (Floating IP) **Protocol:** HTTPS	**Request:** Tenant specific **Requester:** Tenant specific **Credentials:** Tenant specific **Authorization:** Tenant specific **Listener:** Octavia load balancer	Tenant specific **Credentials:** Tenant specific	External workload handled by container applications
15b	**Name:** Guest **Protocol:** HTTPS	**Request:** Tenant specific **Requester:** Tenant specific **Credentials:** Tenant specific **Authorization:** Tenant specific **Listener:** Cluster member (VM or Ironic node)	Tenant specific **Credentials:** Tenant specific	External workload handled by container applications
15c	**Name:** External/EXT_VM (Floating IP)	**Request:** Tenant specific **Requester:** Tenant specific **Credentials:** Tenant specific **Authorization:** Tenant specific	Tenant specific **Credentials:** Tenant specific	External workload handled by container applications

Interface	Network	Request	Response	Operation Description
	Protocol: HTTPS	**Listener:** Cluster member (VM or Ironic node)		

Dependencies

- Keystone
- RabbitMQ
- MariaDB
- Heat
- Glance
- Nova
- Cinder
- Neutron
- Barbican
- Swift

Implementation

Magnum API and Magnum Conductor are run on the SUSE OpenStack Cloud controllers (or core nodes in case of mid-scale deployments).

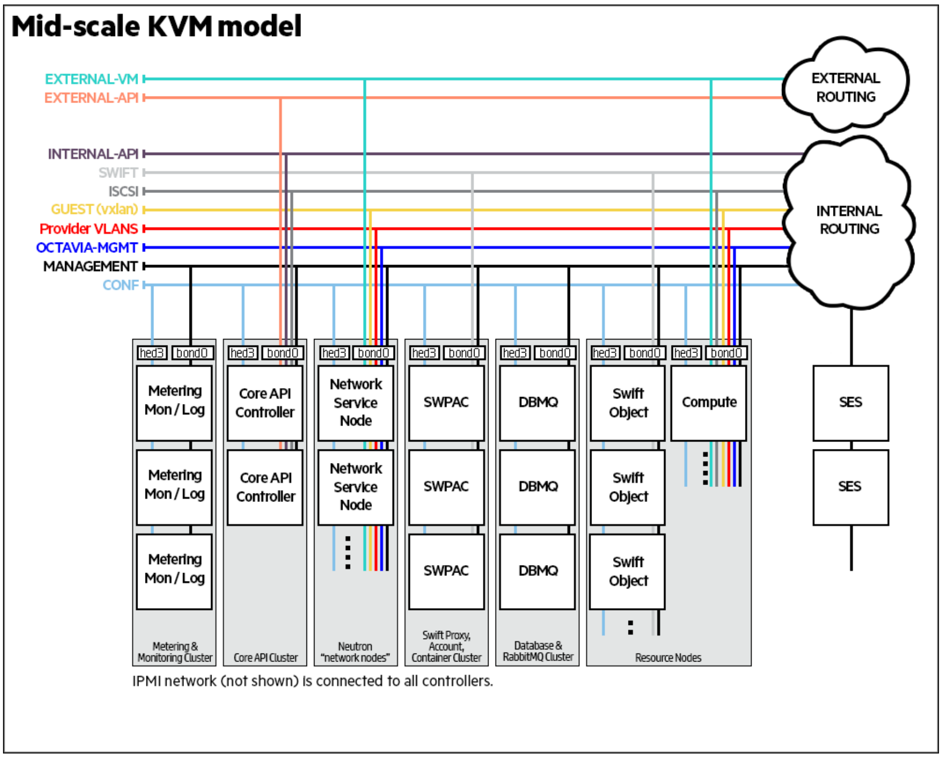


TABLE 14.3: SECURITY GROUPS

Source CIDR/Security Group	Port/Range	Protocol	Notes
Any IP	22	SSH	Tenant Admin access
Any IP/Kubernetes Security Group	2379-2380	HTTPS	Etcd Traffic
Any IP/Kubernetes Security Group	6443	HTTPS	kube-apiserver
Any IP/Kubernetes Security Group	7080	HTTPS	kube-apiserver
Any IP/Kubernetes Security Group	8080	HTTPS	kube-apiserver
Any IP/Kubernetes Security Group	30000-32767	HTTPS	kube-apiserver
Any IP/Kubernetes Security Group	any	tenant app specific	tenant app specific

TABLE 14.4: NETWORK PORTS

Port/Range	Protocol	Notes
22	SSH	Admin Access
9511	HTTPS	Magnum API Access
2379-2380	HTTPS	Etcd (planned)

Summary of controls spanning multiple components and interfaces:

- **Audit**: Magnum performs logging. Logs are collected by the centralized logging service.
- **Authentication**: Authentication via Keystone tokens at APIs. Password authentication to MQ and DB using specific users with randomly-generated passwords.
- **Authorization**: OpenStack provides admin and non-admin roles that are indicated in session tokens. Processes run at minimum privilege. Processes run as unique user/group definitions (magnum/magnum). Appropriate filesystem controls prevent other processes from accessing service's files. Magnum config file is mode 600. Logs written using group adm, user magnum, mode 640. IPtables ensure that no unneeded ports are open. Security Groups provide authorization controls between in-cloud components.
- **Availability**: Redundant hosts, clustered DB, and fail-over provide high availability.
- **Confidentiality**: Network connections over TLS. Network separation via VLANs. Data and config files protected via filesystem controls. Unencrypted local traffic is bound to localhost. Separation of customer traffic on the TUL network via Open Flow (VxLANs).
- **Integrity**: Network connections over TLS. Network separation via VLANs. DB API integrity protected by SQL Alchemy. Data and config files are protected by filesystem controls. Unencrypted traffic is bound to localhost.

14.2 Install the Magnum Service

Installing the Magnum Service can be performed as part of a new SUSE OpenStack Cloud 8 environment or can be added to an existing SUSE OpenStack Cloud 8 environment. Both installations require container management services, running in Magnum cluster VMs with access to specific Openstack API endpoints. The following TCP ports need to be open in your firewall to allow access from VMs to external (public) SUSE OpenStack Cloud endpoints.

TCP Port	Service
5000	Identity
8004	Heat
9511	Magnum

Magnum is dependent on the following OpenStack services.

- Keystone
- Heat
- Nova KVM
- Neutron
- Glance
- Cinder
- Swift
- Barbican
- LBaaS v2 (Octavia) - *optional*

Warning

Magnum relies on the public discovery service *https://discovery.etcd.io* during cluster bootstrapping and update. This service does not perform authentication checks. Although running a cluster cannot be harmed by unauthorized changes in the public discovery registry, it can be compromised during a cluster update operation. To avoid this, it is recommended that you keep your cluster discovery URL (that is, `https://discovery.etc.io/SOME_RANDOM_ID`) secret.

14.2.1 Installing Magnum as part of new SUSE OpenStack Cloud 8 environment

Magnum components are already included in example SUSE OpenStack Cloud models based on Nova KVM, such as **entry-scale-kvm**, **entry-scale-kvm-mml** and **mid-scale**. These models contain the Magnum dependencies (see above). You can follow generic installation instruction for Mid-Scale and Entry-Scale KM model by using this guide: *Chapter 12, Installing Mid-scale and Entry-scale KVM*.

> **Note**
>
> 1. If you modify the cloud model to utilize a dedicated Cloud Lifecycle Manager, add `magnum-client` item to the list of service components for the Cloud Lifecycle Manager cluster.
> 2. Magnum needs a properly configured external endpoint. While preparing the cloud model, ensure that `external-name` setting in `data/network_groups.yml` is set to valid hostname, which can be resolved on DNS server, and a valid TLS certificate is installed for your external endpoint. For non-production test installations, you can omit `external-name`. In test installations, the SUSE OpenStack Cloud installer will use an IP address as a public endpoint hostname, and automatically generate a new certificate, signed by the internal CA. Please refer to *Chapter 29, Configuring Transport Layer Security (TLS)* for more details.
> 3. To use LBaaS v2 (Octavia) for container management and container applications, follow the additional steps to configure LBaaS v2 in the guide.

14.2.2 Adding Magnum to an Existing SUSE OpenStack Cloud Environment

Adding Magnum to an already deployed SUSE OpenStack Cloud 8 installation or during an upgrade can be achieved by performing the following steps.

1. Add items listed below to the list of service components in `~/openstack/my_cloud/definition/data/control_plane.yml`. Add them to clusters which have `server-role` set to `CONTROLLER-ROLE` (entry-scale models) or `CORE_ROLE` (mid-scale model).

```
- magnum-api
- magnum-conductor
```

2. If your environment utilizes a dedicated Cloud Lifecycle Manager, add `magnum-client` to the list of service components for the Cloud Lifecycle Manager.

3. Commit your changes to the local git repository. Run the following playbooks as described in *Chapter 10, Using Git for Configuration Management* for your installation.

   - `config-processor-run.yml`
   - `ready-deployment.yml`
   - `site.yml`

4. Ensure that your external endpoint is configured correctly. The current public endpoint configuration can be verified by running the following commands on the Cloud Lifecycle Manager.

```
$ source service.osrc
$ openstack endpoint list --interface=public --service=identity
+-----------+---------+--------------+----------+---------+-----------+-----------------------+
| ID        | Region  | Service Name | Service  | Enabled | Interface | URL                   |
|           |         |              | Type     |         |           |                       |
+-----------+---------+--------------+----------+---------+-----------+-----------------------+
| d83...aa3 | region0 | keystone     | identity | True    | public    | https://10.245.41.168: |
|           |         |              |          |         |           |             5000/v2.0 |
+-----------+---------+--------------+----------+---------+-----------+-----------------------+
```

   Ensure that the endpoint URL is using either an IP address, or a valid hostname, which can be resolved on the DNS server. If the URL is using an invalid hostname (for example, `myardana.test`), follow the steps in *Chapter 29, Configuring Transport Layer Security (TLS)* to configure a valid external endpoint. You will need to update the `external-name` setting in the `data/network_groups.yml` to a valid hostname, which can be resolved on DNS server, and provide a valid TLS certificate for the external endpoint. For non-production test installations, you can omit the `external-name`. The SUSE OpenStack Cloud installer will use an IP address as public endpoint hostname, and automatically generate a new certificate, signed by the internal CA. For more information, see *Chapter 29, Configuring Transport Layer Security (TLS)*.

5. Ensure that LBaaS v2 (Octavia) is correctly configured. For more information, see *Chapter 31, Configuring Load Balancer as a Service*.

Warning

By default SUSE OpenStack Cloud stores the private key used by Magnum and its passphrase in Barbican which provides a secure place to store such information. You can change this such that this sensitive information is stored on the file system or in the database without encryption. Making such a change exposes you to the risk of this information being exposed to others. If stored in the database then any database backups, or a database breach, could lead to the disclosure of the sensitive information. Similarly, if stored unencrypted on the file system this information is exposed more broadly than if stored in Barbican.

14.3 Integrate Magnum with the DNS Service

Integration with DNSaaS may be needed if:

1. The external endpoint is configured to use `myardana.test` as host name and SUSE OpenStack Cloud front-end certificate is issued for this host name.

2. Minions are registered using Nova VM names as hostnames Kubernetes API server. Most kubectl commands will not work if the VM name (for example, `cl-mu3eevqizh-1-b3vi-fun6qtuh-kube-minion-ff4cqjgsuzhy`) is not getting resolved at the provided DNS server.

Follow these steps to integrate the Magnum Service with the DNS Service.

1. Allow connections from VMs to EXT-API

```
sudo modprobe 8021q
sudo ip link add link virbr5 name vlan108 type vlan id 108
sudo ip link set dev vlan108 up
sudo ip addr add 192.168.14.200/24 dev vlan108
sudo iptables -t nat -A POSTROUTING -o vlan108 -j MASQUERADE
```

2. Run the designate reconfigure playbook.

```
$ cd ~/scratch/ansible/next/ardana/ansible/
$ ansible-playbook -i hosts/verb_hosts designate-reconfigure.yml
```

3. Set up Designate to resolve myardana.test correctly.

```
$ openstack zone create --email hostmaster@myardana.test myardana.test.
# wait for status to become active
$ EXTERNAL_VIP=$(grep HZN-WEB-extapi /etc/hosts | awk '{ print $1 }')
$ openstack recordset create --records $EXTERNAL_VIP --type A myardana.test.
 myardana.test.
# wait for status to become active
$ LOCAL_MGMT_IP=$(grep `hostname` /etc/hosts | awk '{ print $1 }')
$ nslookup myardana.test $LOCAL_MGMT_IP
Server:         192.168.14.2
Address:        192.168.14.2#53
Name:           myardana.test
Address:        192.168.14.5
```

4. If you need to add/override a top level domain record, the following example should be used, substituting proxy.example.org with your own real address:

```
$ openstack tld create --name net
$ openstack zone create --email hostmaster@proxy.example.org proxy.example.org.
$ openstack recordset create --records 16.85.88.10 --type A proxy.example.org.
 proxy.example.org.
$ nslookup proxy.example.org. 192.168.14.2
Server:         192.168.14.2
Address:        192.168.14.2#53
Name:           proxy.example.org
Address:        16.85.88.10
```

5. Enable propagation of dns_assignment and dns_name attributes to neutron ports, as per https://docs.openstack.org/neutron/pike/admin/config-dns-int.html

```
# optionally add 'dns_domain = <some domain name>.' to [DEFAULT] section
# of ardana/ansible/roles/neutron-common/templates/neutron.conf.j2
stack@ksperf2-cp1-c1-m1-mgmt:~/openstack$ cat <<-EOF >>ardana/services/designate/api.yml

   provides-data:
   -   to:
       -   name: neutron-ml2-plugin
       data:
       -   option: extension_drivers
           values:
           -   dns
EOF
$ git commit -a -m "Enable DNS support for neutron ports"
$ cd ardana/ansible
$ ansible-playbook -i hosts/localhost config-processor-run.yml
$ ansible-playbook -i hosts/localhost ready-deployment.yml
```

6. Enable DNSaaS registration of created VMs by editing the `~/openstack/ardana/ansible/roles/neutron-common/templates/neutron.conf.j2` file. You will need to add `external_dns_driver = designate` to the **[DEFAULT]** section and create a new **[designate]** section for the Designate specific configurations.

```
...
advertise_mtu = False
dns_domain = ksperf.
external_dns_driver = designate
{{ neutron_api_extensions_path|trim }}
{{ neutron_vlan_transparent|trim }}

# Add additional options here

[designate]
url = https://10.240.48.45:9001
admin_auth_url = https://10.240.48.45:35357/v3
admin_username = designate
admin_password = P8lZ9FdHuoW
admin_tenant_name = services
allow_reverse_dns_lookup = True
ipv4_ptr_zone_prefix_size = 24
ipv6_ptr_zone_prefix_size = 116
ca_cert = /etc/ssl/certs/ca-certificates.crt
```

7. Commit your changes.

```
$ git commit -a -m "Enable DNSaaS registration of Nova VMs"
[site f4755c0] Enable DNSaaS registration of Nova VMs
1 file changed, 11 insertions(+)
```

15 Installing ESX Computes and OVSvAPP

This section describes the installation step requirements for ESX Computes (nova-proxy) and OVSvAPP.

15.1 Before You Start

1. Review the *Chapter 2, Pre-Installation Checklist* about recommended pre-installation tasks.
2. Prepare the Cloud Lifecycle Manager node. The Cloud Lifecycle Manager must be accessible either directly or via `ssh`, and have SUSE Linux Enterprise Server 12 SP3 installed. All nodes must be accessible to the Cloud Lifecycle Manager. If the nodes do not have direct access to online Cloud subscription channels, the Cloud Lifecycle Manager node will need to host the Cloud repositories.
   a. If you followed the installation instructions for Cloud Lifecycle Manager server (see *Chapter 3, Installing the Cloud Lifecycle Manager server*), SUSE OpenStack Cloud software should already be installed. Double-check whether SUSE Linux Enterprise and SUSE OpenStack Cloud are properly registered at the SUSE Customer Center by starting YaST and running *Software* › *Product Registration*.
   If you have not yet installed SUSE OpenStack Cloud, do so by starting YaST and running *Software* › *Product Registration* › *Select Extensions*. Choose *SUSE OpenStack Cloud* and follow the on-screen instructions. Make sure to register SUSE OpenStack Cloud during the installation process and to install the software pattern `patterns-cloud-ardana`.

   ```
   tux > sudo zypper -n in patterns-cloud-ardana
   ```

   b. Ensure the SUSE OpenStack Cloud media repositories and updates repositories are made available to all nodes in your deployment. This can be accomplished either by configuring the Cloud Lifecycle Manager server as an SMT mirror as described in *Chapter 4, Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)* or by syncing or mounting the Cloud and updates repositories to the Cloud Lifecycle Manager server as described in *Chapter 5, Software Repository Setup*.

c. Configure passwordless **sudo** for the user created when setting up the node (as described in *Section 3.4, "Creating a User"*). Note that this is *not* the user `ardana` that will be used later in this procedure. In the following we assume you named the user `cloud`. Run the command **visudo** as user `root` and add the following line to the end of the file:

```
CLOUD ALL = (root) NOPASSWD:ALL
```

Make sure to replace *CLOUD* with your user name choice.

d. Set the password for the user `ardana`:

```
tux > sudo passwd ardana
```

e. Become the user `ardana`:

```
tux > su - ardana
```

f. Place a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and rename it to `sles12sp3.iso`.

g. Install the templates, examples, and working model directories:

```
ardana > /usr/bin/ardana-init
```

15.2 Setting Up the Cloud Lifecycle Manager

15.2.1 Installing the Cloud Lifecycle Manager

Running the **ARDANA_INIT_AUTO=1** command is optional to avoid stopping for authentication at any step. You can also run **ardana-init** to launch the Cloud Lifecycle Manager. You will be prompted to enter an optional SSH passphrase, which is used to protect the key used by Ansible when connecting to its client nodes. If you do not want to use a passphrase, press Enter at the prompt.

If you have protected the SSH key with a passphrase, you can avoid having to enter the passphrase on every attempt by Ansible to connect to its client nodes with the following commands:

```
ardana > eval $(ssh-agent)
ardana > ssh-add ~/.ssh/id_rsa
```

The Cloud Lifecycle Manager will contain the installation scripts and configuration files to deploy your cloud. You can set up the Cloud Lifecycle Manager on a dedicated node or you do so on your first controller node. The default choice is to use the first controller node as the Cloud Lifecycle Manager.

1. Download the product from:
   - SUSE Customer Center (https://scc.suse.com/)
2. Boot your Cloud Lifecycle Manager from the SLES ISO contained in the download.
3. Enter `install` (all lower-case, exactly as spelled out here) to start installation.
4. Select the language. Note that only the English language selection is currently supported.
5. Select the location.
6. Select the keyboard layout.
7. Select the primary network interface, if prompted:
   - Assign IP address, subnet mask, and default gateway
8. Create new account:
   a. Enter a username.
   b. Enter a password.
   c. Enter time zone.

Once the initial installation is finished, complete the Cloud Lifecycle Manager setup with these steps:

1. Ensure your Cloud Lifecycle Manager has a valid DNS nameserver specified in `/etc/resolv.conf`.

2. Set the environment variable LC_ALL:

```
export LC_ALL=C
```

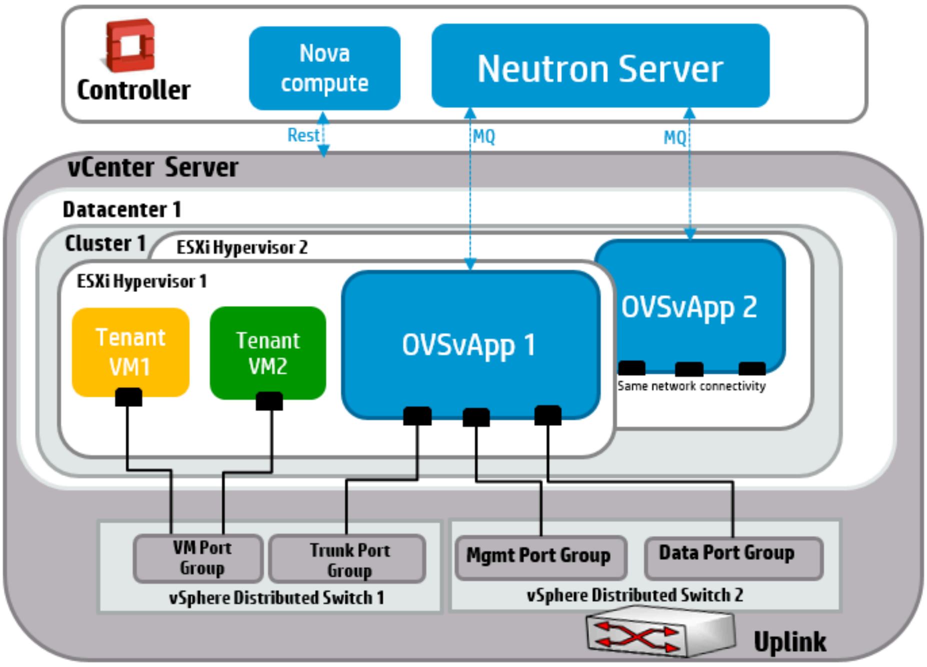
> **Note**
>
> This can be added to `~/.bashrc` or `/etc/bash.bashrc`.

The node should now have a working SLES setup.

15.3 Overview of ESXi and OVSvApp

ESXi is a hypervisor developed by VMware for deploying and serving virtual computers. OVSvApp is a service VM that allows for leveraging advanced networking capabilities that OpenStack Neutron provides. As a result, OpenStack features can be added quickly with minimum effort where ESXi is used. OVSvApp allows for hosting VMs on ESXi hypervisors together with the flexibility of creating port groups dynamically on Distributed Virtual Switches (DVS). Network traffic can then be steered through the OVSvApp VM which provides VLAN and VXLAN underlying infrastructure for VM communication and security features based on OpenStack. More information is available at the OpenStack wiki (https://wiki.openstack.org/wiki/Neutron/Networking-vSphere).

The diagram below illustrates the OVSvApp architecture.



15.4 VM Appliances Used in OVSvApp Implementation

The default configuration deployed with the Cloud Lifecycle Manager for VMware ESX hosts uses service appliances that run as VMs on the VMware hypervisor. There is one OVSvApp VM per VMware ESX host and one nova Compute Proxy per VMware cluster or VMware vCenter Server. Instructions for how to create a template for the Nova Compute Proxy or ovsvapp can be found at *Section 15.9, "Create a SUSE-based Virtual Appliance Template in vCenter"*.

15.4.1 OVSvApp VM

OVSvApp implementation is comprised of:

- a service VM called OVSvApp VM hosted on each ESXi hypervisor within a cluster, and
- two vSphere Distributed vSwitches (DVS).

OVSvApp VMs run SUSE Linux Enterprise and have Open vSwitch installed with an agent called `OVSvApp agent`. The OVSvApp VM routes network traffic to the various VMware tenants and cooperates with the OpenStack deployment to configure the appropriate port and network settings for VMware tenants.

15.4.2 Nova Compute Proxy VM

The Nova compute proxy is the `nova-compute` service for VMware ESX. Only one instance of this service is required for each ESX cluster that is deployed and is communicating with a single VMware vCenter server. (This is not like KVM where the `nova-compute` service must run on every KVM Host.) The single instance of `nova-compute` service can run in the OpenStack controller node or any other service node in your cloud. The main component of the `nova-compute` VM is the OVSvApp nova VCDriver that talks to the VMware vCenter server to perform VM operations such as VM creation and deletion.

15.5 Prerequisites for Installing ESXi and Managing with vCenter

ESX/vCenter integration is not fully automatic. vCenter administrators are responsible for taking steps to ensure secure operation.

- The VMware administrator is responsible for administration of the vCenter servers and the ESX nodes using the VMware administration tools. These responsibilities include:
  - Installing and configuring vCenter server
  - Installing and configuring ESX server and ESX cluster
  - Installing and configuring shared datastores
  - Establishing network connectivity between the ESX network and the Cloud Lifecycle Manager OpenStack management network
- The VMware administration staff is responsible for the review of vCenter logs. These logs are not automatically included in Cloud Lifecycle Manager OpenStack centralized logging.
- The VMware administrator is responsible for administration of the vCenter servers and the ESX nodes using the VMware administration tools.

- Logging levels for vCenter should be set appropriately to prevent logging of the password for the Cloud Lifecycle Manager OpenStack message queue.
- The vCenter cluster and ESX Compute nodes must be appropriately backed up.
- Backup procedures for vCenter should ensure that the file containing the Cloud Lifecycle Manager OpenStack configuration as part of Nova and Cinder volume services is backed up and the backups are protected appropriately.
- Since the file containing the Cloud Lifecycle Manager OpenStack message queue password could appear in the swap area of a vCenter server, appropriate controls should be applied to the vCenter cluster to prevent discovery of the password via snooping of the swap area or memory dumps.
- It is recommended to have a common shared storage for all the ESXi hosts in a particular cluster.
- Ensure that you have enabled HA (High Availability) and DRS (Distributed Resource Scheduler) settings in a cluster configuration before running the installation. DRS and HA are disabled only for OVSvApp. This is done so that it does not move to a different host. If you do not enable DRS and HA prior to installation then you will not be able to disable it only for OVSvApp. As a result DRS or HA could migrate OVSvApp to a different host, which would create a network loop.

Note

No two clusters should have the same name across datacenters in a given vCenter.

15.6 ESXi/vCenter System Requirements

For information about recommended hardware minimums, consult *Book* “Planning an Installation with Cloud Lifecycle Manager”, *Chapter 3 “Recommended Hardware Minimums for the Example Configurations”, Section 3.2 “Recommended Hardware Minimums for an Entry-scale ESX KVM Model”*.

15.7 Creating an ESX Cluster

Steps to create an ESX Cluster:

1. Download the ESXi Hypervisor and vCenter Appliance from the VMware website.
2. Install the ESXi Hypervisor.
3. Configure the Management Interface.
4. Enable the CLI and Shell access.
5. Set the password and login credentials.
6. Extract the vCenter Appliance files.
7. The vCenter Appliance offers two ways to install the vCenter. The directory `vcsa-ui-installer` contains the graphical installer. The `vcsa-cli-installer` directory contains the command line installer. The remaining steps demonstrate using the `vcsa-ui-installer` installer.
8. In the `vcsa-ui-installer`, click the *installer* to start installing the vCenter Appliance in the ESXi Hypervisor.
9. Note the *`MANAGEMENT IP`*, *`USER ID`*, and *`PASSWORD`* of the ESXi Hypervisor.
10. Assign an *`IP ADDRESS`*, *`USER ID`*, and *`PASSWORD`* to the vCenter server.
11. Complete the installation.
12. When the installation is finished, point your Web browser to the *`IP ADDRESS`* of the vCenter. Connect to the vCenter by clicking on link in the browser.
13. Enter the information for the vCenter you just created: *`IP ADDRESS`*, *`USER ID`*, and *`PASSWORD`*.
14. When connected, configure the following:
    - `Datacenter`
        1. Go to `Home` > `Inventory` > `Hosts and Clusters`
        2. Select File > New > Datacenter
        3. Rename the datacenter
    - Cluster

1. Right-click a datacenter or directory in the vSphere Client and select *New Cluster*.

2. Enter a name for the cluster.

3. Choose cluster features.

- Add a Host to Cluster

1. In the vSphere Web Client, navigate to a datacenter, cluster, or directory within a datacenter.

2. Right-click the datacenter, cluster, or directory and select *Add Host*.

3. Type the IP address or the name of the host and click *Next*.

4. Enter the administrator credentials and click *Next*.

5. Review the host summary and click *Next*.

6. Assign a license key to the host.

15.8 Configuring the Required Distributed vSwitches and Port Groups

- *Section 15.8.1, "Creating ESXi TRUNK DVS and Required Portgroup"*
- *Section 15.8.2, "Creating ESXi MGMT DVS and Required Portgroup"*
- *Section 15.8.3, "Configuring OVSvApp Network Resources Using Ansible-Playbook"*
- *Section 15.8.4, "Configuring OVSVAPP Using Python-Networking-vSphere"*

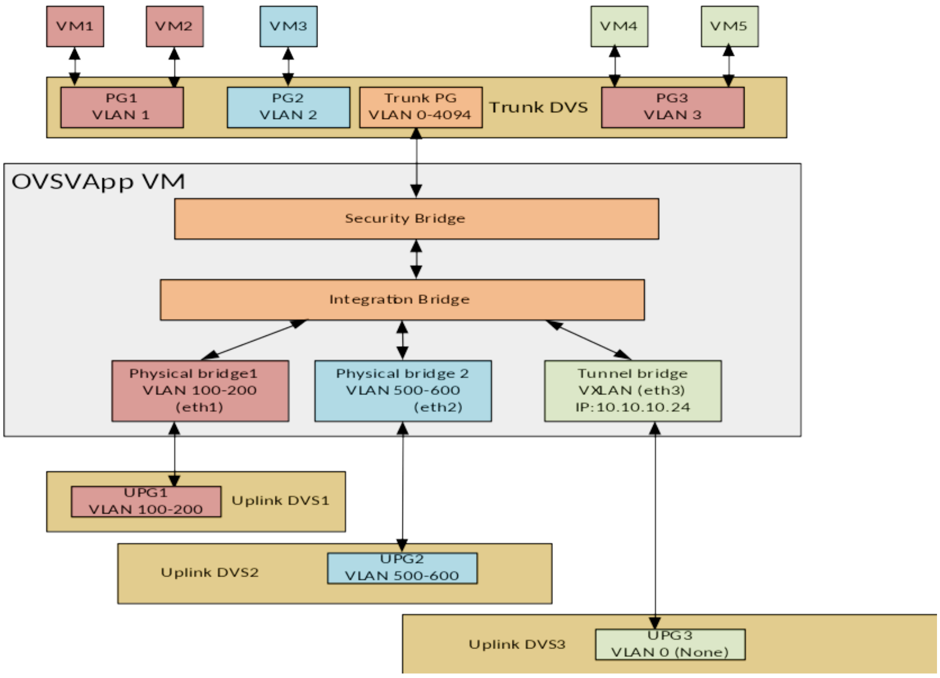
The required Distributed vSwitches (DVS) and port groups can be created by using the vCenter graphical user interface (GUI) or by using the command line tool provided by `python-networking-vsphere`. The vCenter GUI is recommended.

OVSvApp virtual machines (VMs) give ESX installations the ability to leverage some of the advanced networking capabilities and other benefits OpenStack provides. In particular, OVSvApp allows for hosting VMs on ESX/ESXi hypervisors together with the flexibility of creating port groups dynamically on Distributed Virtual Switch.

A port group is a management object for aggregation of multiple ports (on a virtual switch) under a common configuration. A VMware port group is used to group together a list of ports in a virtual switch (DVS in this section) so that they can be configured all at once. The member ports of a port group inherit their configuration from the port group, allowing for configuration of a port by simply dropping it into a predefined port group.

The following sections cover configuring OVSvApp switches on ESX. More information about OVSvApp is available at https://wiki.openstack.org/wiki/Neutron/Networking-vSphere

The diagram below illustrates a typical configuration that uses OVSvApp and Distributed vSwitches.



Detailed instructions are shown in the following sections for four example installations and two command line procedures.

15.8.1 Creating ESXi TRUNK DVS and Required Portgroup

The process of creating an ESXi Trunk Distributed vSwitch (DVS) consists of three steps: create a switch, add host and physical adapters, and add a port group. Use the following detailed instructions to create a trunk DVS and a required portgroup. These instructions use a graphical user interface (GUI). The GUI menu options may vary slightly depending on the specific version of vSphere installed. Command line interface (CLI) instructions are below the GUI instructions.

15.8.1.1 Creating ESXi Trunk DVS with vSphere Web Client

1. Create the switch.

    a. Using vSphere webclient, connect to the vCenter server.

    b. Under *Hosts and cluster*, right-click on the appropriate datacenter. Select *Distributed Switch* > *New Distributed Switch*.

    c. Name the switch `TRUNK`. Click *Next*.

    d. Select version 6.0.0 or larger. Click *Next*.

    e. Under *Edit settings*, lower the number of uplink ports to the lowest possible number (0 or 1). Uncheck *Create a default port group*. Click *Next*.

    f. Under *Ready to complete*, verify the settings are correct and click *Finish*.

2. Add host and physical adapters.

    a. Under *Networking* find the DVS named `TRUNK` you just created. Right-click on it and select *Manage hosts*.

    b. Under *Select task*, select *Add hosts*. Click *Next*.

    c. Click *New hosts*.

    d. Select the `CURRENT ESXI HOST` and select *OK*. Click *Next*.

    e. Under *Select network adapter tasks*, select *Manage advanced host settings* and **UNCHECK** all other boxes. Click *Next*.

    f. Under *Advanced host settings*, check that the `Maximum Number of Ports` reads `(auto)`. There is nothing else to do. Click *Next*.

    g. Under *Ready to complete*, verify that one and only one host is being added and click *Finish*.

3. Add port group.

    a. Right-click on the TRUNK DVS that was just created (or modified) and select *Distributed Port Group* > *New Distributed Port Group*.

    b. Name the port group `TRUNK-PG`. Click *Next*.

c. Under *Configure settings* select:

- `port binding` > `Static binding`
- `port allocation` > `Elastic`
- `vlan type` > `VLAN trunking` with range of 1–4094.

d. Check `Customized default policies configuration`. Click *Next*.

e. Under *Security* use the following values:

Setting	Value
promiscuous mode	accept
MAC address changes	reject
Forged transmits	accept

f. Set *Autoexpand* to `true` (port count growing).

g. Skip *Traffic shaping* and click *Next*.

h. Skip *Teaming and fail over* and click *Next*.

i. Skip *Monitoring* and click *Next*.

j. Under *Miscellaneous* there is nothing to be done. Click *Next*.

k. Under *Edit additional settings* add a description if desired. Click *Next*.

l. Under *Ready to complete* verify everything is as expected and click *Finish*.

15.8.2 Creating ESXi MGMT DVS and Required Portgroup

The process of creating an ESXi Mgmt Distributed vSwitch (DVS) consists of three steps: create a switch, add host and physical adapters, and add a port group. Use the following detailed instructions to create a mgmt DVS and a required portgroup.

1. Create the switch.

a. Using the vSphere webclient, connect to the vCenter server.

b. Under *Hosts and Cluster*, right-click on the appropriate datacenter, and select `Distributed Switch` > `New Distributed Switch`

c. Name the switch `MGMT`. Click *Next*.

d. Select version 6.0.0 or higher. Click *Next*.

e. Under *Edit settings*, select the appropriate number of uplinks. The `MGMT` DVS is what connects the ESXi host to the OpenStack management network. Uncheck `Create a default port group`. Click *Next*.

f. Under *Ready to complete*, verify the settings are correct. Click *Finish*.

2. Add host and physical adapters to Distributed Virtual Switch.

a. Under `Networking`, find the `MGMT` DVS you just created. Right-click on it and select *Manage hosts*.

b. Under *Select task*, select *Add hosts*. Click *Next*.

c. Click *New hosts*.

d. Select the current ESXi host and select *OK*. Click *Next*.

e. Under *Select network adapter tasks*, select *Manage physical adapters* and **UNCHECK** all other boxes. Click *Next*.

f. Under *Manage physical network adapters*, click on the interface you are using to connect the ESXi to the OpenStack management network. The name is of the form `vmnic#` (for example, `vmnic0`, `vmnic1`, etc.). When the interface is highlighted, select *Assign uplink* then select the uplink name to assign or auto assign. Repeat the process for each uplink physical NIC you will be using to connect to the OpenStack data network. Click *Next*.

g. Verify that you understand and accept the impact shown by *Analyze impact*. Click *Next*.

h. Verify that everything is correct and click on *Finish*.

3. Add MGMT port group to switch.

a. Right-click on the `MGMT` DVS and select *Distributed Port Group* > *New Distributed Port Group*.

b. Name the port group `MGMT-PG`. Click *Next*.

c. Under *Configure settings*, select:

- `port binding` > `Static binding`
- `port allocation` > `Elastic`
- `vlan type` > `None`

Click *Next*.

d. Under *Ready to complete*, verify that everything is as expected and click *Finish*.

4. Add GUEST port group to the switch.

a. Right-click on the DVS (MGMT) that was just created (or modified). Select *Distributed Port Group* > *New Distributed Port Group*.

b. Name the port group `GUEST-PG`. Click *Next*.

c. Under *Configure settings*, select:

- `port binding` > `Static binding`
- `port allocation` > `Elastic`
- `vlan type` > `VLAN trunking` The VLAN range corresponds to the VLAN ids being used by the OpenStack underlay. This is the same VLAN range as configured in the `neutron.conf` configuration file for the Neutron server.

d. Select *Customize default policies configuration*. Click *Next*.

e. Under *Security*, use the following settings:

setting	value
promiscuous mode	accept
MAC address changes	reject

setting	value
Forged transmits	accept

f. Skip *Traffic shaping* and click *Next*.

g. Under *Teaming and fail over*, make changes appropriate for your network and deployment.

h. Skip *Monitoring* and click *Next*.

i. Skip *Miscellaneous* and click *Next*.

j. Under *Edit addition settings*, add a description if desired. Click *Next*.

k. Under *Ready to complete*, verify everything is as expected. Click *Finish*.

5. Add ESX-CONF port group.

a. Right-click on the DVS (MGMT) that was just created (or modified). Select *Distributed Port Group* > *New Distributed Port Group*.

b. Name the port group `ESX-CONF-PG`. Click *Next*.

c. Under *Configure settings*, select:

- `port binding` > `Static binding`
- `port allocation` > `Elastic`
- `vlan type` > `None`

Click *Next*.

- `port binding` > `Static binding`
- `port allocation` > `Elastic`
- `vlan type` > `None`

Click *Next*.

d. Under *Ready to complete*, verify that everything is as expected and click *Finish*.

15.8.3 Configuring OVSvApp Network Resources Using Ansible-Playbook

The Ardana ansible playbook `neutron-create-ovsvapp-resources.yml` can be used to create Distributed Virtual Switches and Port Groups on a vCenter cluster.

The playbook requires the following inputs:

- `vcenter_username`
- `vcenter_encrypted_password`
- `vcenter_ip`
- `vcenter_port` (default 443)
- `vc_net_resources_location` This is the path to a file which contains the definition of the resources to be created. The definition is in JSON format.

In order to execute the playbook from the Cloud Lifecycle Manager, the `python-networking-vsphere` package must be installed.

```
tux > sudo zypper install python-networking-vsphere
```

Running the playbook:

```
ardana > ansible-playbook neutron-create-ovsvapp-resources.yml \
-i hosts/verb_hosts -vvv -e 'variable_host=localhost
vcenter_username=USERNAME
vcenter_encrypted_password=ENCRYPTED_PASSWORD
vcenter_ip=IP_ADDRESS
vcenter_port=443
vc_net_resources_location=LOCATION_TO_RESOURCE_DEFINITION_FILE
'
```

The `RESOURCE_DEFINITION_FILE` is in JSON format and contains the resources to be created.

Sample file contents:

```
{
  "datacenter_name": "DC1",
  "host_names": [
    "192.168.100.21",
    "192.168.100.222"
  ],
  "network_properties": {
    "switches": [
      {
        "type": "dvSwitch",
        "name": "TRUNK",
```

```
        "pnic_devices": [],
        "max_mtu": "1500",
        "description": "TRUNK DVS for ovsvapp.",
        "max_ports": 30000
      },
      {
        "type": "dvSwitch",
        "name": "MGMT",
        "pnic_devices": [
          "vmnic1"
        ],
        "max_mtu": "1500",
        "description": "MGMT DVS for ovsvapp. Uses 'vmnic0' to connect to OpenStack Management network",
        "max_ports": 30000
      }
    ],
    "portGroups": [
      {
        "name": "TRUNK-PG",
        "vlan_type": "trunk",
        "vlan_range_start": "1",
        "vlan_range_end": "4094",
        "dvs_name": "TRUNK",
        "nic_teaming": null,
        "allow_promiscuous": true,
        "forged_transmits": true,
        "auto_expand": true,
        "description": "TRUNK port group. Configure as trunk for vlans 1-4094. Default nic_teaming
selected."
      },
      {
        "name": "MGMT-PG",
        "dvs_name": "MGMT",
        "nic_teaming": null,
        "description": "MGMT port group. Configured as type 'access' (vlan with vlan_id = 0, default).
Default nic_teaming. Promiscuous false, forged_transmits default"
      },
      {
        "name": "GUEST-PG",
        "dvs_name": "GUEST",
        "vlan_type": "MGMT",
        "vlan_range_start": 100,
        "vlan_range_end": 200,
        "nic_teaming": null,
        "allow_promiscuous": true,
        "forged_transmits": true,
        "auto_expand": true,
        "description": "GUEST port group. Configure for vlans 100 through 200."
      },
      {
        "name": "ESX-CONF-PG",
        "dvs_name": "MGMT",
        "nic_teaming": null,
        "description": "ESX-CONF port group. Configured as type 'access' (vlan with vlan_id = 0,
default)."
```

```
    }
  ]
 }
}
```

15.8.4 Configuring OVSVAPP Using Python-Networking-vSphere

Scripts can be used with the Networking-vSphere Project (https://wiki.openstack.org/wiki/Neutron/Networking-vSphere). The scripts automate some of the process of configuring OVSvAPP from the command line. The following are help entries for two of the scripts:

```
tux > cd /opt/repos/networking-vsphere
 tux > ovsvapp-manage-dvs -h
usage: ovsvapp-manage-dvs [-h] [--tcp tcp_port]
                          [--pnic_devices pnic_devices [pnic_devices ...]]
                          [--max_mtu max_mtu]
                          [--host_names host_names [host_names ...]]
                          [--description description] [--max_ports max_ports]
                          [--cluster_name cluster_name] [--create]
                          [--display_spec] [-v]
                          dvs_name vcenter_user vcenter_password vcenter_ip
                          datacenter_name
positional arguments:
  dvs_name              Name to use for creating the DVS
  vcenter_user          Username to be used for connecting to vCenter
  vcenter_password      Password to be used for connecting to vCenter
  vcenter_ip            IP address to be used for connecting to vCenter
  datacenter_name       Name of data center where the DVS will be created
optional arguments:
  -h, --help            show this help message and exit
  --tcp tcp_port        TCP port to be used for connecting to vCenter
  --pnic_devices pnic_devices [pnic_devices ...]
                        Space separated list of PNIC devices for DVS
  --max_mtu max_mtu     MTU to be used by the DVS
  --host_names host_names [host_names ...]
                        Space separated list of ESX hosts to add to DVS
  --description description
                        DVS description
  --max_ports max_ports
                        Maximum number of ports allowed on DVS
  --cluster_name cluster_name
                        Cluster name to use for DVS
  --create              Create DVS on vCenter
  --display_spec        Print create spec of DVS
 -v                    Verbose output
```

```
tux > cd /opt/repos/networking-vsphere
 tux > ovsvapp-manage-dvpg -h
usage: ovsvapp-manage-dvpg [-h] [--tcp tcp_port] [--vlan_type vlan_type]
                           [--vlan_id vlan_id]
                           [--vlan_range_start vlan_range_start]
                           [--vlan_range_stop vlan_range_stop]
                           [--description description] [--allow_promiscuous]
                           [--allow_forged_transmits] [--notify_switches]
                           [--network_failover_detection]
                           [--load_balancing
 {loadbalance_srcid,loadbalance_ip,loadbalance_srcmac,loadbalance_loadbased,failover_explicit}]
                           [--create] [--display_spec]
                           [--active_nics ACTIVE_NICS [ACTIVE_NICS ...]] [-v]
                           dvpg_name vcenter_user vcenter_password vcenter_ip
                           dvs_name
positional arguments:
  dvpg_name             Name to use for creating theDistributed Virtual Port
                        Group (DVPG)
  vcenter_user          Username to be used for connecting to vCenter
  vcenter_password      Password to be used for connecting to vCenter
  vcenter_ip            IP address to be used for connecting to vCenter
  dvs_name              Name of the Distributed Virtual Switch (DVS) to create
                        the DVPG in
optional arguments:
  -h, --help            show this help message and exit
  --tcp tcp_port        TCP port to be used for connecting to vCenter
  --vlan_type vlan_type
                        Vlan type to use for the DVPG
  --vlan_id vlan_id     Vlan id to use for vlan_type='vlan'
  --vlan_range_start vlan_range_start
                        Start of vlan id range for vlan_type='trunk'
  --vlan_range_stop vlan_range_stop
                        End of vlan id range for vlan_type='trunk'
  --description description
                        DVPG description
  --allow_promiscuous   Sets promiscuous mode of DVPG
  --allow_forged_transmits
                        Sets forge transmit mode of DVPG
  --notify_switches     Set nic teaming 'notify switches' to True.
  --network_failover_detection
                        Set nic teaming 'network failover detection' to True
  --load_balancing
 {loadbalance_srcid,loadbalance_ip,loadbalance_srcmac,loadbalance_loadbased,failover_explicit}
                        Set nic teaming load balancing algorithm.
                        Default=loadbalance_srcid
  --create              Create DVPG on vCenter
  --display_spec        Send DVPG's create spec to OUTPUT
```

```
  --active_nics ACTIVE_NICS [ACTIVE_NICS ...]
                        Space separated list of active nics to use in DVPG nic
                        teaming
 -v                    Verbose output
```

15.9 Create a SUSE-based Virtual Appliance Template in vCenter

1. Download the SLES12-SP3 ISO image (`SLE-12-SP4-Server-DVD-x86_64-GM-DVD1.iso`) from https://www.suse.com/products/server/download/ . You need to sign in or create a SUSE customer service account before downloading.
2. Create a new Virtual Machine in vCenter Resource Pool.
3. Configure the Storage selection.
4. Configure the Guest Operating System.
5. Create a Disk.
6. Ready to Complete.
7. Edit Settings before booting the VM with additional Memory, typically 16GB or 32GB, though large scale environments may require larger memory allocations.
8. Edit Settings before booting the VM with additional Network Settings. Ensure there are four network adapters, one each for TRUNK, MGMT, ESX-CONF, and GUEST.
9. Attach the ISO image to the DataStore.
10. Configure the 'disk.enableUUID=TRUE' flag in the General - Advanced Settings.
11. After attaching the CD/DVD drive with the ISO image and completing the initial VM configuration, power on the VM by clicking the Play button on the VM's summary page.
12. Click *Installation* when the VM boots from the console window.
13. Accept the License agreement, language and Keyboard selection.
14. Select the System Role to Xen Virtualization Host.
15. Select the 'Proposed Partitions' in the Suggested Partition screen.
16. Edit the Partitions to select the 'LVM' Mode and then select the 'ext4' filesystem type.

17. Increase the size of the root partition from 10GB to 60GB.

18. Create an additional logical volume to accommodate the LV_CRASH volume (15GB). Do not mount the volume at this time, it will be used later.

19. Configure the Admin User/Password and User name.

20. Installation Settings (Disable Firewall and enable SSH).

21. The operating system will be successfully installed and the VM will reboot.

22. Check that the contents of the ISO files are copied to the locations shown below on your Cloud Lifecycle Manager. This may already be completed on the Cloud Lifecycle Manager.

    - The contents of the SLES SDK ISO (`SLE-12-SP3-SDK-DVD-x86_64-GM-DVD1.iso`) must be mounted or copied to `/opt/ardana_packager/ardana/sles12/zypper/SDK/` (create the directory if it is missing). If you choose to mount the ISO, we recommend creating an `/etc/fstab` entry to ensure the ISO is mounted after a reboot.

    - Mount or copy the contents of `SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso` to `/opt/ardana_packager/ardana/sles12/zypper/OS/` (create the directory if it is missing).

    - Mount or copy the contents of `SLE-12-SP3-SDK-DVD-x86_64-GM-DVD1.iso` to `/opt/ardana_packager/ardana/sles12/zypper/SDK/`.

23. Log in to the VM with the configured user credentials.

24. The VM must be set up before a template can be created with it. The IP addresses configured here are temporary and will need to be reconfigured as VMs are created using this template. The temporary IP address should not overlap with the network range for the MGMT network.

    a. The VM should now have four network interfaces. Configure them as follows:

        i.
        ```
        ardana > cd /etc/sysconfig/network
               tux > sudo ls
        ```

        The directory will contain the files: `ifcfg-br0`, `ifcfg-br1`, `ifcfg-br2`, `ifcfg-br3`, `ifcfg-eth0`, `ifcfg-eth1`, `ifcfg-eth2`, and `ifcfg-eth3`.

ii. If you have configured a default route while installing the VM, then there will be a `routes` file.

iii. Note the IP addresses configured for MGMT.

iv. Configure the temporary IP for the MGMT network. Edit the `ifcfg-eth1` file.

- ```
  tux > sudo vi /etc/sysconfig/network/ifcfg-eth1
  BOOTPROTO='static'
  BROADCAST=''
  ETHTOOL_OPTIONS=''
  IPADDR='192.168.24.132/24' (Configure the IP address of the MGMT
   Interface)
  MTU=''
  NETWORK=''
  REMOTE_IPADDR=''
  STARTMODE='auto'
  ```

v. Edit the `ifcfg-eth0`, `ifcfg-eth2`, and `ifcfg-eth3` files.

A. ```
   tux > sudo vi /etc/sysconfig/network/ifcfg-eth0
   BOOTPROTO='static'
   BROADCAST=''
   ETHTOOL_OPTIONS=''
   IPADDR=''
   MTU=''
   NETWORK=''
   REMOTE_IPADDR=''
   STARTMODE='auto'
   ```

B. ```
   tux > sudo vi /etc/sysconfig/network/ifcfg-eth2
   BOOTPROTO=''
   BROADCAST=''
   ETHTOOL_OPTIONS=''
   IPADDR=''
   MTU=''
   NAME='VMXNET3 Ethernet Controller'
   NETWORK=''
   REMOTE_IPADDR=''
   STARTMODE='auto'
   ```

C. ```
   tux > sudo vi /etc/sysconfig/network/ifcfg-eth3
   BOOTPROTO=''
   BROADCAST=''
   ETHTOOL_OPTIONS=''
   ```

```
IPADDR=''
MTU=''
NAME='VMXNET3 Ethernet Controller'
NETWORK=''
REMOTE_IPADDR=''
STARTMODE='auto'
```

D. If the default route is not configured, add a default route file manually.

I. Create a file `routes` in `/etc/sysconfig/network`.

II. Edit the file to add your default route.

```
tux > sudo sudo vi routes
        default 192.168.24.140 - -
```

vi. Delete all the bridge configuration files, which are not required: `ifcfg-br0`, `ifcfg-br1`, `ifcfg-br2`, and `ifcfg-br3`.

b. Add `ardana` user and home directory if that is not your default `user`. The username and password should be `ardana/ardana`.

```
tux > sudo useradd -m ardana
      tux > sudo passwd ardana
```

c. Create a `ardana` usergroup in the VM if it does not exist.

i. Check for an existing `ardana` group.

```
tux > sudo groups ardana
```

ii. Add `ardana` group if necessary.

```
tux > sudo groupadd ardana
```

iii. Add `ardana` user to the `ardana` group.

```
tux > sudo gpasswd -a ardana ardana
```

d. Allow the `ardana` user to `sudo` without password. Setting up `sudo` on SLES is covered in the SUSE documentation at https://documentation.suse.com/sles/12-SP5/single-html/SLES-admin/#sec-sudo-conf. We recommend creating user specific sudo config files in the `/etc/sudoers.d` directory. Create an `/etc/sudoers.d/ardana` config file with the following content to allow sudo commands without the requirement of a password.

```
ardana ALL=(ALL) NOPASSWD:ALL
```

e. Add the Zypper repositories using the ISO-based repositories created previously. Change the value of `deployer_ip` if necessary.

```
tux > sudo DEPLOYER_IP=192.168.24.140
     tux > sudo zypper addrepo --no-gpgcheck --refresh \
     http://$deployer_ip:79/ardana/sles12/zypper/OS SLES-OS
     tux > sudo zypper addrepo --no-gpgcheck --refresh \
     http://$deployer_ip:79/ardana/sles12/zypper/SDK SLES-SDK
```

Verify that the repositories have been added.

```
tux > zypper repos --detail
```

f. Set up SSH access that does not require a password to the temporary IP address that was configured for `eth1` .
When you have started the installation using the Cloud Lifecycle Manager or if you are adding a SLES node to an existing cloud, the Cloud Lifecycle Manager public key needs to be copied to the SLES node. You can do this by copying `~/.ssh/authorized_keys` from another node in the cloud to the same location on the SLES node. If you are installing a new cloud, this file will be available on the nodes after running the `bm-reimage.yml` playbook.

Important

Ensure that there is global read access to the file `~/.ssh/authorized_keys`.

Test passwordless ssh from the Cloud Lifecycle Manager and check your ability to remotely execute sudo commands.

```
tux > ssh ardana@IP_OF_SLES_NODE_eth1
     "sudo tail -5 /var/log/messages"
```

25. Shutdown the VM and create a template out of the VM appliance for future use.

26. The VM Template will be saved in your vCenter Datacenter and you can view it from *VMS and Templates* menu. Note that menu options will vary slightly depending on the version of vSphere that is deployed.

15.10 ESX Network Model Requirements

For this model the following networks are needed:

- `MANAGEMENT-NET` : This is an untagged network this is used for the control plane as well as the esx-compute proxy and ovsvapp VMware instance. It is tied to the MGMT DVS/PG in vSphere.
- `EXTERNAL-API_NET` : This is a tagged network for the external/public API. There is no difference in this model from those without ESX and there is no additional setup needed in vSphere for this network.
- `EXTERNAL-VM-NET` : This is a tagged network used for Floating IP (FIP) assignment to running instances. There is no difference in this model from those without ESX and there is no additional setup needed in vSphere for this network.
- `GUEST-NET` : This is a tagged network used internally for neutron. It is tied to the GUEST PG in vSphere.
- `ESX-CONF-NET` : This is a separate configuration network for ESX that must be reachable via the MANAGEMENT-NET. It is tied to the ESX-CONF PG in vSphere.
- `TRUNK-NET` : This is an untagged network used internally for ESX. It is tied to the TRUNC DVS/PG in vSphere.

15.11 Creating and Configuring Virtual Machines Based on Virtual Appliance Template

The following process for creating and configuring VMs from the vApp template should be repeated for every cluster in the DataCenter. Each cluster should host a Nova Proxy VM, and each host in a cluster should have an OVSvApp VM running. The following method uses the `vSphere Client Management Tool` to deploy saved templates from the vCenter.

1. Identify the cluster that you want Nova Proxy to manage.

2. Create a VM from the template on a chosen cluster.

3. The first VM that was deployed will be the `Nova Compute Proxy VM`. This VM can reside on any `HOST` inside a cluster. There should be only one instance of this VM in a cluster.

4. The `Nova Compute Proxy` will use only two of the four interfaces configured previously (`ESX_CONF` and `MANAGEMENT`).

   > **Note**
   >
   > Do not swap the interfaces. They must be in the specified order (`ESX_CONF` is `eth0`, `MGMT` is `eth1`).

5. After the VM has been deployed, log in to it with `ardana/ardana` credentials. Log in to the VM with SSH using the `MGMT` IP address. Make sure that all root level commands work with `sudo`. This is required for the Cloud Lifecycle Manager to configure the appliance for services and networking.

6. Install another VM from the template and name it `OVSvApp-VM1-HOST1`. (You can add a suffix with the host name to identify the host it is associated with).

   > **Note**
   >
   > The VM must have four interfaces configured in the right order. The VM must be accessible from the Management Network through SSH from the Cloud Lifecycle Manager.
   >
   > - `/etc/sysconfig/network/ifcfg-eth0` is `ESX_CONF`.
   > - `/etc/sysconfig/network/ifcfg-eth1` is `MGMT`.
   > - `/etc/sysconfig/network/ifcfg-eth2` is `TRUNK`.
   > - `/etc/sysconfig/network/ifcfg-eth3` is `GUEST`.

7. If there is more than one `HOST` in the cluster, deploy another VM from the Template and name it `OVSvApp-VM2-HOST2`.

8. If the OVSvApp VMs end up on the same `HOST`, then manually separate the VMs and follow the instructions below to add rules for High Availability (HA) and Distributed Resource Scheduler (DRS).

> **Note**
>
> HA seeks to minimize system downtime and data loss. See also *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 4 "High Availability"*. DRS is a utility that balances computing workloads with available resources in a virtualized environment.

9. When installed from a template to a cluster, the VM will not be bound to a particular host if you have more than one Hypervisor. The requirement for the OVSvApp is that there be only one OVSvApp Appliance per host and that it should be constantly bound to the same host. DRS or VMotion should not be allowed to migrate the VMs from the existing HOST. This would cause major network interruption. In order to achieve this we need to configure rules in the cluster HA and DRS settings.

> **Note**
>
> VMotion enables the live migration of running virtual machines from one physical server to another with zero downtime, continuous service availability, and complete transaction integrity.

10. Configure rules for OVSvApp VMs.
    a. Configure *vSphere HA - Virtual Machine Options*.
    b. *Use Cluster Setting* must be disabled.
    c. VM should be `Power-On`.
11. Configure *Cluster DRS Groups/Rules*.
    a. Configure *vSphere DRS - DRS Group Manager*.
    b. Create a DRS Group for the OVSvApp VMs.
    c. Add VMs to the DRS Group.
    d. Add appropriate *Rules* to the DRS Groups.

12. All three VMs are up and running. Following the preceding process, there is one Nova Compute Proxy VM per cluster, and `OVSvAppVM1` and `OVSvAppVM2` on each HOST in the cluster.

13. Record the configuration attributes of the VMs.

    - Nova Compute Proxy VM:

        - `Cluster Name` where this VM is located
        - `Management IP Address`
        - `VM Name` The actual name given to the VM to identify it.

    - OVSvAppVM1

        - `Cluster Name` where this VM is located
        - `Management IP Address`
        - `esx_hostname` that this OVSvApp is bound to
        - `cluster_dvs_mapping` The Distributed vSwitch name created in the datacenter for this particular cluster.
          Example format:
          `DATA_CENTER`/host/*`CLUSTERNAME`*: *`DVS-NAME`* Do not substitute for `host`'. It is a constant.

    - OVSvAppVM2:

        - `Cluster Name` where this VM is located
        - `Management IP Address`
        - `esx_hostname` that this OVSvApp is bound to
        - `cluster_dvs_mapping` The Distributed vSwitch name created in the datacenter for this particular cluster.
          Example format:
          `DATA_CENTER`/host/*`CLUSTERNAME`*: *`DVS-NAME`* Do not substitute for `host`'. It is a constant.

15.12 Collect vCenter Credentials and UUID

- Obtain the vCenter UUID from vSphere with the URL shown below:

  ```
  https://VCENTER-IP/mob/?moid=ServiceInstance&doPath=content.about
  ```

  Select the field `instanceUUID`. Copy and paste the **value** of `# field instanceUUID`.

- Record the `UUID`
- Record the `vCenter Password`
- Record the `vCenter Management IP`
- Record the `DataCenter Name`
- Record the `Cluster Name`
- Record the `DVS (Distributed vSwitch) Name`

15.13 Edit Input Models to Add and Configure Virtual Appliances

The following steps should be used to edit the Ardana input model data to add and configure the Virtual Appliances that were just created. The process assumes that the SUSE OpenStack Cloud is deployed and a valid Cloud Lifecycle Manager is in place.

1. Edit the following files in `~/openstack/my_cloud/definition/data/`: `servers.yml`, `disks_app_vm.yml`, and `pass_through.yml`. Fill in attribute values recorded in the previous step.
2. Follow the instructions in `pass_through.yml` to encrypt your vCenter password using an encryption key.
3. Export an environment variable for the encryption key.

   ```
   ARDANA_USER_PASSWORD_ENCRYPT_KEY=ENCRYPTION_KEY
   ```

4. Run `~ardana/openstack/ardana/ansible/ardanaencrypt.py` script. It will prompt for `unencrypted value?`. Enter the unencrypted vCenter password and it will return an encrypted string.

5. Copy and paste the encrypted password string in the `pass_through.yml` file as a value for the `password` field **enclosed in double quotes**.

6. Enter the `username`, `ip`, and `id` of the vCenter server in the Global section of the `pass_through.yml` file. Use the values recorded in the previous step.

7. In the `servers` section of the `pass_through.yml` file, add the details about the Nova Compute Proxy and OVSvApp VMs that was recorded in the previous step.

```
# Here the 'id' refers to the name of the node running the
      # esx-compute-proxy. This is identical to the 'servers.id' in
      # servers.yml.
      # NOTE: There should be one esx-compute-proxy node per ESX
      # resource pool or cluster.
      # cluster_dvs_mapping in the format
      # 'Datacenter-name/host/Cluster-Name:Trunk-DVS-Name'
      # Here 'host' is a string and should not be changed or
      # substituted.
      # vcenter_id is same as the 'vcenter-uuid' obtained in the global
      # section.
      # 'id': is the name of the appliance manually installed
      # 'vcenter_cluster': Name of the vcenter target cluster
      # esx_hostname: Name of the esx host hosting the ovsvapp
      # NOTE: For every esx host in a cluster there should be an ovsvapp
      # instance running.
      id: esx-compute1
      data:
        vmware:
          vcenter_cluster: <vmware cluster1 name>
          vcenter_id: <vcenter-uuid>
    -
      id: ovsvapp1
      data:
        vmware:
          vcenter_cluster: <vmware cluster1 name>
          cluster_dvs_mapping: <cluster dvs mapping>
          esx_hostname: <esx hostname hosting the ovsvapp>
          vcenter_id: <vcenter-uuid>
    -
      id: ovsvapp2
      data:
        vmware:
          vcenter_cluster: <vmware cluster1 name>
          cluster_dvs_mapping: <cluster dvs mapping>
          esx_hostname: <esx hostname hosting the ovsvapp>
          vcenter_id: <vcenter-uuid>
```

The VM `id` string should match exactly with the data written in the `servers.yml` file.

8. Edit the `servers.yml` file, adding the Nova Proxy VM and OVSvApp information recorded in the previous step.

```
# Below entries shall be added by the user
    # for entry-scale-kvm-esx after following
    # the doc instructions in creating the
    # esx-compute-proxy VM Appliance and the
    # esx-ovsvapp VM Appliance.
    # Added just for the reference
    # NOTE: There should be one esx-compute per
    # Cluster and one ovsvapp per Hypervisor in
    # the Cluster.
    # id - is the name of the virtual appliance
    # ip-addr - is the Mgmt ip address of the appliance
    # The values shown below are examples and has to be
    # substituted based on your setup.
    # Nova Compute proxy node
    - id: esx-compute1
      server-group: RACK1
      ip-addr: 192.168.24.129
      role: ESX-COMPUTE-ROLE
    # OVSVAPP node
    - id: ovsvapp1
      server-group: RACK1
      ip-addr: 192.168.24.130
      role: OVSVAPP-ROLE
    - id: ovsvapp2
      server-group: RACK1
      ip-addr: 192.168.24.131
      role: OVSVAPP-ROLE
```

Examples of `pass_through.yml` and `servers.yml` files:

```
pass_through.yml
product:
  version: 2
pass-through:
  global:
    vmware:
      - username: administrator@vsphere.local
        ip: 10.84.79.3
        port: '443'
        cert_check: false
        password: @hos@U2FsdGVkX19aqGOUYGgcAIMQSN2lZ1X+gyNoytAGCTI=
```

```
        id: a0742a39-860f-4177-9f38-e8db82ad59c6
  servers:
    - data:
        vmware:
          vcenter_cluster: QE
          vcenter_id: a0742a39-860f-4177-9f38-e8db82ad59c6
      id: lvm-nova-compute1-esx01-qe
    - data:
        vmware:
          vcenter_cluster: QE
          cluster_dvs_mapping: 'PROVO/host/QE:TRUNK-DVS-QE'
          esx_hostname: esx01.qe.provo
          vcenter_id: a0742a39-860f-4177-9f38-e8db82ad59c6
      id: lvm-ovsvapp1-esx01-qe
    - data:
        vmware:
          vcenter_cluster: QE
          cluster_dvs_mapping: 'PROVO/host/QE:TRUNK-DVS-QE'
          esx_hostname: esx02.qe.provo
          vcenter_id: a0742a39-860f-4177-9f38-e8db82ad59c6
          id: lvm-ovsvapp2-esx02-qe
```

```
servers.yml
product:
  version: 2
servers:
  - id: deployer
    ilo-ip: 192.168.10.129
    ilo-password: 8hAcPMne
    ilo-user: CLM004
    ip-addr: 192.168.24.125
    is-deployer: true
    mac-addr: '8c:dc:d4:b4:c5:4c'
    nic-mapping: MY-2PORT-SERVER
    role: DEPLOYER-ROLE
    server-group: RACK1
  - id: controller3
    ilo-ip: 192.168.11.52
    ilo-password: 8hAcPMne
    ilo-user: HLM004
    ip-addr: 192.168.24.128
    mac-addr: '8c:dc:d4:b5:ed:b8'
    nic-mapping: MY-2PORT-SERVER
    role: CONTROLLER-ROLE
    server-group: RACK1
  - id: controller2
    ilo-ip: 192.168.10.204
```

```
    ilo-password: 8hAcPMne
    ilo-user: HLM004
    ip-addr: 192.168.24.127
    mac-addr: '8c:dc:d4:b5:ca:c8'
    nic-mapping: MY-2PORT-SERVER
    role: CONTROLLER-ROLE
    server-group: RACK2
  - id: controller1
    ilo-ip: 192.168.11.57
    ilo-password: 8hAcPMne
    ilo-user: CLM004
    ip-addr: 192.168.24.126
    mac-addr: '5c:b9:01:89:c6:d8'
    nic-mapping: MY-2PORT-SERVER
    role: CONTROLLER-ROLE
    server-group: RACK3
  # Nova compute proxy for QE cluster added manually
  - id: lvm-nova-compute1-esx01-qe
    server-group: RACK1
    ip-addr: 192.168.24.129
    role: ESX-COMPUTE-ROLE
  # OVSvApp VM for QE cluster added manually
  # First ovsvapp vm in esx01 node
  - id: lvm-ovsvapp1-esx01-qe
    server-group: RACK1
    ip-addr: 192.168.24.132
    role: OVSVAPP-ROLE
  # Second ovsvapp vm in esx02 node
  - id: lvm-ovsvapp2-esx02-qe
    server-group: RACK1
    ip-addr: 192.168.24.131
    role: OVSVAPP-ROLE
baremetal:
  subnet: 192.168.24.0
  netmask: 255.255.255.0
```

9. Edit the `disks_app_vm.yml` file based on your `lvm` configuration. The attributes of `Volume Group`, `Physical Volume`, and `Logical Volumes` must be edited based on the `LVM` configuration of the VM.
   When you partitioned `LVM` during installation, you received `Volume Group` name, `Physical Volume` name and `Logical Volumes` with their partition sizes.
   This information can be retrieved from any of the VMs (Nova Proxy VM or the OVSvApp VM):

```
tux > sudo pvdisplay
```

```
# — Physical volume —
    # PV Name /dev/sda1
    # VG Name system
    # PV Size 80.00 GiB / not usable 3.00 MiB
    # Allocatable yes
    # PE Size 4.00 MiB
    # Total PE 20479
    # Free PE 511
    # Allocated PE 19968
    # PV UUID 7Xn7sm-FdB4-REev-63Z3-uNdM-TF3H-S3ZrIZ
```

The Physical Volume Name is `/dev/sda1`. And the Volume Group Name is `system`.

To find `Logical Volumes`:

```
tux > sudo fdisk -l
```

```
# Disk /dev/sda: 80 GiB, 85899345920 bytes, 167772160 sectors
    # Units: sectors of 1 * 512 = 512 bytes
    # Sector size (logical/physical): 512 bytes / 512 bytes
    # I/O size (minimum/optimal): 512 bytes / 512 bytes
    # Disklabel type: dos
    # Disk identifier: 0x0002dc70
    # Device Boot Start End Sectors Size Id Type
    # /dev/sda1 * 2048 167772159 167770112 80G 8e Linux LVM
    # Disk /dev/mapper/system-root: 60 GiB, 64424509440 bytes,
    # 125829120 sectors
    # Units: sectors of 1 * 512 = 512 bytes
    # Sector size (logical/physical): 512 bytes / 512 bytes
    # I/O size (minimum/optimal): 512 bytes / 512 bytes
    # Disk /dev/mapper/system-swap: 2 GiB, 2147483648 bytes, 4194304 sectors
    # Units: sectors of 1 * 512 = 512 bytes
    # Sector size (logical/physical): 512 bytes / 512 bytes
    # I/O size (minimum/optimal): 512 bytes / 512 bytes
    # Disk /dev/mapper/system-LV_CRASH: 16 GiB, 17179869184 bytes,
    # 33554432 sectors
    # Units: sectors of 1 * 512 = 512 bytes
    # Sector size (logical/physical): 512 bytes / 512 bytes
    # I/O size (minimum/optimal): 512 bytes / 512 bytes
    # NOTE: Even though we have configured the SWAP partition, it is
    # not required to be configured in here. Just configure the root
    # and the LV_CRASH partition
```

- The line with `/dev/mapper/system-root: 60 GiB, 64424509440 bytes` indicates that the first logical partition is `root`.
- The line with `/dev/mapper/system-LV_CRASH: 16 GiB, 17179869184 bytes` indicates that the second logical partition is `LV_CRASH`.
- The line with `/dev/mapper/system-swap: 2 GiB, 2147483648 bytes, 4194304 sectors` indicates that the third logical partition is `swap`.

10. Edit the `disks_app_vm.yml` file. It is not necessary to configure the `swap` partition.

```
volume-groups:
    - name: system (Volume Group Name)
      physical-volumes:
       - /dev/sda1 (Physical Volume Name)
      logical-volumes:
        - name: root   ( Logical Volume 1)
          size: 75%    (Size in percentage)
          fstype: ext4 ( filesystem type)
          mount: /     ( Mount point)
        - name: LV_CRASH   (Logical Volume 2)
          size: 20%        (Size in percentage)
          mount: /var/crash (Mount point)
          fstype: ext4      (filesystem type)
          mkfs-opts: -O large_file
```

An example `disks_app_vm.yml` file:

```
disks_app_vm.yml
---
  product:
    version: 2
  disk-models:
  - name: APP-VM-DISKS
    # Disk model to be used for application vms such as nova-proxy and ovsvapp
    # /dev/sda1 is used as a volume group for /, /var/log and /var/crash
    # Additional disks can be added to either volume group
    #
    # NOTE: This is just an example file and has to filled in by the user
    # based on the lvm partition map for their virtual appliance
    # While installing the operating system opt for the LVM partition and
    # create three partitions as shown below
    # Here is an example partition map
    # In this example we have three logical partitions
    # root partition (75%)
```

```
# swap (5%) and
# LV_CRASH (20%)
# Run this command 'sudo pvdisplay' on the virtual appliance to see the
# output as shown below
#
# — Physical volume —
# PV Name /dev/sda1
# VG Name system
# PV Size 80.00 GiB / not usable 3.00 MiB
# Allocatable yes
# PE Size 4.00 MiB
# Total PE 20479
# Free PE 511
# Allocated PE 19968
# PV UUID 7Xn7sm-FdB4-REev-63Z3-uNdM-TF3H-S3ZrIZ
#
# Next run the following command on the virtual appliance
#
# sudo fdisk -l
# The output will be as shown below
#
# Disk /dev/sda: 80 GiB, 85899345920 bytes, 167772160 sectors
# Units: sectors of 1 * 512 = 512 bytes
# Sector size (logical/physical): 512 bytes / 512 bytes
# I/O size (minimum/optimal): 512 bytes / 512 bytes
# Disklabel type: dos
# Disk identifier: 0x0002dc70
# Device Boot Start End Sectors Size Id Type
# /dev/sda1 * 2048 167772159 167770112 80G 8e Linux LVM
# Disk /dev/mapper/system-root: 60 GiB, 64424509440 bytes,
# 125829120 sectors
# Units: sectors of 1 * 512 = 512 bytes
# Sector size (logical/physical): 512 bytes / 512 bytes
# I/O size (minimum/optimal): 512 bytes / 512 bytes
# Disk /dev/mapper/system-swap: 2 GiB, 2147483648 bytes, 4194304 sectors
# Units: sectors of 1 * 512 = 512 bytes
# Sector size (logical/physical): 512 bytes / 512 bytes
# I/O size (minimum/optimal): 512 bytes / 512 bytes
# Disk /dev/mapper/system-LV_CRASH: 16 GiB, 17179869184 bytes,
# 33554432 sectors
# Units: sectors of 1 * 512 = 512 bytes
# Sector size (logical/physical): 512 bytes / 512 bytes
# I/O size (minimum/optimal): 512 bytes / 512 bytes
# NOTE: Even though we have configured the SWAP partition, it is
# not required to be configured in here. Just configure the root
# and the LV_CRASH partition
volume-groups:
```

```
      - name: system
        physical-volumes:
         - /dev/sda1
        logical-volumes:
          - name: root
            size: 75%
            fstype: ext4
            mount: /
          - name: LV_CRASH
            size: 20%
            mount: /var/crash
            fstype: ext4
            mkfs-opts: -O large_file
```

15.14 Running the Configuration Processor With Applied Changes

If the changes are being applied to a previously deployed cloud, then after the previous section is completed, the Configuration Processor should be run with the changes that were applied.

1. Run the Configuration Processor

   ```
   ardana > cd ~/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost config-processor-run.yml \
   -e remove_deleted_servers="y" -e free_unused_addresses="y"
   ```

2.
   ```
   ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
   ```

3. Run the `site.yml` playbook against only the VMs that were added.

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible/
   ardana > ansible-playbook -i hosts/verb_hosts site.yml --extra-vars \
   "hux_svc_ignore_stop":true --limit hlm004-cp1-esx-comp0001-mgmt, \
   hlm004-cp1-esx-ovsvapp0001-mgmt,hlm004-cp1-esx-ovsvapp0002-mgmt
   ```

If the changes are being applied ahead of deploying a new (greenfield) cloud, then after the previous section is completed, the following steps should be run.

1. Run the Configuration Processor

   ```
   ardana > cd ~/ardana/ansible
    ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
   ```

2. ```
   ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
   ```

3. Run the `site.yml` playbook against only the VMs that were added.

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible/
    ardana > ansible-playbook -i hosts/verb_hosts site.yml
   ```

15.15 Test the ESX-OVSvApp Environment

When all of the preceding installation steps have been completed, test the ESX-OVSvApp environment with the following steps:

1. SSH to the Controller
2. Source the `service.osrc` file
3. Create a Network
4. Create a Subnet
5. Create a VMware-based Glance image if there is not one available in the Glance repo. The following instructions can be used to create such an image that can be used by Nova to to create a VM in vCenter.

   a. Download a `vmdk` image file for the corresponding distro that you want for a VM.

   b. Create a Nova image for VMware Hypervisor

   ```
   ardana > glance image-create --name
        DISTRO --container-format bare --disk-format
        vmdk --property vmware_disktype="sparse" --property
        vmware_adaptertype="ide" --property hypervisor_type=vmware <
        SERVER_CLOUDIMG.VMDK
   ```

   ```
   +--------------------+--------------------------------------+
   | Property           | Value                                |
   +--------------------+--------------------------------------+
   | checksum           | 45a4a06997e64f7120795c68beeb0e3c     |
   | container_format   | bare                                 |
   | created_at         | 2018-02-17T10:42:14Z                 |
   | disk_format        | vmdk                                 |
   | hypervisor_type    | vmware                               |
   | id                 | 17e4915a-ada0-4b95-bacf-ba67133f39a7 |
   | min_disk           | 0                                    |
   ```
   ```

```
| min_ram           | 0                                  |
| name              | leap                               |
| owner             | 821b7bb8148f439191d108764301af64   |
| protected         | False                              |
| size              | 372047872                          |
| status            | active                             |
| tags              | []                                 |
| updated_at        | 2018-02-17T10:42:23Z               |
| virtual_size      | None                               |
| visibility        | shared                             |
| vmware_adaptertype | ide                               |
| vmware_disktype   | sparse                             |
+-------------------+------------------------------------+
```

The image you created needs to be uploaded or saved. Otherwise the size will still be `0`.

c. Upload/save the image

```
ardana > openstack image save --file \
     ./SERVER_CLOUDIMG.VMDK
     17e4915a-ada0-4b95-bacf-ba67133f39a7
```

d. After saving the image, check that it is active and has a valid size.

```
ardana > openstack image list
```

```
+--------------------------------------+------------------------+--------+
| ID                                   | Name                   | Status |
+--------------------------------------+------------------------+--------+
| c48a9349-8e5c-4ca7-81ac-9ed8e2cab3aa | cirros-0.3.2-i386-disk | active |
| 17e4915a-ada0-4b95-bacf-ba67133f39a7 | leap                   | active |
+--------------------------------------+------------------------+--------+
```

e. Check the details of the image

```
ardana > openstack image show 17e4915a-ada0-4b95-bacf-ba67133f39a7
```

```
+------------------
+--------------------------------------------------------------------------------+
| Field            | Value
           |
+------------------
+--------------------------------------------------------------------------------+
| checksum         | 45a4a06997e64f7120795c68beeb0e3c
           |
```

```
| container_format | bare
             |
| created_at       | 2018-02-17T10:42:14Z
             |
| disk_format      | vmdk
             |
| file             | /v2/images/40aa877c-2b7a-44d6-9b6d-f635dcbafc77/file
             |
| id               | 17e4915a-ada0-4b95-bacf-ba67133f39a7
             |
| min_disk         | 0
             |
| min_ram          | 0
             |
| name             | leap
             |
| owner            | 821b7bb8148f439191d108764301af64
             |
| properties       | hypervisor_type='vmware', vmware_adaptertype='ide',
 vmware_disktype='sparse' |
| protected        | False
             |
| schema           | /v2/schemas/image
             |
| size             | 372047872
             |
| status           | active
             |
| tags             |
             |
| updated_at       | 2018-02-17T10:42:23Z
             |
| virtual_size     | None
             |
| visibility       | shared
             |
+------------------
+--------------------------------------------------------------------------------+
```

f. Create a Nova instance with the VMware VMDK-based image and target it to the new cluster in the vCenter.

g. The new VM will appear in the vCenter.

h. The respective PortGroups for the OVSvApp on the Trunk-DVS will be created and connected.

i. Test the VM for connectivity and service.

16 Integrating NSX for vSphere

This section describes the installation and integration of NSX-v, a Software Defined Networking (SDN) network virtualization and security platform for VMware's vSphere.

VMware's NSX embeds networking and security functionality, normally handled by hardware, directly into the hypervisor. NSX can reproduce, in software, an entire networking environment, and provides a complete set of logical networking elements and services including logical switching, routing, firewalling, load balancing, VPN, QoS, and monitoring. Virtual networks are programmatically provisioned and managed independent of the underlying hardware.

VMware's Neutron plugin called NSX for vSphere (NSX-v) has been tested under the following scenarios:

- Virtual SUSE OpenStack Cloud deployment
- Baremetal SUSE OpenStack Cloud deployment

Installation instructions are provided for both scenarios. This documentation is meant as an example of how to integrate VMware's NSX-v Neutron plugin with SUSE OpenStack Cloud. The examples in this documentation are not suitable for all environments. To configure this for your specific environment, use the design guide Reference Design: VMware® NSX for vSphere (NSX) Network Virtualization Design Guide (https://communities.vmware.com/servlet/JiveServlet/downloadBody/27683-102-8-41631/NSX).

This section includes instructions for:

- Integrating with NSX for vSphere on Baremetal
- Integrating with NSX for vSphere on virtual machines with changes necessary for Baremetal integration
- Verifying NSX-v functionality

16.1 Integrating with NSX for vSphere

This section describes the installation steps and requirements for integrating with NSX for vSphere on virtual machines and baremetal hardware.

16.1.1 Pre-Integration Checklist

The following installation and integration instructions assumes an understanding of VMware's ESXI and vSphere products for setting up virtual environments.

Please review the following requirements for the VMware vSphere environment.

Software Requirements

Before you install or upgrade NSX, verify your software versions. The following are the required versions.

Software	Version
SUSE OpenStack Cloud	8
VMware NSX-v Manager	6.3.4 or higher
VMWare NSX-v Neutron Plugin	Pike Release (TAG=11.0.0)
VMWare ESXi and vSphere Appliance (vSphere web Client)	6.0 or higher

A vCenter server (appliance) is required to manage the vSphere environment. It is recommended that you install a vCenter appliance as an ESX virtual machine.

> **Important**
>
> Each ESXi compute cluster is required to have shared storage between the hosts in the cluster, otherwise attempts to create instances through nova-compute will fail.

16.1.2 Installing OpenStack

OpenStack can be deployed in two ways: on baremetal (physical hardware) or in an ESXi virtual environment on virtual machines. The following instructions describe how to install OpenStack.

> **Note**
>
> **Changes for installation on baremetal hardware are noted in each section.**

This deployment example will consist of two ESXi clusters at minimum: a `control-plane` cluster and a `compute` cluster. The control-plane cluster must have 3 ESXi hosts minimum (due to VMware's recommendation that each NSX controller virtual machine is on a separate host). The compute cluster must have 2 ESXi hosts minimum. There can be multiple compute clusters. The following table outlines the virtual machine specifications to be built in the control-plane cluster:

TABLE 16.1: NSX HARDWARE REQUIREMENTS FOR VIRTUAL MACHINE INTEGRATION

Virtual Machine Role	Required Number	Disk	Memory	Network	CPU
Dedicated lifecycle manager **Baremetal - not needed**	1	100GB	8GB	3 VMXNET Virtual Network Adapters	4 vCPU
Controller virtual machines **Baremetal - not needed**	3	3 x 300GB	32GB	3 VMXNET Virtual Network Adapters	8 vCPU
Compute virtual machines	1 per compute cluster	80GB	4GB	3 VMXNET Virtual Network Adapters	2 vCPU
NSX Edge Gateway/DLR/Metadata-proxy appliances		Autogenerated by NSXv	Autogenerated by NSXv	Autogenerated by NSXv	Autogenerated by NSXv

Baremetal: In addition to the ESXi hosts, it is recommended to have one physical host for the Cloud Lifecycle Manager node and three physical hosts for the controller nodes.

16.1.2.1 Network Requirements

NSX-v requires the following for networking:

- The ESXi hosts, vCenter, and the NSX Manager appliance must resolve DNS lookup.
- The ESXi host must have the NTP service configured and enabled.
- Jumbo frames must be enabled on the switch ports that the ESXi hosts are connected to.
- The ESXi hosts must have at least 2 physical network cards each.

16.1.2.2 Network Model

The model in these instructions requires the following networks:

ESXi Hosts and vCenter
: This is the network that the ESXi hosts and vCenter use to route traffic with.

NSX Management
: The network which the NSX controllers and NSX Manager will use.

NSX VTEP Pool
: The network that NSX uses to create endpoints for VxLAN tunnels.

Management
: The network that OpenStack uses for deployment and maintenance of the cloud.

Internal API (optional)
: The network group that will be used for management (private API) traffic within the cloud.

External API
: This is the network that users will use to make requests to the cloud.

External VM
: VLAN-backed provider network for external access to guest VMs (floating IPs).

16.1.2.3 vSphere port security settings

Baremetal: Even though the OpenStack deployment is on baremetal, it is still necessary to define each VLAN within a vSphere Distributed Switch for the Nova compute proxy virtual machine.

The vSphere port security settings for both VMs and baremetal are shown in the table below.

Network Group	VLAN Type	Interface	vSphere Port Group Security Settings
ESXi Hosts and vCenter	Tagged	N/A	Defaults
NSX Manager Must be able to reach ESXi Hosts and vCenter	Tagged	N/A	Defaults
NSX VTEP Pool	Tagged	N/A	Defaults
Management	Tagged or Untagged	eth0	**Promiscuous Mode**: Accept **MAC Address Changes**: Reject **Forged Transmits:**Reject
Internal API (Optional, may be combined with the Management Network. If network segregation is required for security reasons, you can keep this as a separate network.)	Tagged	eth2	**Promiscuous Mode**: Accept **MAC Address Changes**: Reject **Forged Transmits**: Accept
External API (Public)	Tagged	eth1	**Promiscuous Mode**: Accept **MAC Address Changes**: Reject **Forged Transmits**: Accept
External VM	Tagged	N/A	**Promiscuous Mode**: Accept **MAC Address Changes**: Reject **Forged Transmits**: Accept
Baremetal Only: IPMI	Untagged	N/A	N/A

16.1.2.4 Configuring the vSphere Environment

Before deploying OpenStack with NSX-v, the VMware vSphere environment must be properly configured, including setting up vSphere distributed switches and port groups. For detailed instructions, see *Chapter 15, Installing ESX Computes and OVSvAPP*.

Installing and configuring the VMware NSX Manager and creating the NSX network within the vSphere environment is covered below.

Before proceeding with the installation, ensure that the following are configured in the vSphere environment.

- The vSphere datacenter is configured with at least two clusters, one **control-plane** cluster and one **compute** cluster.
- Verify that all software, hardware, and networking requirements have been met.
- Ensure the vSphere distributed virtual switches (DVS) are configured for each cluster.

> **Note**
>
> The MTU setting for each DVS should be set to 1600. NSX should automatically apply this setting to each DVS during the setup process. Alternatively, the setting can be manually applied to each DVS before setup if desired.

Make sure there is a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and that it is called `sles12sp3.iso`.

Install the `open-vm-tools` package.

```
tux > sudo zypper install open-vm-tools
```

16.1.2.4.1 Install NSX Manager

The NSX Manager is the centralized network management component of NSX. It provides a single point of configuration and REST API entry-points.

The NSX Manager is installed as a virtual appliance on one of the ESXi hosts within the vSphere environment. This guide will cover installing the appliance on one of the ESXi hosts within the control-plane cluster. For more detailed information, refer to VMware's NSX Installation Guide. (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-D8578F6E-A40C-493A-9B43-877C2B75ED52.html)

To install the NSX Manager, download the virtual appliance from VMware (https://www.vmware.com/go/download-nsx-vsphere) and deploy the appliance within vCenter onto one of the ESXi hosts. For information on deploying appliances within vCenter, refer to VMware's documentation for ESXi 5.5 (https://pubs.vmware.com/vsphere-55/index.jsp?topic=%2Fcom.vmware.vsphere.vm_admin.doc%2FGUID-AFEDC48B-C96F-4088-9C1F-4F0A30E965DE.html) or 6.0 (https://pubs.vmware.com/vsphere-60/index.jsp?topic=%2Fcom.vmware.vsphere.vm_admin.doc%2FGUID-AFEDC48B-C96F-4088-9C1F-4F0A30E965DE.html).

During the deployment of the NSX Manager appliance, be aware of the following:

When prompted, select *Accept extra configuration options*. This will present options for configuring IPv4 and IPv6 addresses, the default gateway, DNS, NTP, and SSH properties during the installation, rather than configuring these settings manually after the installation.

- Choose an ESXi host that resides within the control-plane cluster.
- Ensure that the network mapped port group is the DVS port group that represents the VLAN the NSX Manager will use for its networking (in this example it is labeled as the `NSX Management` network).

Note

The IP address assigned to the NSX Manager must be able to resolve reverse DNS.

Power on the NSX Manager virtual machine after it finishes deploying and wait for the operating system to fully load. When ready, carry out the following steps to have the NSX Manager use single sign-on (SSO) and to register the NSX Manager with vCenter:

1. Open a web browser and enter the hostname or IP address that was assigned to the NSX Manager during setup.
2. Log in with the username `admin` and the password set during the deployment.
3. After logging in, click on *Manage vCenter Registration*.
4. Configure the NSX Manager to connect to the vCenter server.
5. Configure NSX manager for single sign on (SSO) under the *Lookup Server URL* section.

> **Note**
>
> When configuring SSO, use `Lookup Service Port 443` for vCenter version 6.0. Use `Lookup Service Port 7444` for vCenter version 5.5.
>
> SSO makes vSphere and NSX more secure by allowing the various components to communicate with each other through a secure token exchange mechanism, instead of requiring each component to authenticate a user separately. For more details, refer to VMware's documentation on Configure Single Sign-On (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-523B0D77-AAB9-4535-B326-1716967EC0D2.html).

Both the `Lookup Service URL` and the `vCenter Server` sections should have a status of `connected` when configured properly.

Log into the vSphere Web Client (log out and and back in if already logged in). The NSX Manager will appear under the *Networking & Security* section of the client.

> **Note**
>
> The *Networking & Security* section will not appear under the vSphere desktop client. Use of the web client is required for the rest of this process.

16.1.2.4.2 Add NSX Controllers

The NSX controllers serve as the central control point for all logical switches within the vSphere environment's network, and they maintain information about all hosts, logical switches (VXLANs), and distributed logical routers.

NSX controllers will each be deployed as a virtual appliance on the ESXi hosts within the control-plane cluster to form the NSX Controller cluster. For details about NSX controllers and the NSX control plane in general, refer to VMware's NSX documentation (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-4E0FEE83-CF2C-45E0-B0E6-177161C3D67C.html).

Important

Whatever the size of the NSX deployment, the following conditions must be met:

- Each NSX Controller cluster must contain three controller nodes. Having a different number of controller nodes is not supported.
- Before deploying NSX Controllers, you must deploy an NSX Manager appliance and register vCenter with NSX Manager.
- Determine the IP pool settings for your controller cluster, including the gateway and IP address range. DNS settings are optional.
- The NSX Controller IP network must have connectivity to the NSX Manager and to the management interfaces on the ESXi hosts.

Log in to the vSphere web client and do the following steps to add the NSX controllers:

1. In vCenter, navigate to *Home*, select *Networking & Security* › *Installation*, and then select the *Management* tab.
2. In the *NSX Controller nodes* section, click the *Add Node* icon represented by a green plus sign.
3. Enter the NSX Controller settings appropriate to your environment. If you are following this example, use the control-plane clustered ESXi hosts and control-plane DVS port group for the controller settings.
4. If it has not already been done, create an IP pool for the NSX Controller cluster with at least three IP addressess by clicking *New IP Pool*. Individual controllers can be in separate IP subnets, if necessary.
5. Click *OK* to deploy the controller. After the first controller is completely deployed, deploy two additional controllers.

Important

Three NSX controllers is mandatory. VMware recommends configuring a DRS anti-affinity rule to prevent the controllers from residing on the same ESXi host. See more information about DRS Affinity Rules (https://pubs.vmware.com/vsphere-51/index.jsp?topic=%2Fcom.vmware.vsphere.resmgmt.doc%2FGUID-FF28F29C-8B67-4EFF-A2EF-63B3537E6934.html) ↗.

16.1.2.4.3 Prepare Clusters for NSX Management

During *Host Preparation*, the NSX Manager:

- Installs the NSX kernel modules on ESXi hosts that are members of vSphere clusters
- Builds the NSX control-plane and management-plane infrastructure

The NSX kernel modules are packaged in `VIB` (vSphere Installation Bundle) files. They run within the hypervisor kernel and provide services such as distributed routing, distributed firewall, and VXLAN bridging capabilities. These files are installed on a per-cluster level, and the setup process deploys the required software on all ESXi hosts in the target cluster. When a new ESXi host is added to the cluster, the required software is automatically installed on the newly added host.

Before beginning the NSX host preparation process, make sure of the following in your environment:

- Register vCenter with NSX Manager and deploy the NSX controllers.
- Verify that DNS reverse lookup returns a fully qualified domain name when queried with the IP address of NSX Manager.
- Verify that the ESXi hosts can resolve the DNS name of vCenter server.
- Verify that the ESXi hosts can connect to vCenter Server on port 80.
- Verify that the network time on vCenter Server and the ESXi hosts is synchronized.
- For each vSphere cluster that will participate in NSX, verify that the ESXi hosts within each respective cluster are attached to a common VDS.

For example, given a deployment with two clusters named Host1 and Host2. Host1 is attached to VDS1 and VDS2. Host2 is attached to VDS1 and VDS3. When you prepare a cluster for NSX, you can only associate NSX with VDS1 on the cluster. If you add another host (Host3) to the cluster and Host3 is not attached to VDS1, it is an invalid configuration, and Host3 will not be ready for NSX functionality.

- If you have vSphere Update Manager (VUM) in your environment, you must disable it before preparing clusters for network virtualization. For information on how to check if VUM is enabled and how to disable it if necessary, see the VMware knowledge base (http://kb.vmware.com/kb/2053782).
- In the vSphere web client, ensure that the cluster is in the resolved state (listed under the *Host Preparation* tab). If the Resolve option does not appear in the cluster's Actions list, then it is in a resolved state.

To prepare the vSphere clusters for NSX:

1. In vCenter, select *Home* › *Networking & Security* › *Installation*, and then select the *Host Preparation* tab.
2. Continuing with the example in these instructions, click on the *Actions* button (gear icon) and select *Install* for both the control-plane cluster and compute cluster (if you are using something other than this example, then only install on the clusters that require NSX logical switching, routing, and firewalls).
3. Monitor the installation until the `Installation Status` column displays a green check mark.

   Important

   While installation is in progress, do not deploy, upgrade, or uninstall any service or component.

   Important

   If the `Installation Status` column displays a red warning icon and says `Not Ready`, click *Resolve*. Clicking *Resolve* might result in a reboot of the host. If the installation is still not successful, click the warning icon. All errors will be displayed. Take the required action and click *Resolve* again.

4. To verify the VIBs (`esx-vsip` and `esx-vxlan`) are installed and registered, SSH into an ESXi host within the prepared cluster. List the names and versions of the VIBs installed by running the following command:

```
tux > esxcli software vib list | grep esx
```

```
...
esx-vsip      6.0.0-0.0.2732470    VMware  VMwareCertified   2015-05-29
esx-vxlan     6.0.0-0.0.2732470    VMware  VMwareCertified   2015-05-29
...
```

Important

After host preparation:

- A host reboot is not required
- If you add a host to a prepared cluster, the NSX VIBs are automatically installed on the host.
- If you move a host to an unprepared cluster, the NSX VIBs are automatically uninstalled from the host. In this case, a host reboot is required to complete the uninstall process.

16.1.2.4.4 Configure VXLAN Transport Parameters

VXLAN is configured on a per-cluster basis, where each vSphere cluster that is to participate in NSX is mapped to a vSphere Distributed Virtual Switch (DVS). When mapping a vSphere cluster to a DVS, each ESXi host in that cluster is enabled for logical switches. The settings chosen in this section will be used in creating the VMkernel interface.

Configuring transport parameters involves selecting a DVS, a VLAN ID, an MTU size, an IP addressing mechanism, and a NIC teaming policy. The MTU for each switch must be set to 1550 or higher. By default, it is set to 1600 by NSX. This is also the recommended setting for integration with OpenStack.

To configure the VXLAN transport parameters:

1. In the vSphere web client, navigate to *Home* › *Networking & Security* › *Installation*.
2. Select the *Host Preparation* tab.

3. Click the *Configure* link in the VXLAN column.
4. Enter the required information.
5. If you have not already done so, create an IP pool for the VXLAN tunnel end points (VTEP) by clicking *New IP Pool*:
6. Click *OK* to create the VXLAN network.

When configuring the VXLAN transport network, consider the following:

- Use a NIC teaming policy that best suits the environment being built. `Load Balance - SRCID` as the VMKNic teaming policy is usually the most flexible out of all the available options. This allows each host to have a VTEP vmkernel interface for each dvuplink on the selected distributed switch (two dvuplinks gives two VTEP interfaces per ESXi host).
- Do not mix different teaming policies for different portgroups on a VDS where some use Etherchannel or Link Aggregation Control Protocol (LACPv1 or LACPv2) and others use a different teaming policy. If uplinks are shared in these different teaming policies, traffic will be interrupted. If logical routers are present, there will be routing problems. Such a configuration is not supported and should be avoided.
- For larger environments it may be better to use DHCP for the VMKNic IP Addressing.
- For more information and further guidance, see the VMware NSX for vSphere Network Virtualization Design Guide (https://communities.vmware.com/docs/DOC-27683).

16.1.2.4.5 Assign Segment ID Pool

Each VXLAN tunnel will need a segment ID to isolate its network traffic. Therefore, it is necessary to configure a segment ID pool for the NSX VXLAN network to use. If an NSX controller is not deployed within the vSphere environment, a multicast address range must be added to spread traffic across the network and avoid overloading a single multicast address.

For the purposes of the example in these instructions, do the following steps to assign a segment ID pool. Otherwise, follow best practices as outlined in VMware's documentation (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-7B33DE72-78A7-448C-A61C-9B41D1EB12AD.html).

1. In the vSphere web client, navigate to *Home* › *Networking & Security* › *Installation*.
2. Select the *Logical Network Preparation* tab.

3. Click *Segment ID*, and then *Edit*.

4. Click *OK* to save your changes.

16.1.2.4.6 Create a Transport Zone

A transport zone controls which hosts a logical switch can reach and has the following characteristics.

- It can span one or more vSphere clusters.
- Transport zones dictate which clusters can participate in the use of a particular network. Therefore they dictate which VMs can participate in the use of a particular network.
- A vSphere NSX environment can contain one or more transport zones based on the environment's requirements.
- A host cluster can belong to multiple transport zones.
- A logical switch can belong to only one transport zone.

> **Note**
>
> OpenStack has only been verified to work with a single transport zone within a vSphere NSX-v environment. Other configurations are currently not supported.

For more information on transport zones, refer to VMware's Add A Transport Zone (https://pubs.vmware.com/NSX-62/topic/com.vmware.nsx.install.doc/GUID-0B3B-D895-8037-48A8-831C-8A8986C3CA42.html).

To create a transport zone:

1. In the vSphere web client, navigate to *Home* › *Networking & Security* › *Installation*.

2. Select the *Logical Network Preparation* tab.

3. Click *Transport Zones*, and then click the *New Transport Zone* (New Logical Switch) icon.

4. In the *New Transport Zone* dialog box, type a name and an optional description for the transport zone.

5. For these example instructions, select the control plane mode as `Unicast`.

> **Note**
>
> Whether there is a controller in the environment or if the environment is going to use multicast addresses will determine the control plane mode to select:
>
> - `Unicast` (what this set of instructions uses): The control plane is handled by an NSX controller. All unicast traffic leverages optimized headend replication. No multicast IP addresses or special network configuration is required.
> - `Multicast`: Multicast IP addresses in the physical network are used for the control plane. This mode is recommended only when upgrading from older VXLAN deployments. Requires PIM/IGMP in the physical network.
> - `Hybrid`: Offloads local traffic replication to the physical network (L2 multicast). This requires IGMP snooping on the first-hop switch and access to an IGMP querier in each VTEP subnet, but does not require PIM. The first-hop switch handles traffic replication for the subnet.

6. Select the clusters to be added to the transport zone.
7. Click *OK* to save your changes.

16.1.2.4.7 Deploying SUSE OpenStack Cloud

With vSphere environment setup completed, the OpenStack can be deployed. The following sections will cover creating virtual machines within the vSphere environment, configuring the cloud model and integrating NSX-v Neutron core plugin into the OpenStack:

1. Create the virtual machines
2. Deploy the Cloud Lifecycle Manager
3. Configure the Neutron environment with NSX-v
4. Modify the cloud input model
5. Set up the parameters
6. Deploy the Operating System with Cobbler
7. Deploy the cloud

16.1.2.5 Deploying SUSE OpenStack Cloud

Within the vSphere environment, create the OpenStack virtual machines. At minimum, there must be the following:

- One Cloud Lifecycle Manager deployer
- Three OpenStack controllers
- One OpenStack Neutron compute proxy

For the minimum NSX hardware requirements, refer to *Table 16.1, "NSX Hardware Requirements for Virtual Machine Integration"*.

If ESX VMs are to be used as Nova compute proxy nodes, set up three LAN interfaces in each virtual machine as shown in the networking model table below. There must be at least one Nova compute proxy node per cluster.

Network Group	Interface
Management	`eth0`
External API	`eth1`
Internal API	`eth2`

16.1.2.5.1 Advanced Configuration Option

Important

Within vSphere for each in the virtual machine:

- In the *Options* section, under *Advanced configuration parameters*, ensure that `disk.EnableUUIDoption` is set to `true`.
- If the option does not exist, it must be added. This option is required for the OpenStack deployment.
- If the option is not specified, then the deployment will fail when attempting to configure the disks of each virtual machine.

16.1.2.5.2 Setting Up the Cloud Lifecycle Manager

16.1.2.5.2.1 Installing the Cloud Lifecycle Manager

Running the `ARDANA_INIT_AUTO=1` command is optional to avoid stopping for authentication at any step. You can also run `ardana-init` to launch the Cloud Lifecycle Manager. You will be prompted to enter an optional SSH passphrase, which is used to protect the key used by Ansible when connecting to its client nodes. If you do not want to use a passphrase, press `Enter` at the prompt.

If you have protected the SSH key with a passphrase, you can avoid having to enter the passphrase on every attempt by Ansible to connect to its client nodes with the following commands:

```
ardana > eval $(ssh-agent)
ardana > ssh-add ~/.ssh/id_rsa
```

The Cloud Lifecycle Manager will contain the installation scripts and configuration files to deploy your cloud. You can set up the Cloud Lifecycle Manager on a dedicated node or you do so on your first controller node. The default choice is to use the first controller node as the Cloud Lifecycle Manager.

1. Download the product from:
   - SUSE Customer Center (https://scc.suse.com/)
2. Boot your Cloud Lifecycle Manager from the SLES ISO contained in the download.
3. Enter `install` (all lower-case, exactly as spelled out here) to start installation.
4. Select the language. Note that only the English language selection is currently supported.
5. Select the location.
6. Select the keyboard layout.
7. Select the primary network interface, if prompted:
   - Assign IP address, subnet mask, and default gateway
8. Create new account:
   a. Enter a username.

b. Enter a password.

c. Enter time zone.

Once the initial installation is finished, complete the Cloud Lifecycle Manager setup with these steps:

1. Ensure your Cloud Lifecycle Manager has a valid DNS nameserver specified in `/etc/resolv.conf`.

2. Set the environment variable LC_ALL:

```
export LC_ALL=C
```

> **Note**
>
> This can be added to `~/.bashrc` or `/etc/bash.bashrc`.

The node should now have a working SLES setup.

16.1.2.5.3 Configure the Neutron Environment with NSX-v

In summary, integrating NSX with vSphere has four major steps:

1. Modify the input model to define the server roles, servers, network roles and networks. *Section 16.1.2.5.3.2, "Modify the Input Model"*

2. Set up the parameters needed for Neutron and Nova to communicate with the ESX and NSX Manager. *Section 16.1.2.5.3.3, "Deploying the Operating System with Cobbler"*

3. Do the steps to deploy the cloud. *Section 16.1.2.5.3.4, "Deploying the Cloud"*

16.1.2.5.3.1 Third-Party Import of VMware NSX-v Into Neutron and Neutronclient

To import the NSX-v Neutron core-plugin into Cloud Lifecycle Manager, run the third-party import playbook.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost third-party-import.yml
```

16.1.2.5.3.2 Modify the Input Model

After the third-party import has completed successfully, modify the input model:

1. Prepare for input model changes
2. Define the servers and server roles needed for a NSX-v cloud.
3. Define the necessary networks and network groups
4. Specify the services needed to be deployed on the Cloud Lifecycle Manager controllers and the Nova ESX compute proxy nodes.
5. Commit the changes and run the configuration processor.

16.1.2.5.3.2.1 Prepare for Input Model Changes

The previous steps created a modified SUSE OpenStack Cloud tarball with the NSX-v core plugin in the Neutron and `neutronclient` venvs. The `tar` file can now be extracted and the `ardana-init.bash` script can be run to set up the deployment files and directories. If a modified `tar` file was not created, then extract the tar from the /media/cdrom/ardana location.

To run the `ardana-init.bash` script which is included in the build, use this commands:

```
ardana > ~/ardana/hos-init.bash
```

16.1.2.5.3.2.2 Create the Input Model

Copy the example input model to `~/openstack/my_cloud/definition/` directory:

```
ardana > cd ~/ardana-extensions/ardana-extensions-nsx/vmware/examples/models/entry-scale-
nsx
ardana > cp -R entry-scale-nsx ~/openstack/my_cloud/definition
```

Refer to the reference input model in `ardana-extensions/ardana-extensions-nsx/vmware/examples/models/entry-scale-nsx/` for details about how these definitions should be made. The main differences between this model and the standard Cloud Lifecycle Manager input models are:

- Only the neutron-server is deployed. No other neutron agents are deployed.
- Additional parameters need to be set in `pass_through.yml` and `nsx/nsx_config.yml`.
- Nova ESX compute proxy nodes may be ESX virtual machines.

16.1.2.5.3.2.2.1 Set up the Parameters

The special parameters needed for the NSX-v integrations are set in the files `pass_through.yml` and `nsx/nsx_config.yml`. They are in the `~/openstack/my_cloud/definition/data` directory.

Parameters in `pass_through.yml` are in the sample input model in the `ardana-extensions/ardana-extensions-nsx/vmware/examples/models/entry-scale-nsx/` directory. The comments in the sample input model file describe how to locate the values of the required parameters.

```
#
# (c) Copyright 2017 SUSE LLC
#
# Licensed under the Apache License, Version 2.0 (the "License"); you may
# not use this file except in compliance with the License. You may obtain
# a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS, WITHOUT
# WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the
# License for the specific language governing permissions and limitations
# under the License.
#
---
product:
  version: 2
pass-through:
  global:
    vmware:
      - username: VCENTER_ADMIN_USERNAME
        ip: VCENTER_IP
        port: 443
        cert_check: false
        # The password needs to be encrypted using the script
        # openstack/ardana/ansible/ardanaencrypt.py on the deployer:
        #
        # $ cd ~/openstack/ardana/ansible
        # $ export ARDANA_USER_PASSWORD_ENCRYPT_KEY=ENCRYPTION_KEY
        # $ ./ardanaencrypt.py
        #
        # The script will prompt for the vCenter password. The string
        # generated is the encrypted password. Enter the string
        # enclosed by double-quotes below.
```

```
        password: "ENCRYPTED_PASSWD_FROM_ARDANAENCRYPT"

        # The id is is obtained by the URL
        # https://VCENTER_IP/mob/?moid=ServiceInstance&doPath=content%2eabout,
        # field instanceUUID.
        id: VCENTER_UUID
  servers:
    -
      # Here the 'id' refers to the name of the node running the
      # esx-compute-proxy. This is identical to the 'servers.id' in
      # servers.yml. There should be one esx-compute-proxy node per ESX
      # resource pool.
      id: esx-compute1
      data:
        vmware:
          vcenter_cluster: VMWARE_CLUSTER1_NAME
          vcenter_id: VCENTER_UUID
    -
      id: esx-compute2
      data:
        vmware:
          vcenter_cluster: VMWARE_CLUSTER2_NAME
          vcenter_id: VCENTER_UUID
```

There are parameters in `nsx/nsx_config.yml`. The comments describes how to retrieve the values.

```
# (c) Copyright 2017 SUSE LLC
#
# Licensed under the Apache License, Version 2.0 (the "License"); you may
# not use this file except in compliance with the License. You may obtain
# a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS, WITHOUT
# WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the
# License for the specific language governing permissions and limitations
# under the License.
#
---
  product:
    version: 2
  configuration-data:
    - name: NSX-CONFIG-CP1
      services:
```

```
  - nsx
data:
  # (Required) URL for NSXv manager (e.g - https://management_ip).
  manager_uri: 'https://NSX_MGR_IP

  # (Required) NSXv username.
  user: 'admin'

  # (Required) Encrypted NSX Manager password.
  # Password encryption is done by the script
  # ~/openstack/ardana/ansible/ardanaencrypt.py on the deployer:
  #
  # $ cd ~/openstack/ardana/ansible
  # $ export ARDANA_USER_PASSWORD_ENCRYPT_KEY=ENCRYPTION_KEY
  # $ ./ardanaencrypt.py
  #
  # NOTE: Make sure that the NSX Manager password is encrypted with the same key
  # used to encrypt the VCenter password.
  #
  # The script will prompt for the NSX Manager password. The string
  # generated is the encrypted password. Enter the string enclosed
  # by double-quotes below.
  password: "ENCRYPTED_NSX_MGR_PASSWD_FROM_ARDANAENCRYPT"
  # (Required) datacenter id for edge deployment.
  # Retrieved using
  #    http://VCENTER_IP_ADDR/mob/?moid=ServiceInstance&doPath=content
  # click on the value from the rootFolder property. The datacenter_moid is
  # the value of the childEntity property.
  # The vCenter-ip-address comes from the file pass_through.yml in the
  # input model under "pass-through.global.vmware.ip".
  datacenter_moid: 'datacenter-21'
  # (Required) id of logic switch for physical network connectivity.
  # How to retrieve
  # 1. Get to the same page where the datacenter_moid is found.
  # 2. Click on the value of the rootFolder property.
  # 3. Click on the value of the childEntity property
  # 4. Look at the network property. The external network is
  #    network associated with EXTERNAL VM in VCenter.
  external_network: 'dvportgroup-74'
  # (Required) clusters ids containing OpenStack hosts.
  # Retrieved using http://VCENTER_IP_ADDR/mob, click on the value
  # from the rootFolder property. Then click on the value of the
  # hostFolder property. Cluster_moids are the values under childEntity
  # property of the compute clusters.
  cluster_moid: 'domain-c33,domain-c35'
  # (Required) resource-pool id for edge deployment.
  resource_pool_id: 'resgroup-67'
```

```
# (Optional) datastore id for edge deployment. If not needed,
# do not declare it.
# datastore_id: 'datastore-117'

# (Required) network scope id of the transport zone.
# To get the vdn_scope_id, in the vSphere web client from the Home
# menu:
#   1. click on Networking & Security
#   2. click on installation
#   3. click on the Logical Netowrk Preparation tab.
#   4. click on the Transport Zones button.
#   5. Double click on the transport zone being configure.
#   6. Select Manage tab.
#   7. The vdn_scope_id will appear at the end of the URL.
vdn_scope_id: 'vdnscope-1'

# (Optional) Dvs id for VLAN based networks. If not needed,
# do not declare it.
# dvs_id: 'dvs-68'

# (Required) backup_edge_pool: backup edge pools management range,
# - edge_type>[edge_size]:MINIMUM_POOLED_EDGES:MAXIMUM_POOLED_EDGES
# - edge_type: service (service edge) or  vdr (distributed edge)
# - edge_size:  compact ,  large (by default),  xlarge  or  quadlarge
backup_edge_pool: 'service:compact:4:10,vdr:compact:4:10'

# (Optional) mgt_net_proxy_ips: management network IP address for
# metadata proxy. If not needed, do not declare it.
# mgt_net_proxy_ips: '10.142.14.251,10.142.14.252'

# (Optional) mgt_net_proxy_netmask: management network netmask for
# metadata proxy. If not needed, do not declare it.
# mgt_net_proxy_netmask: '255.255.255.0'

# (Optional) mgt_net_moid: Network ID for management network connectivity
# Do not declare if not used.
# mgt_net_moid: 'dvportgroup-73'

# ca_file: Name of the certificate file. If insecure is set to True,
# then this parameter is ignored. If insecure is set to False and this
# parameter is not defined, then the system root CAs will be used
# to verify the server certificate.
ca_file: a/nsx/certificate/file

# insecure:
# If true (default), the NSXv server certificate is not verified.
# If false, then the default CA truststore is used for verification.
```

```
# This option is ignored if "ca_file" is set
insecure: True
# (Optional) edge_ha: if true, will duplicate any edge pool resources
# Default to False if undeclared.
# edge_ha: False
# (Optional) spoofguard_enabled:
# If True (default), indicates NSXV spoofguard component is used to
# implement port-security feature.
# spoofguard_enabled: True
# (Optional) exclusive_router_appliance_size:
# Edge appliance size to be used for creating exclusive router.
# Valid values: 'compact', 'large', 'xlarge', 'quadlarge'
# Defaults to 'compact' if not declared.  # exclusive_router_appliance_size:
'compact'
```

16.1.2.5.3.2.3 Commit Changes and Run the Configuration Processor

Commit your changes with the input model and the required configuration values added to the `pass_through.yml` and `nsx/nsx_config.yml` files.

```
ardana > cd ~/openstack/my_cloud/definition
ardana > git commit -A -m "Configuration changes for NSX deployment"
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml \
 -e \encrypt="" -e rekey=""
```

If the playbook `config-processor-run.yml` fails, there is an error in the input model. Fix the error and repeat the above steps.

16.1.2.5.3.3 Deploying the Operating System with Cobbler

1. From the Cloud Lifecycle Manager, run Cobbler to install the operating system on the nodes after it has to be deployed:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost cobbler-deploy.yml
   ```

2. Verify the nodes that will have an operating system installed by Cobbler by running this command:

   ```
   tux > sudo cobbler system find --netboot-enabled=1
   ```

3. Reimage the nodes using Cobbler. Do not use Cobbler to reimage the nodes running as ESX virtual machines. The command below is run on a setup where the Nova ESX compute proxies are VMs. Controllers 1, 2, and 3 are running on physical servers.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost bm-reimage.yml -e \
   nodelist=controller1,controller2,controller3
```

4. When the playbook has completed, each controller node should have an operating system installed with an IP address configured on `eth0`.

5. After your controller nodes have been completed, you should install the operating system on your Nova compute proxy virtual machines. Each configured virtual machine should be able to PXE boot into the operating system installer.

6. From within the vSphere environment, power on each Nova compute proxy virtual machine and watch for it to PXE boot into the OS installer via its console.

   a. If successful, the virtual machine will have the operating system automatically installed and will then automatically power off.

   b. When the virtual machine has powered off, power it on and let it boot into the operating system.

7. Verify network settings after deploying the operating system to each node.

   - Verify that the NIC bus mapping specified in the cloud model input file (`~/ardana/my_cloud/definition/data/nic_mappings.yml`) matches the NIC bus mapping on each OpenStack node.
     Check the NIC bus mapping with this command:

     ```
     tux > sudo cobbler system list
     ```

   - After the playbook has completed, each controller node should have an operating system installed with an IP address configured on eth0.

8. When the ESX compute proxy nodes are VMs, install the operating system if you have not already done so.

16.1.2.5.3.4 Deploying the Cloud

When the configuration processor has completed successfully, the cloud can be deployed. Set the ARDANA_USER_PASSWORD_ENCRYPT_KEY environment variable before running `site.yml`.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > export ARDANA_USER_PASSWORD_ENCRYPT_KEY=PASSWORD_KEY
ardana > ansible-playbook -i hosts/verb_hosts site.yml
ardana > ansible-playbook -i hosts/verb_hosts ardana-cloud-configure.yml
```

`PASSWORD_KEY` in the `export` command is the key used to encrypt the passwords for vCenter and NSX Manager.

16.2 Integrating with NSX for vSphere on Baremetal

This section describes the installation steps and requirements for integrating with NSX for vSphere on baremetal physical hardware.

16.2.1 Pre-Integration Checklist

The following installation and integration instructions assumes an understanding of VMware's ESXI and vSphere products for setting up virtual environments.

Please review the following requirements for the VMware vSphere environment.

Software Requirements

Before you install or upgrade NSX, verify your software versions. The following are the required versions.

Software	Version
SUSE OpenStack Cloud	8
VMware NSX-v Manager	6.3.4 or higher
VMWare NSX-v Neutron Plugin	Pike Release (TAG=11.0.0)
VMWare ESXi and vSphere Appliance (vSphere web Client)	6.0 or higher

A vCenter server (appliance) is required to manage the vSphere environment. It is recommended that you install a vCenter appliance as an ESX virtual machine.

> **Important**
>
> Each ESXi compute cluster is required to have shared storage between the hosts in the cluster, otherwise attempts to create instances through nova-compute will fail.

16.2.2 Installing on Baremetal

OpenStack can be deployed in two ways: on baremetal (physical hardware) or in an ESXi virtual environment on virtual machines. The following instructions describe how to install OpenStack on baremetal nodes with vCenter and NSX Manager running as virtual machines. For instructions on virtual machine installation, see *Section 16.1, "Integrating with NSX for vSphere"*.

This deployment example will consist of two ESXi clusters at minimum: a `control-plane` cluster and a `compute` cluster. The control-plane cluster must have 3 ESXi hosts minimum (due to VMware's recommendation that each NSX controller virtual machine is on a separate host). The compute cluster must have 2 ESXi hosts minimum. There can be multiple compute clusters. The following table outlines the virtual machine specifications to be built in the control-plane cluster:

TABLE 16.2: NSX HARDWARE REQUIREMENTS FOR BAREMETAL INTEGRATION

Virtual Machine Role	Required Number	Disk	Memory	Network	CPU
Compute virtual machines	1 per compute cluster	80GB	4GB	3 VMXNET Virtual Network Adapters	2 vCPU
NSX Edge Gateway/DLR/Metadata-proxy appliances		Autogenerated by NSXv	Autogenerated by NSXv	Autogenerated by NSXv	Autogenerat-

Virtual Machine Role	Required Number	Disk	Memory	Network	CPU
					ed by NSXv

In addition to the ESXi hosts, it is recommended that there is one physical host for the Cloud Lifecycle Manager node and three physical hosts for the controller nodes.

16.2.2.1 Network Requirements

NSX-v requires the following for networking:

- The ESXi hosts, vCenter, and the NSX Manager appliance must resolve DNS lookup.
- The ESXi host must have the NTP service configured and enabled.
- Jumbo frames must be enabled on the switch ports that the ESXi hosts are connected to.
- The ESXi hosts must have at least 2 physical network cards each.

16.2.2.2 Network Model

The model in these instructions requires the following networks:

ESXi Hosts and vCenter

This is the network that the ESXi hosts and vCenter use to route traffic with.

NSX Management

The network which the NSX controllers and NSX Manager will use.

NSX VTEP Pool

The network that NSX uses to create endpoints for VxLAN tunnels.

Management

The network that OpenStack uses for deployment and maintenance of the cloud.

Internal API (optional)

The network group that will be used for management (private API) traffic within the cloud.

External API

This is the network that users will use to make requests to the cloud.

External VM

VLAN-backed provider network for external access to guest VMs (floating IPs).

16.2.2.3 vSphere port security settings

Even though the OpenStack deployment is on baremetal, it is still necessary to define each VLAN within a vSphere Distributed Switch for the Nova compute proxy virtual machine. Therefore, the vSphere port security settings are shown in the table below.

Network Group	VLAN Type	Interface	vSphere Port Group Security Settings
IPMI	Untagged	N/A	N/A
ESXi Hosts and vCenter	Tagged	N/A	Defaults
NSX Manager Must be able to reach ESXi Hosts and vCenter	Tagged	N/A	Defaults
NSX VTEP Pool	Tagged	N/A	Defaults
Management	Tagged or Untagged	bond0	• **Promiscuous Mode**: Accept • **MAC Address Changes**: Reject • **Forged Transmits**:Reject
Internal API (Optional, may be combined with the Management Network. If network segregation is required for security reasons, you can keep this as a separate network.)	Tagged	bond0	• **Promiscuous Mode**: Accept • **MAC Address Changes**: Reject • **Forged Transmits**: Accept

Network Group	VLAN Type	Interface	vSphere Port Group Security Settings
External API (Public)	Tagged	N/A	• **Promiscuous Mode**: Accept • **MAC Address Changes**: Reject • **Forged Transmits**: Accept
External VM	Tagged	N/A	• **Promiscuous Mode**: Accept • **MAC Address Changes**: Reject • **Forged Transmits**: Accept

16.2.2.4 Configuring the vSphere Environment

Before deploying OpenStack with NSX-v, the VMware vSphere environment must be properly configured, including setting up vSphere distributed switches and port groups. For detailed instructions, see *Chapter 15, Installing ESX Computes and OVSvAPP*.

Installing and configuring the VMware NSX Manager and creating the NSX network within the vSphere environment is covered below.

Before proceeding with the installation, ensure that the following are configured in the vSphere environment.

- The vSphere datacenter is configured with at least two clusters, one **control-plane** cluster and one **compute** cluster.
- Verify that all software, hardware, and networking requirements have been met.
- Ensure the vSphere distributed virtual switches (DVS) are configured for each cluster.

> **Note**
>
> The MTU setting for each DVS should be set to 1600. NSX should automatically apply this setting to each DVS during the setup process. Alternatively, the setting can be manually applied to each DVS before setup if desired.

Make sure there is a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and that it is called `sles12sp3.iso`.

Install the `open-vm-tools` package.

```
tux > sudo zypper install open-vm-tools
```

16.2.2.4.1 Install NSX Manager

The NSX Manager is the centralized network management component of NSX. It provides a single point of configuration and REST API entry-points.

The NSX Manager is installed as a virtual appliance on one of the ESXi hosts within the vSphere environment. This guide will cover installing the appliance on one of the ESXi hosts within the control-plane cluster. For more detailed information, refer to VMware's NSX Installation Guide. (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-D8578F6E-A40C-493A-9B43-877C2B75ED52.html)

To install the NSX Manager, download the virtual appliance from VMware (https://www.vmware.com/go/download-nsx-vsphere) and deploy the appliance within vCenter onto one of the ESXi hosts. For information on deploying appliances within vCenter, refer to VMware's documentation for ESXi 5.5 (https://pubs.vmware.com/vsphere-55/index.jsp?topic=%2Fcom.vmware.vsphere.vm_admin.doc%2FGUID-AFEDC48B-C96F-4088-9C1F-4F0A30E965DE.html) or 6.0 (https://pubs.vmware.com/vsphere-60/index.jsp?topic=%2Fcom.vmware.vsphere.vm_admin.doc%2FGUID-AFEDC48B-C96F-4088-9C1F-4F0A30E965DE.html).

During the deployment of the NSX Manager appliance, be aware of the following:

When prompted, select *Accept extra configuration options*. This will present options for configuring IPv4 and IPv6 addresses, the default gateway, DNS, NTP, and SSH properties during the installation, rather than configuring these settings manually after the installation.

- Choose an ESXi host that resides within the control-plane cluster.
- Ensure that the network mapped port group is the DVS port group that represents the VLAN the NSX Manager will use for its networking (in this example it is labeled as the `NSX Management` network).

Note

The IP address assigned to the NSX Manager must be able to resolve reverse DNS.

Power on the NSX Manager virtual machine after it finishes deploying and wait for the operating system to fully load. When ready, carry out the following steps to have the NSX Manager use single sign-on (SSO) and to register the NSX Manager with vCenter:

1. Open a web browser and enter the hostname or IP address that was assigned to the NSX Manager during setup.
2. Log in with the username `admin` and the password set during the deployment.
3. After logging in, click on *Manage vCenter Registration*.
4. Configure the NSX Manager to connect to the vCenter server.
5. Configure NSX manager for single sign on (SSO) under the *Lookup Server URL* section.

Note

When configuring SSO, use `Lookup Service Port 443` for vCenter version 6.0. Use `Lookup Service Port 7444` for vCenter version 5.5.

SSO makes vSphere and NSX more secure by allowing the various components to communicate with each other through a secure token exchange mechanism, instead of requiring each component to authenticate a user separately. For more details, refer to VMware's documentation on Configure Single Sign-On (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-523B0D77-AAB9-4535-B326-1716967EC0D2.html).

Both the `Lookup Service URL` and the `vCenter Server` sections should have a status of `connected` when configured properly.

Log into the vSphere Web Client (log out and and back in if already logged in). The NSX Manager will appear under the *Networking & Security* section of the client.

Note

The *Networking & Security* section will not appear under the vSphere desktop client. Use of the web client is required for the rest of this process.

16.2.2.4.2 Add NSX Controllers

The NSX controllers serve as the central control point for all logical switches within the vSphere environment's network, and they maintain information about all hosts, logical switches (VXLANs), and distributed logical routers.

NSX controllers will each be deployed as a virtual appliance on the ESXi hosts within the control-plane cluster to form the NSX Controller cluster. For details about NSX controllers and the NSX control plane in general, refer to VMware's NSX documentation (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-4E0FEE83-CF2C-45E0-B0E6-177161C3D67C.html).

> **Important**
>
> Whatever the size of the NSX deployment, the following conditions must be met:
>
> - Each NSX Controller cluster must contain three controller nodes. Having a different number of controller nodes is not supported.
> - Before deploying NSX Controllers, you must deploy an NSX Manager appliance and register vCenter with NSX Manager.
> - Determine the IP pool settings for your controller cluster, including the gateway and IP address range. DNS settings are optional.
> - The NSX Controller IP network must have connectivity to the NSX Manager and to the management interfaces on the ESXi hosts.

Log in to the vSphere web client and do the following steps to add the NSX controllers:

1. In vCenter, navigate to *Home*, select *Networking & Security* › *Installation*, and then select the *Management* tab.
2. In the *NSX Controller nodes* section, click the *Add Node* icon represented by a green plus sign.
3. Enter the NSX Controller settings appropriate to your environment. If you are following this example, use the control-plane clustered ESXi hosts and control-plane DVS port group for the controller settings.

4. If it has not already been done, create an IP pool for the NSX Controller cluster with at least three IP addressess by clicking *New IP Pool*. Individual controllers can be in separate IP subnets, if necessary.

5. Click *OK* to deploy the controller. After the first controller is completely deployed, deploy two additional controllers.

> **Important**
>
> Three NSX controllers is mandatory. VMware recommends configuring a DRS anti-affinity rule to prevent the controllers from residing on the same ESXi host. See more information about DRS Affinity Rules (https://pubs.vmware.com/vsphere-51/index.jsp?topic=%2Fcom.vmware.vsphere.resmgmt.doc%2FGUID-FF28F29C-8B67-4EFF-A2EF-63B3537E6934.html) ↗.

16.2.2.4.3 Prepare Clusters for NSX Management

During *Host Preparation*, the NSX Manager:

- Installs the NSX kernel modules on ESXi hosts that are members of vSphere clusters
- Builds the NSX control-plane and management-plane infrastructure

The NSX kernel modules are packaged in `VIB` (vSphere Installation Bundle) files. They run within the hypervisor kernel and provide services such as distributed routing, distributed firewall, and VXLAN bridging capabilities. These files are installed on a per-cluster level, and the setup process deploys the required software on all ESXi hosts in the target cluster. When a new ESXi host is added to the cluster, the required software is automatically installed on the newly added host.

Before beginning the NSX host preparation process, make sure of the following in your environment:

- Register vCenter with NSX Manager and deploy the NSX controllers.
- Verify that DNS reverse lookup returns a fully qualified domain name when queried with the IP address of NSX Manager.
- Verify that the ESXi hosts can resolve the DNS name of vCenter server.

- Verify that the ESXi hosts can connect to vCenter Server on port 80.
- Verify that the network time on vCenter Server and the ESXi hosts is synchronized.
- For each vSphere cluster that will participate in NSX, verify that the ESXi hosts within each respective cluster are attached to a common VDS.
  For example, given a deployment with two clusters named Host1 and Host2. Host1 is attached to VDS1 and VDS2. Host2 is attached to VDS1 and VDS3. When you prepare a cluster for NSX, you can only associate NSX with VDS1 on the cluster. If you add another host (Host3) to the cluster and Host3 is not attached to VDS1, it is an invalid configuration, and Host3 will not be ready for NSX functionality.
- If you have vSphere Update Manager (VUM) in your environment, you must disable it before preparing clusters for network virtualization. For information on how to check if VUM is enabled and how to disable it if necessary, see the VMware knowledge base (http://kb.vmware.com/kb/2053782).
- In the vSphere web client, ensure that the cluster is in the resolved state (listed under the *Host Preparation* tab). If the Resolve option does not appear in the cluster's Actions list, then it is in a resolved state.

To prepare the vSphere clusters for NSX:

1. In vCenter, select *Home* › *Networking & Security* › *Installation*, and then select the *Host Preparation* tab.
2. Continuing with the example in these instructions, click on the *Actions* button (gear icon) and select *Install* for both the control-plane cluster and compute cluster (if you are using something other than this example, then only install on the clusters that require NSX logical switching, routing, and firewalls).
3. Monitor the installation until the `Installation Status` column displays a green check mark.

   ### Important
   While installation is in progress, do not deploy, upgrade, or uninstall any service or component.

> **Important**
>
> If the `Installation Status` column displays a red warning icon and says `Not Ready`, click *Resolve*. Clicking *Resolve* might result in a reboot of the host. If the installation is still not successful, click the warning icon. All errors will be displayed. Take the required action and click *Resolve* again.

4. To verify the VIBs (`esx-vsip` and `esx-vxlan`) are installed and registered, SSH into an ESXi host within the prepared cluster. List the names and versions of the VIBs installed by running the following command:

```
tux > esxcli software vib list | grep esx
```

```
...
esx-vsip      6.0.0-0.0.2732470    VMware   VMwareCertified   2015-05-29
esx-vxlan     6.0.0-0.0.2732470    VMware   VMwareCertified   2015-05-29
...
```

> **Important**
>
> After host preparation:
>
> - A host reboot is not required
> - If you add a host to a prepared cluster, the NSX VIBs are automatically installed on the host.
> - If you move a host to an unprepared cluster, the NSX VIBs are automatically uninstalled from the host. In this case, a host reboot is required to complete the uninstall process.

16.2.2.4.4 Configure VXLAN Transport Parameters

VXLAN is configured on a per-cluster basis, where each vSphere cluster that is to participate in NSX is mapped to a vSphere Distributed Virtual Switch (DVS). When mapping a vSphere cluster to a DVS, each ESXi host in that cluster is enabled for logical switches. The settings chosen in this section will be used in creating the VMkernel interface.

Configuring transport parameters involves selecting a DVS, a VLAN ID, an MTU size, an IP addressing mechanism, and a NIC teaming policy. The MTU for each switch must be set to 1550 or higher. By default, it is set to 1600 by NSX. This is also the recommended setting for integration with OpenStack.

To configure the VXLAN transport parameters:

1. In the vSphere web client, navigate to *Home* › *Networking & Security* › *Installation*.
2. Select the *Host Preparation* tab.
3. Click the *Configure* link in the VXLAN column.
4. Enter the required information.
5. If you have not already done so, create an IP pool for the VXLAN tunnel end points (VTEP) by clicking *New IP Pool*:
6. Click *OK* to create the VXLAN network.

When configuring the VXLAN transport network, consider the following:

- Use a NIC teaming policy that best suits the environment being built. `Load Balance - SRCID` as the VMKNic teaming policy is usually the most flexible out of all the available options. This allows each host to have a VTEP vmkernel interface for each dvuplink on the selected distributed switch (two dvuplinks gives two VTEP interfaces per ESXi host).
- Do not mix different teaming policies for different portgroups on a VDS where some use Etherchannel or Link Aggregation Control Protocol (LACPv1 or LACPv2) and others use a different teaming policy. If uplinks are shared in these different teaming policies, traffic will be interrupted. If logical routers are present, there will be routing problems. Such a configuration is not supported and should be avoided.
- For larger environments it may be better to use DHCP for the VMKNic IP Addressing.
- For more information and further guidance, see the VMware NSX for vSphere Network Virtualization Design Guide (https://communities.vmware.com/docs/DOC-27683) ↗.

16.2.2.4.5 Assign Segment ID Pool

Each VXLAN tunnel will need a segment ID to isolate its network traffic. Therefore, it is necessary to configure a segment ID pool for the NSX VXLAN network to use. If an NSX controller is not deployed within the vSphere environment, a multicast address range must be added to spread traffic across the network and avoid overloading a single multicast address.

For the purposes of the example in these instructions, do the following steps to assign a segment ID pool. Otherwise, follow best practices as outlined in VMware's documentation (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-7B33DE72-78A7-448C-A61C-9B41D1EB12AD.html).

1. In the vSphere web client, navigate to *Home* › *Networking & Security* › *Installation*.
2. Select the *Logical Network Preparation* tab.
3. Click *Segment ID*, and then *Edit*.
4. Click *OK* to save your changes.

16.2.2.4.6 Assign Segment ID Pool

Each VXLAN tunnel will need a segment ID to isolate its network traffic. Therefore, it is necessary to configure a segment ID pool for the NSX VXLAN network to use. If an NSX controller is not deployed within the vSphere environment, a multicast address range must be added to spread traffic across the network and avoid overloading a single multicast address.

For the purposes of the example in these instructions, do the following steps to assign a segment ID pool. Otherwise, follow best practices as outlined in VMware's documentation (https://pubs.vmware.com/NSX-62/index.jsp?topic=%2Fcom.vmware.nsx.install.doc%2FGUID-7B33DE72-78A7-448C-A61C-9B41D1EB12AD.html).

1. In the vSphere web client, navigate to *Home* › *Networking & Security* › *Installation*.
2. Select the *Logical Network Preparation* tab.
3. Click *Segment ID*, and then *Edit*.
4. Click *OK* to save your changes.

16.2.2.4.7 Create a Transport Zone

A transport zone controls which hosts a logical switch can reach and has the following characteristics.

- It can span one or more vSphere clusters.
- Transport zones dictate which clusters can participate in the use of a particular network. Therefore they dictate which VMs can participate in the use of a particular network.
- A vSphere NSX environment can contain one or more transport zones based on the environment's requirements.
- A host cluster can belong to multiple transport zones.
- A logical switch can belong to only one transport zone.

> **Note**
>
> OpenStack has only been verified to work with a single transport zone within a vSphere NSX-v environment. Other configurations are currently not supported.

For more information on transport zones, refer to VMware's Add A Transport Zone (https://pubs.vmware.com/NSX-62/topic/com.vmware.nsx.install.doc/GUID-0B3B-D895-8037-48A8-831C-8A8986C3CA42.html).

To create a transport zone:

1. In the vSphere web client, navigate to *Home* › *Networking & Security* › *Installation*.
2. Select the *Logical Network Preparation* tab.
3. Click *Transport Zones*, and then click the *New Transport Zone* (New Logical Switch) icon.
4. In the *New Transport Zone* dialog box, type a name and an optional description for the transport zone.
5. For these example instructions, select the control plane mode as `Unicast`.

> **Note**
>
> Whether there is a controller in the environment or if the environment is going to use multicast addresses will determine the control plane mode to select:
>
> - `Unicast` (what this set of instructions uses): The control plane is handled by an NSX controller. All unicast traffic leverages optimized headend replication. No multicast IP addresses or special network configuration is required.
> - `Multicast`: Multicast IP addresses in the physical network are used for the control plane. This mode is recommended only when upgrading from older VXLAN deployments. Requires PIM/IGMP in the physical network.
> - `Hybrid`: Offloads local traffic replication to the physical network (L2 multicast). This requires IGMP snooping on the first-hop switch and access to an IGMP querier in each VTEP subnet, but does not require PIM. The first-hop switch handles traffic replication for the subnet.

6. Select the clusters to be added to the transport zone.
7. Click *OK* to save your changes.

16.2.2.4.8 Deploying SUSE OpenStack Cloud

With vSphere environment setup completed, the OpenStack can be deployed. The following sections will cover creating virtual machines within the vSphere environment, configuring the cloud model and integrating NSX-v Neutron core plugin into the OpenStack:

1. Create the virtual machines
2. Deploy the Cloud Lifecycle Manager
3. Configure the Neutron environment with NSX-v
4. Modify the cloud input model
5. Set up the parameters
6. Deploy the Operating System with Cobbler

7. Deploy the cloud

16.2.2.4.9 Deploying SUSE OpenStack Cloud on Baremetal

Within the vSphere environment, create the OpenStack compute proxy virtual machines. There needs to be one Neutron compute proxy virtual machine per ESXi compute cluster.

For the minimum NSX hardware requirements, refer to *Table 16.2, "NSX Hardware Requirements for Baremetal Integration"*. Also be aware of the networking model to use for the VM network interfaces, see *Table 16.3, "NSX Interface Requirements"*:

If ESX VMs are to be used as Nova compute proxy nodes, set up three LAN interfaces in each virtual machine as shown in the table below. There is at least one Nova compute proxy node per cluster.

TABLE 16.3: NSX INTERFACE REQUIREMENTS

Network Group	Interface
Management	`eth0`
External API	`eth1`
Internal API	`eth2`

16.2.2.4.9.1 Advanced Configuration Option

Important

Within vSphere for each in the virtual machine:

- In the *Options* section, under *Advanced configuration parameters*, ensure that `disk.EnableUUIDoption` is set to `true`.
- If the option does not exist, it must be added. This option is required for the OpenStack deployment.
- If the option is not specified, then the deployment will fail when attempting to configure the disks of each virtual machine.

16.2.2.4.9.2 Setting Up the Cloud Lifecycle Manager

16.2.2.4.9.2.1 Installing the Cloud Lifecycle Manager

Running the `ARDANA_INIT_AUTO=1` command is optional to avoid stopping for authentication at any step. You can also run `ardana-init` to launch the Cloud Lifecycle Manager. You will be prompted to enter an optional SSH passphrase, which is used to protect the key used by Ansible when connecting to its client nodes. If you do not want to use a passphrase, press **Enter** at the prompt.

If you have protected the SSH key with a passphrase, you can avoid having to enter the passphrase on every attempt by Ansible to connect to its client nodes with the following commands:

```
ardana > eval $(ssh-agent)
ardana > ssh-add ~/.ssh/id_rsa
```

The Cloud Lifecycle Manager will contain the installation scripts and configuration files to deploy your cloud. You can set up the Cloud Lifecycle Manager on a dedicated node or you do so on your first controller node. The default choice is to use the first controller node as the Cloud Lifecycle Manager.

1. Download the product from:
   - SUSE Customer Center (https://scc.suse.com/)
2. Boot your Cloud Lifecycle Manager from the SLES ISO contained in the download.
3. Enter `install` (all lower-case, exactly as spelled out here) to start installation.
4. Select the language. Note that only the English language selection is currently supported.
5. Select the location.
6. Select the keyboard layout.
7. Select the primary network interface, if prompted:
   - Assign IP address, subnet mask, and default gateway
8. Create new account:
   a. Enter a username.

b. Enter a password.

c. Enter time zone.

Once the initial installation is finished, complete the Cloud Lifecycle Manager setup with these steps:

1. Ensure your Cloud Lifecycle Manager has a valid DNS nameserver specified in `/etc/resolv.conf`.

2. Set the environment variable LC_ALL:

```
export LC_ALL=C
```

> **Note**
>
> This can be added to `~/.bashrc` or `/etc/bash.bashrc`.

The node should now have a working SLES setup.

16.2.2.4.9.3 Configure the Neutron Environment with NSX-v

In summary, integrating NSX with vSphere has four major steps:

1. Modify the input model to define the server roles, servers, network roles and networks. *Section 16.1.2.5.3.2, "Modify the Input Model"*

2. Set up the parameters needed for Neutron and Nova to communicate with the ESX and NSX Manager. *Section 16.1.2.5.3.3, "Deploying the Operating System with Cobbler"*

3. Do the steps to deploy the cloud. *Section 16.1.2.5.3.4, "Deploying the Cloud"*

16.2.2.4.9.3.1 Third-Party Import of VMware NSX-v Into Neutron and Neutronclient

To import the NSX-v Neutron core-plugin into Cloud Lifecycle Manager, run the third-party import playbook.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost third-party-import.yml
```

16.2.2.4.9.3.2 Modify the Input Model

After the third-party import has completed successfully, modify the input model:

1. Prepare for input model changes
2. Define the servers and server roles needed for a NSX-v cloud.
3. Define the necessary networks and network groups
4. Specify the services needed to be deployed on the Cloud Lifecycle Manager controllers and the Nova ESX compute proxy nodes.
5. Commit the changes and run the configuration processor.

16.2.2.4.9.3.2.1 Prepare for Input Model Changes

The previous steps created a modified SUSE OpenStack Cloud tarball with the NSX-v core plugin in the Neutron and `neutronclient` venvs. The `tar` file can now be extracted and the `ardana-init.bash` script can be run to set up the deployment files and directories. If a modified `tar` file was not created, then extract the tar from the /media/cdrom/ardana location.

To run the `ardana-init.bash` script which is included in the build, use this commands:

```
ardana > ~/ardana/hos-init.bash
```

16.2.2.4.9.3.2.2 Create the Input Model

Copy the example input model to `~/openstack/my_cloud/definition/` directory:

```
ardana > cd ~/ardana-extensions/ardana-extensions-nsx/vmware/examples/models/entry-scale-
nsx
ardana > cp -R entry-scale-nsx ~/openstack/my_cloud/definition
```

Refer to the reference input model in `ardana-extensions/ardana-extensions-nsx/vmware/examples/models/entry-scale-nsx/` for details about how these definitions should be made. The main differences between this model and the standard Cloud Lifecycle Manager input models are:

- Only the neutron-server is deployed. No other neutron agents are deployed.
- Additional parameters need to be set in `pass_through.yml` and `nsx/nsx_config.yml`.
- Nova ESX compute proxy nodes may be ESX virtual machines.

16.2.2.4.9.3.2.2.1 Set up the Parameters

The special parameters needed for the NSX-v integrations are set in the files `pass_through.yml` and `nsx/nsx_config.yml`. They are in the `~/openstack/my_cloud/definition/data` directory.

Parameters in `pass_through.yml` are in the sample input model in the `ardana-extensions/ardana-extensions-nsx/vmware/examples/models/entry-scale-nsx/` directory. The comments in the sample input model file describe how to locate the values of the required parameters.

```
#
# (c) Copyright 2017 SUSE LLC
#
# Licensed under the Apache License, Version 2.0 (the "License"); you may
# not use this file except in compliance with the License. You may obtain
# a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS, WITHOUT
# WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the
# License for the specific language governing permissions and limitations
# under the License.
#
---
product:
  version: 2
pass-through:
  global:
    vmware:
      - username: VCENTER_ADMIN_USERNAME
        ip: VCENTER_IP
        port: 443
        cert_check: false
        # The password needs to be encrypted using the script
        # openstack/ardana/ansible/ardanaencrypt.py on the deployer:
        #
        # $ cd ~/openstack/ardana/ansible
        # $ export ARDANA_USER_PASSWORD_ENCRYPT_KEY=ENCRYPTION_KEY
        # $ ./ardanaencrypt.py
        #
        # The script will prompt for the vCenter password. The string
        # generated is the encrypted password. Enter the string
        # enclosed by double-quotes below.
```

```
        password: "ENCRYPTED_PASSWD_FROM_ARDANAENCRYPT"

        # The id is is obtained by the URL
        # https://VCENTER_IP/mob/?moid=ServiceInstance&doPath=content%2eabout,
        # field instanceUUID.
        id: VCENTER_UUID
  servers:
    -
      # Here the 'id' refers to the name of the node running the
      # esx-compute-proxy. This is identical to the 'servers.id' in
      # servers.yml. There should be one esx-compute-proxy node per ESX
      # resource pool.
      id: esx-compute1
      data:
        vmware:
          vcenter_cluster: VMWARE_CLUSTER1_NAME
          vcenter_id: VCENTER_UUID
    -
      id: esx-compute2
      data:
        vmware:
          vcenter_cluster: VMWARE_CLUSTER2_NAME
          vcenter_id: VCENTER_UUID
```

There are parameters in `nsx/nsx_config.yml`. The comments describes how to retrieve the values.

```
# (c) Copyright 2017 SUSE LLC
#
# Licensed under the Apache License, Version 2.0 (the "License"); you may
# not use this file except in compliance with the License. You may obtain
# a copy of the License at
#
# http://www.apache.org/licenses/LICENSE-2.0
#
# Unless required by applicable law or agreed to in writing, software
# distributed under the License is distributed on an "AS IS" BASIS, WITHOUT
# WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the
# License for the specific language governing permissions and limitations
# under the License.
#
---
  product:
    version: 2
  configuration-data:
    - name: NSX-CONFIG-CP1
      services:
```

```
    - nsx
  data:
    # (Required) URL for NSXv manager (e.g - https://management_ip).
    manager_uri: 'https://NSX_MGR_IP

    # (Required) NSXv username.
    user: 'admin'

    # (Required) Encrypted NSX Manager password.
    # Password encryption is done by the script
    # ~/openstack/ardana/ansible/ardanaencrypt.py on the deployer:
    #
    # $ cd ~/openstack/ardana/ansible
    # $ export ARDANA_USER_PASSWORD_ENCRYPT_KEY=ENCRYPTION_KEY
    # $ ./ardanaencrypt.py
    #
    # NOTE: Make sure that the NSX Manager password is encrypted with the same key
    # used to encrypt the VCenter password.
    #
    # The script will prompt for the NSX Manager password. The string
    # generated is the encrypted password. Enter the string enclosed
    # by double-quotes below.
    password: "ENCRYPTED_NSX_MGR_PASSWD_FROM_ARDANAENCRYPT"
    # (Required) datacenter id for edge deployment.
    # Retrieved using
    #    http://VCENTER_IP_ADDR/mob/?moid=ServiceInstance&doPath=content
    # click on the value from the rootFolder property. The datacenter_moid is
    # the value of the childEntity property.
    # The vCenter-ip-address comes from the file pass_through.yml in the
    # input model under "pass-through.global.vmware.ip".
    datacenter_moid: 'datacenter-21'
    # (Required) id of logic switch for physical network connectivity.
    # How to retrieve
    # 1. Get to the same page where the datacenter_moid is found.
    # 2. Click on the value of the rootFolder property.
    # 3. Click on the value of the childEntity property
    # 4. Look at the network property. The external network is
    #    network associated with EXTERNAL VM in VCenter.
    external_network: 'dvportgroup-74'
    # (Required) clusters ids containing OpenStack hosts.
    # Retrieved using http://VCENTER_IP_ADDR/mob, click on the value
    # from the rootFolder property. Then click on the value of the
    # hostFolder property. Cluster_moids are the values under childEntity
    # property of the compute clusters.
    cluster_moid: 'domain-c33,domain-c35'
    # (Required) resource-pool id for edge deployment.
    resource_pool_id: 'resgroup-67'
```

```
# (Optional) datastore id for edge deployment. If not needed,
# do not declare it.
# datastore_id: 'datastore-117'

# (Required) network scope id of the transport zone.
# To get the vdn_scope_id, in the vSphere web client from the Home
# menu:
#   1. click on Networking & Security
#   2. click on installation
#   3. click on the Logical Netowrk Preparation tab.
#   4. click on the Transport Zones button.
#   5. Double click on the transport zone being configure.
#   6. Select Manage tab.
#   7. The vdn_scope_id will appear at the end of the URL.
vdn_scope_id: 'vdnscope-1'

# (Optional) Dvs id for VLAN based networks. If not needed,
# do not declare it.
# dvs_id: 'dvs-68'

# (Required) backup_edge_pool: backup edge pools management range,
# - edge_type>[edge_size]:MINIMUM_POOLED_EDGES:MAXIMUM_POOLED_EDGES
# - edge_type: service (service edge) or  vdr (distributed edge)
# - edge_size:  compact ,  large (by default),  xlarge  or  quadlarge
backup_edge_pool: 'service:compact:4:10,vdr:compact:4:10'

# (Optional) mgt_net_proxy_ips: management network IP address for
# metadata proxy. If not needed, do not declare it.
# mgt_net_proxy_ips: '10.142.14.251,10.142.14.252'

# (Optional) mgt_net_proxy_netmask: management network netmask for
# metadata proxy. If not needed, do not declare it.
# mgt_net_proxy_netmask: '255.255.255.0'

# (Optional) mgt_net_moid: Network ID for management network connectivity
# Do not declare if not used.
# mgt_net_moid: 'dvportgroup-73'

# ca_file: Name of the certificate file. If insecure is set to True,
# then this parameter is ignored. If insecure is set to False and this
# parameter is not defined, then the system root CAs will be used
# to verify the server certificate.
ca_file: a/nsx/certificate/file

# insecure:
# If true (default), the NSXv server certificate is not verified.
# If false, then the default CA truststore is used for verification.
```

```
        # This option is ignored if "ca_file" is set
        insecure: True
        # (Optional) edge_ha: if true, will duplicate any edge pool resources
        # Default to False if undeclared.
        # edge_ha: False
        # (Optional) spoofguard_enabled:
        # If True (default), indicates NSXV spoofguard component is used to
        # implement port-security feature.
        # spoofguard_enabled: True
        # (Optional) exclusive_router_appliance_size:
        # Edge appliance size to be used for creating exclusive router.
        # Valid values: 'compact', 'large', 'xlarge', 'quadlarge'
        # Defaults to 'compact' if not declared.  # exclusive_router_appliance_size:
        'compact'
```

16.2.2.4.9.3.2.3 Commit Changes and Run the Configuration Processor

Commit your changes with the input model and the required configuration values added to the `pass_through.yml` and `nsx/nsx_config.yml` files.

```
ardana > cd ~/openstack/my_cloud/definition
ardana > git commit -A -m "Configuration changes for NSX deployment"
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml \
 -e \encrypt="" -e rekey=""
```

If the playbook `config-processor-run.yml` fails, there is an error in the input model. Fix the error and repeat the above steps.

16.2.2.4.9.3.3 Deploying the Operating System with Cobbler

1. From the Cloud Lifecycle Manager, run Cobbler to install the operating system on the nodes after it has to be deployed:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost cobbler-deploy.yml
   ```

2. Verify the nodes that will have an operating system installed by Cobbler by running this command:

   ```
   tux > sudo cobbler system find --netboot-enabled=1
   ```

3. Reimage the nodes using Cobbler. Do not use Cobbler to reimage the nodes running as ESX virtual machines. The command below is run on a setup where the Nova ESX compute proxies are VMs. Controllers 1, 2, and 3 are running on physical servers.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost bm-reimage.yml -e \
   nodelist=controller1,controller2,controller3
```

4. When the playbook has completed, each controller node should have an operating system installed with an IP address configured on `eth0`.

5. After your controller nodes have been completed, you should install the operating system on your Nova compute proxy virtual machines. Each configured virtual machine should be able to PXE boot into the operating system installer.

6. From within the vSphere environment, power on each Nova compute proxy virtual machine and watch for it to PXE boot into the OS installer via its console.

   a. If successful, the virtual machine will have the operating system automatically installed and will then automatically power off.

   b. When the virtual machine has powered off, power it on and let it boot into the operating system.

7. Verify network settings after deploying the operating system to each node.

   - Verify that the NIC bus mapping specified in the cloud model input file (`~/ardana/my_cloud/definition/data/nic_mappings.yml`) matches the NIC bus mapping on each OpenStack node.
     Check the NIC bus mapping with this command:

     ```
     tux > sudo cobbler system list
     ```

   - After the playbook has completed, each controller node should have an operating system installed with an IP address configured on eth0.

8. When the ESX compute proxy nodes are VMs, install the operating system if you have not already done so.

16.2.2.4.9.3.4 Deploying the Cloud

When the configuration processor has completed successfully, the cloud can be deployed. Set the ARDANA_USER_PASSWORD_ENCRYPT_KEY environment variable before running `site.yml`.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > export ARDANA_USER_PASSWORD_ENCRYPT_KEY=PASSWORD_KEY
ardana > ansible-playbook -i hosts/verb_hosts site.yml
ardana > ansible-playbook -i hosts/verb_hosts ardana-cloud-configure.yml
```

`PASSWORD_KEY` in the `export` command is the key used to encrypt the passwords for vCenter and NSX Manager.

16.3 Verifying the NSX-v Functionality After Integration

After you have completed your OpenStack deployment and integrated the NSX-v Neutron plugin, you can use these steps to verify that NSX-v is enabled and working in the environment.

1. Validating Neutron from the Cloud Lifecycle Manager. All of these commands require that you authenticate by `service.osrc` file.

   ```
   ardana > source ~/service.osrc
   ```

2. List your Neutron networks:

   ```
   ardana > neutron network list
   +--------------------------------------+----------------
   +--------------------------------------------------------+
   | id                                   | name           | subnets
                                |
   +--------------------------------------+----------------
   +--------------------------------------------------------+
   | 574d5f6c-871e-47f8-86d2-4b7c33d91002 | inter-edge-net | c5e35e22-0c1c-4886-
   b7f3-9ce3a6ab1512 169.254.128.0/17 |
   +--------------------------------------+----------------
   +--------------------------------------------------------+
   ```

3. List your Neutron subnets:

   ```
   ardana > neutron subnet list
   ```

```
+--------------------------------------+-------------------+------------------
+--------------------------------------------------------+
| id                                   | name              | cidr             |
 allocation_pools                                       |
+--------------------------------------+-------------------+------------------
+--------------------------------------------------------+
| c5e35e22-0c1c-4886-b7f3-9ce3a6ab1512 | inter-edge-subnet | 169.254.128.0/17 |
 {"start": "169.254.128.2", "end": "169.254.255.254"} |
+--------------------------------------+-------------------+------------------
+--------------------------------------------------------+
```

4. List your Neutron routers:

```
ardana > neutron router list
+--------------------------------------+-----------------------
+-----------------------+-------------+
| id                                   | name                  |
 external_gateway_info | distributed |
+--------------------------------------+-----------------------
+-----------------------+-------------+
| 1c5bf781-5120-4b7e-938b-856e23e9f156 | metadata_proxy_router | null
   | False       |
| 8b5d03bf-6f77-4ea9-bb27-87dd2097eb5c | metadata_proxy_router | null
   | False       |
+--------------------------------------+-----------------------
+-----------------------+-------------+
```

5. List your Neutron ports:

```
ardana > neutron port list
+--------------------------------------+------+-------------------
+--------------------------------------------------------+
| id                                   | name | mac_address       | fixed_ips
                                      |
+--------------------------------------+------+-------------------
+--------------------------------------------------------+
| 7f5f0461-0db4-4b9a-a0c6-faa0010b9be2 |      | fa:16:3e:e5:50:d4 | {"subnet_id":
                                      |
|                                      |      |                   |
 "c5e35e22-0c1c-4886-b7f3-9ce3a6ab1512",               |
|                                      |      |                   | "ip_address":
 "169.254.128.2"}                        |
| 89f27dff-f38d-4084-b9b0-ded495255dcb |      | fa:16:3e:96:a0:28 | {"subnet_id":
                                      |
|                                      |      |                   |
 "c5e35e22-0c1c-4886-b7f3-9ce3a6ab1512",               |
```

```
|                                      |      |                   | "ip_address":
 "169.254.128.3"}                       |
+--------------------------------------+------+-------------------
+-------------------------------------------------------+
```

6. List your Neutron security group rules:

```
ardana > neutron security group rule list
+--------------------------------------+----------------+-----------+-----------
+---------------+-----------------+
| id                                   | security_group | direction | ethertype |
 protocol/port | remote          |
+--------------------------------------+----------------+-----------+-----------
+---------------+-----------------+
| 0385bd3a-1050-4bc2-a212-22ddab00c488 | default        | egress    | IPv6      |
 any           | any             |
| 19f6f841-1a9a-4b4b-bc45-7e8501953d8f | default        | ingress   | IPv6      |
 any           | default (group) |
| 1b3b5925-7aa6-4b74-9df0-f417ee6218f1 | default        | egress    | IPv4      |
 any           | any             |
| 256953cc-23d7-404d-b140-2600d55e44a2 | default        | ingress   | IPv4      |
 any           | default (group) |
| 314c4e25-5822-44b4-9d82-4658ae87d93f | default        | egress    | IPv6      |
 any           | any             |
| 59d4a71e-9f99-4b3b-b75b-7c9ad34081e0 | default        | ingress   | IPv6      |
 any           | default (group) |
| 887e25ef-64b7-4b69-b301-e053f88efa6c | default        | ingress   | IPv4      |
 any           | default (group) |
| 949e9744-75cd-4ae2-8cc6-6c0f578162d7 | default        | ingress   | IPv4      |
 any           | default (group) |
| 9a83027e-d6d6-4b6b-94fa-7c0ced2eba37 | default        | egress    | IPv4      |
 any           | any             |
| abf63b79-35ad-428a-8829-8e8d796a9917 | default        | egress    | IPv4      |
 any           | any             |
| be34b72b-66b6-4019-b782-7d91674ca01d | default        | ingress   | IPv6      |
 any           | default (group) |
| bf3d87ce-05c8-400d-88d9-a940e43760ca | default        | egress    | IPv6      |
 any           | any             |
+--------------------------------------+----------------+-----------+-----------
+---------------+-----------------+
```

Verify metadata proxy functionality

To test that the metadata proxy virtual machines are working as intended, verify that there are at least two metadata proxy virtual machines from within vSphere (there will be four if edge high availability was set to true).

When that is verified, create a new compute instance either with the API, CLI, or within the cloud console GUI and log into the instance. From within the instance, using curl, grab the metadata instance-id from the metadata proxy address.

```
ardana > curl http://169.254.169.254/latest/meta-data/instance-id
i-00000004
```

17 Installing Baremetal (Ironic)

Bare Metal as a Service is enabled in this release for deployment of Nova instances on bare metal nodes using flat networking.

17.1 Installation for SUSE OpenStack Cloud Entry-scale Cloud with Ironic Flat Network

This page describes the installation step requirements for the SUSE OpenStack Cloud Entry-scale Cloud with Ironic Flat Network.

17.1.1 Configure Your Environment

Prior to deploying an operational environment with Ironic, operators need to be aware of the nature of TLS certificate authentication. As pre-built deployment agent ramdisks images are supplied, these ramdisk images will only authenticate known third-party TLS Certificate Authorities in the interest of end-to-end security. As such, uses of self-signed certificates and private certificate authorities will be unable to leverage ironic without modifying the supplied ramdisk images.

1. Set up your configuration files, as follows:

   a. See the sample sets of configuration files in the `~/openstack/examples/` directory. Each set will have an accompanying README.md file that explains the contents of each of the configuration files.

   b. Copy the example configuration files into the required setup directory and edit them to contain the details of your environment:

   ```
   cp -r ~/openstack/examples/entry-scale-ironic-flat-network/* \
     ~/openstack/my_cloud/definition/
   ```

2. *(Optional)* You can use the `ardanaencrypt.py` script to encrypt your IPMI passwords. This script uses OpenSSL.

   a. Change to the Ansible directory:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ```

b. Put the encryption key into the following environment variable:

```
export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>
```

c. Run the python script below and follow the instructions. Enter a password that you want to encrypt.

```
ardana > ./ardanaencrypt.py
```

d. Take the string generated and place it in the `ilo-password` field in your `~/openstack/my_cloud/definition/data/servers.yml` file, remembering to enclose it in quotes.

e. Repeat the above for each server.

Note

Before you run any playbooks, remember that you need to export the encryption key in the following environment variable: `export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>`

3. Commit your configuration to the local git repo (*Chapter 10, Using Git for Configuration Management*), as follows:

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "My config or other commit message"
```

Important

This step needs to be repeated any time you make changes to your configuration files before you move on to the following steps. See *Chapter 10, Using Git for Configuration Management* for more information.

17.1.2 Provisioning Your Baremetal Nodes

To provision the baremetal nodes in your cloud deployment you can either use the automated operating system installation process provided by SUSE OpenStack Cloud or you can use the 3rd party installation tooling of your choice. We will outline both methods below:

17.1.2.1 Using Third Party Baremetal Installers

If you do not wish to use the automated operating system installation tooling included with SUSE OpenStack Cloud then the requirements that have to be met using the installation tooling of your choice are:

- The operating system must be installed via the SLES ISO provided on the SUSE Customer Center (https://scc.suse.com/).
- Each node must have SSH keys in place that allows the same user from the Cloud Lifecycle Manager node who will be doing the deployment to SSH to each node without a password.
- Passwordless sudo needs to be enabled for the user.
- There should be a LVM logical volume as `/root` on each node.
- If the LVM volume group name for the volume group holding the `root` LVM logical volume is `ardana-vg`, then it will align with the disk input models in the examples.
- Ensure that `openssh-server`, `python`, `python-apt`, and `rsync` are installed.

If you chose this method for installing your baremetal hardware, skip forward to the step *Running the Configuration Processor*.

17.1.2.2 Using the Automated Operating System Installation Provided by SUSE OpenStack Cloud

If you would like to use the automated operating system installation tools provided by SUSE OpenStack Cloud, complete the steps below.

17.1.2.2.1 Deploying Cobbler

This phase of the install process takes the baremetal information that was provided in `servers.yml` and installs the Cobbler provisioning tool and loads this information into Cobbler. This sets each node to `netboot-enabled: true` in Cobbler. Each node will be automatically marked as `netboot-enabled: false` when it completes its operating system install successfully. Even if the node tries to PXE boot subsequently, Cobbler will not serve it. This is deliberate so that you cannot reimage a live node by accident.

The `cobbler-deploy.yml` playbook prompts for a password - this is the password that will be encrypted and stored in Cobbler, which is associated with the user running the command on the Cloud Lifecycle Manager, that you will use to log in to the nodes via their consoles after install. The username is the same as the user set up in the initial dialogue when installing the Cloud Lifecycle Manager from the ISO, and is the same user that is running the cobbler-deploy play.

> **Note**
>
> When imaging servers with your own tooling, it is still necessary to have ILO/IPMI settings for all nodes. Even if you are not using Cobbler, the username and password fields in `servers.yml` need to be filled in with dummy settings. For example, add the following to `servers.yml`:
>
> ```
> ilo-user: manual
> ilo-password: deployment
> ```

1. Run the following playbook which confirms that there is IPMI connectivity for each of your nodes so that they are accessible to be re-imaged in a later step:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost bm-power-status.yml
   ```

2. Run the following playbook to deploy Cobbler:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost cobbler-deploy.yml
   ```

17.1.2.2.2 Imaging the Nodes

This phase of the install process goes through a number of distinct steps:

1. Powers down the nodes to be installed
2. Sets the nodes hardware boot order so that the first option is a network boot.
3. Powers on the nodes. (The nodes will then boot from the network and be installed using infrastructure set up in the previous phase)
4. Waits for the nodes to power themselves down (this indicates a successful install). This can take some time.
5. Sets the boot order to hard disk and powers on the nodes.
6. Waits for the nodes to be reachable by SSH and verifies that they have the signature expected.

Deploying nodes has been automated in the Cloud Lifecycle Manager and requires the following:

- All of your nodes using SLES must already be installed, either manually or via Cobbler.
- Your input model should be configured for your SLES nodes, according to the instructions at *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 10 "Modifying Example Configurations for Compute Nodes", Section 10.1 "SLES Compute Nodes"*.
- You should have run the configuration processor and the `ready-deployment.yml` playbook.

Execute the following steps to re-image one or more nodes after you have run the `ready-deployment.yml` playbook.

1. Run the following playbook, specifying your SLES nodes using the nodelist. This playbook will reconfigure Cobbler for the nodes listed.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook prepare-sles-grub2.yml -e \
      nodelist=node1[,node2,node3]
```

2. Re-image the node(s) with the following command:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost bm-reimage.yml \
      -e nodelist=node1[,node2,node3]
```

If a nodelist is not specified then the set of nodes in Cobbler with `netboot-enabled: True` is selected. The playbook pauses at the start to give you a chance to review the set of nodes that it is targeting and to confirm that it is correct.

You can use the command below which will list all of your nodes with the `netboot-enabled: True` flag set:

```
sudo cobbler system find --netboot-enabled=1
```

17.1.3 Running the Configuration Processor

Once you have your configuration files setup, you need to run the configuration processor to complete your configuration.

When you run the configuration processor, you will be prompted for two passwords. Enter the first password to make the configuration processor encrypt its sensitive data, which consists of the random inter-service passwords that it generates and the ansible `group_vars` and `host_vars` that it produces for subsequent deploy runs. You will need this password for subsequent Ansible deploy and configuration processor runs. If you wish to change an encryption password that you have already used when running the configuration processor then enter the new password at the second prompt, otherwise just press **Enter** to bypass this.

Run the configuration processor with this command:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

For automated installation (for example CI), you can specify the required passwords on the ansible command line. For example, the command below will disable encryption by the configuration processor:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml \
  -e encrypt="" -e rekey=""
```

If you receive an error during this step, there is probably an issue with one or more of your configuration files. Verify that all information in each of your configuration files is correct for your environment. Then commit those changes to Git using the instructions in the previous section before re-running the configuration processor again.

For any troubleshooting information regarding these steps, see *Section 23.2, "Issues while Updating Configuration Files"*.

17.1.4 Deploying the Cloud

1. Use the playbook below to create a deployment directory:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost ready-deployment.yml
```

2. [OPTIONAL] - Run the `wipe_disks.yml` playbook to ensure all of your non-OS partitions on your nodes are completely wiped before continuing with the installation. The `wipe_disks.yml` playbook is only meant to be run on systems immediately after running `bm-reimage.yml`. If used for any other case, it may not wipe all of the expected partitions. If you are using fresh machines this step may not be necessary.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml
```

If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

```
ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml --ask-vault-pass
```

3. Run the `site.yml` playbook below:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts site.yml
```

If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

```
ardana > ansible-playbook -i hosts/verb_hosts site.yml --ask-vault-pass
```

> **Note**
>
> The step above runs `osconfig` to configure the cloud and `ardana-deploy` to deploy the cloud. Therefore, this step may run for a while, perhaps 45 minutes or more, depending on the number of nodes in your environment.

4. Verify that the network is working correctly. Ping each IP in the `/etc/hosts` file from one of the controller nodes.

For any troubleshooting information regarding these steps, see *Section 23.3, "Issues while Deploying the Cloud"*.

17.1.5 Ironic configuration

Run the `ironic-cloud-configure.yml` playbook below:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts ironic-cloud-configure.yml
```

This step configures ironic flat network, uploads glance images and sets the ironic configuration.

To see the images uploaded to glance, run:

```
$ source ~/service.osrc
$ glance image list
```

This will produce output like the following example, showing three images that have been added by Ironic:

```
+--------------------------------------+--------------------------+
| ID                                   | Name                     |
+--------------------------------------+--------------------------+
| d4e2a0ff-9575-4bed-ac5e-5130a1553d93 | ir-deploy-iso-HOS3.0     |
| b759a1f0-3b33-4173-a6cb-be5706032124 | ir-deploy-kernel-HOS3.0  |
| ce5f4037-e368-46f2-941f-c01e9072676c | ir-deploy-ramdisk-HOS3.0 |
+--------------------------------------+--------------------------+
```

To see the network created by Ironic, run:

```
$ neutron net-list
```

This returns details of the "flat-net" generated by the Ironic install:

```
+---------------+----------+------------------------------------------------------+
| id            | name     | subnets                                              |
+---------------+----------+------------------------------------------------------+
| f9474...11010 | flat-net | ca8f8df8-12c8-4e58-b1eb-76844c4de7e8 192.168.245.0/24 |
+---------------+----------+------------------------------------------------------+
```

17.1.6 Node Configuration

17.1.6.1 DHCP

Once booted, nodes obtain network configuration via DHCP. If multiple interfaces are to be utilized, you may want to pre-build images with settings to execute DHCP on all interfaces. An easy way to build custom images is with KIWI, the command line utility to build Linux system appliances.

For information about building custom KIWI images, see *Section 17.3.11, "Building Glance Images Using KIWI"*. For more information, see the KIWI documentation at https://osinside.github.io/kiwi/.

17.1.6.2 Configuration Drives

Warning

Configuration Drives are stored unencrypted and should not include any sensitive data.

You can use Configuration Drives to store metadata for initial boot setting customization. Configuration Drives are extremely useful for initial machine configuration. However, as a general security practice, they should not include any sensitive data. Configuration Drives should only be trusted upon the initial boot of an instance. `cloud-init` utilizes a lock file for this purpose. Custom instance images should not rely upon the integrity of a Configuration Drive beyond the initial boot of a host as an administrative user within a deployed instance can potentially modify a configuration drive once written to disk and released for use.

For more information about Configuration Drives, see http://docs.openstack.org/user-guide/cli_config_drive.html.

17.1.7 TLS Certificates with Ironic Python Agent (IPA) Images

As part of SUSE OpenStack Cloud 8, Ironic Python Agent, better known as IPA in the OpenStack community, images are supplied and loaded into Glance. Two types of image exist. One is a traditional boot ramdisk which is used by the `agent_ipmitool`, `pxe_ipmitool`, and `pxe_ilo` drivers. The other is an ISO image that is supplied as virtual media to the host when using the `agent_ilo` driver.

As these images are built in advance, they are unaware of any private certificate authorities. Users attempting to utilize self-signed certificates or a private certificate authority will need to inject their signing certificate(s) into the image in order for IPA to be able to boot on a remote node, and ensure that the TLS endpoints being connected to in SUSE OpenStack Cloud can be trusted. This is not an issue with publicly signed certificates.

As two different types of images exist, below are instructions for disassembling the image ramdisk file or the ISO image. Once this has been done, you will need to re-upload the files to glance, and update any impacted node's `driver_info`, for example, the `deploy_ramdisk` and `ilo_deploy_iso` settings that were set when the node was first defined. Respectively, this can be done with the

```
ironic node-update <node> replace driver_info/deploy_ramdisk=<glance_id>
```

or

```
ironic node-update <node> replace driver_info/ilo_deploy_iso=<glance_id>
```

17.1.7.1 Add New Trusted CA Certificate Into Deploy Images

Perform the following steps.

1. To upload your trusted CA certificate to the Cloud Lifecycle Manager, follow the directions in *Section 29.7, "Upload to the Cloud Lifecycle Manager"*.

2. Delete the deploy images.

```
ardana > openstack image delete ir-deploy-iso-ARDANA5.0
ardana > openstack image delete ir-deploy-ramdisk-ARDANA5.0
```

3. On the deployer, run `ironic-reconfigure.yml` playbook to re-upload the images that include the new trusted CA bundle.

```
ardana > cd /var/lib/ardana/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
```

4. Update the existing Ironic nodes with the new image IDs accordingly. For example,

```
ardana > openstack baremetal node set --driver-info \
deploy_ramdisk=NEW_RAMDISK_ID NODE_ID
```

17.2 Ironic in Multiple Control Plane

SUSE OpenStack Cloud 8 introduces the concept of multiple control planes - see the Input Model documentation for the relevant *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 5 "Input Model", Section 5.2 "Concepts", Section 5.2.2 "Control Planes", Section 5.2.2.1 "Control Planes* *and Regions”* and *Book “*Planning an Installation with Cloud Lifecycle Manager*”, Chapter 6 “Configuration Objects”, Section 6.2 “Control Plane”, Section 6.2.3 “Multiple Control Planes”*. This document covers the use of an Ironic region in a multiple control plane cloud model in SUSE OpenStack Cloud.

17.2.1 Networking for Baremetal in Multiple Control Plane

IRONIC-FLAT-NET is the network configuration for baremetal control plane.

You need to set the environment variable **OS_REGION_NAME** to the Ironic region in baremetal control plane. This will set up the Ironic flat networking in Neutron.

```
export OS_REGION_NAME=<ironic_region>
```

To see details of the `IRONIC-FLAT-NETWORK` created during configuration, use the following command:

```
neutron net-list
```

Referring to the diagram below, the Cloud Lifecycle Manager is a shared service that runs in a Core API Controller in a Core API Cluster. Ironic Python Agent (IPA) must be able to make REST API calls to the Ironic API (the connection is represented by the green line to Internal routing). The IPA connect to Swift to get user images (the gray line connecting to Swift routing).

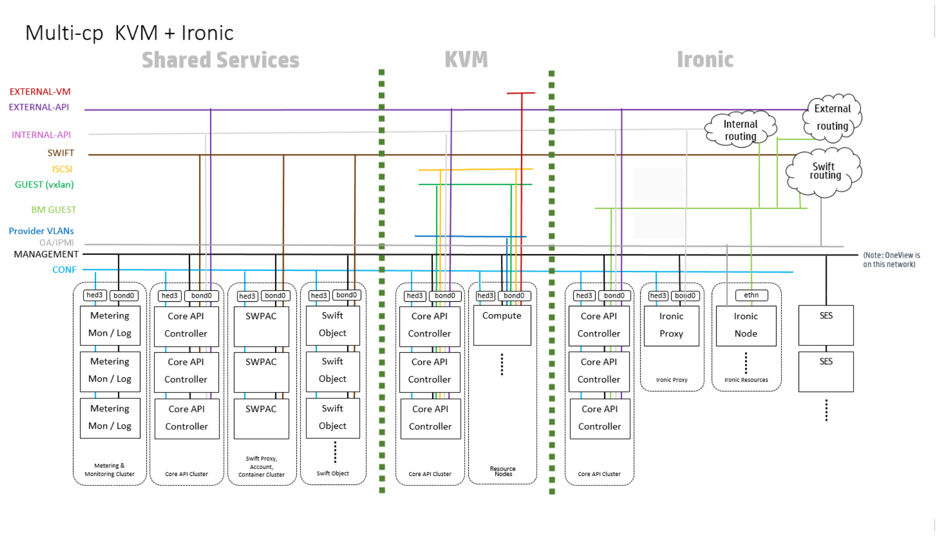


FIGURE 17.1: ARCHITECTURE OF MULTIPLE CONTROL PLANE WITH IRONIC

17.2.2 Handling Optional Swift Service

Swift is very resource-intensive and as a result, it is now optional in the SUSE OpenStack Cloud control plane. A number of services depend on Swift, and if it is not present, they must provide a fallback strategy. For example, Glance can use the filesystem in place of Swift for its backend store.

In Ironic, agent-based drivers require Swift. If it is not present, it is necessary to disable access to this Ironic feature in the control plane. The `enable_agent_driver` flag has been added to the Ironic configuration data and can have values of `true` or `false`. Setting this flag to `false` will disable Swift configurations and the agent based drivers in the Ironic control plane.

17.2.3 Instance Provisioning

In a multiple control plane cloud setup, changes for Glance container name in the Swift namespace of `ironic-conductor.conf` introduces a conflict with the one in `glance-api.conf`. Provisioning with agent-based drivers requires the container name to be the same in Ironic and Glance. Hence, on instance provisioning with agent-based drivers (Swift-enabled), the agent is not able to fetch the images from Glance store and fails at that point.

You can resolve this issue using the following steps:

1. Copy the value of `swift_store_container` from the file `/opt/stack/service/glance-api/etc/glance-api.conf`
2. Log in to the Cloud Lifecycle Manager and use the value for `swift_container` in glance namespace of `~/scratch/ansible/next/ardana/ansible/roles/ironic-common/templates/ironic-conductor.conf.j2`
3. Run the following playbook:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
```

17.3 Provisioning Bare-Metal Nodes with Flat Network Model

Warning

Providing bare-metal resources to an untrusted third party is not advised as a malicious user can potentially modify hardware firmware.

Important

The steps outlined in *Section 17.1.7, "TLS Certificates with Ironic Python Agent (IPA) Images"* *must* be performed.

A number of drivers are available to provision and manage bare-metal machines. The drivers are named based on the deployment mode and the power management interface. SUSE OpenStack Cloud has been tested with the following drivers:

- agent_ilo
- agent_ipmi
- pxe_ilo
- pxe_ipmi

Before you start, you should be aware that:

1. Node Cleaning is enabled for all the drivers in SUSE OpenStack Cloud 8.
2. Node parameter settings must have matching flavors in terms of `cpus`, `local_gb`, and `memory_mb`, `boot_mode` and `cpu_arch`.
3. It is advisable that nodes enrolled for ipmitool drivers are pre-validated in terms of BIOS settings, in terms of boot mode, prior to setting capabilities.
4. Network cabling and interface layout should also be pre-validated in any given particular boot mode or configuration that is registered.

5. The use of `agent_` drivers is predicated upon Glance images being backed by a Swift image store, specifically the need for the temporary file access features. Using the file system as a Glance back-end image store means that the `agent_` drivers cannot be used.

6. Manual Cleaning (RAID) and Node inspection is supported by ilo drivers (`agent_ilo` and `pxe_ilo`)

17.3.1 Supplied Images

As part of the SUSE OpenStack Cloud Entry-scale Ironic Cloud installation, Ironic Python Agent (IPA) images are supplied and loaded into Glance. To see the images that have been loaded, execute the following commands on the deployer node:

```
$ source ~/service.osrc
glance image list
```

This will display three images that have been added by Ironic:

```
Deploy_iso : openstack-ironic-image.x86_64-8.0.0.kernel.4.4.120-94.17-default
Deploy_kernel : openstack-ironic-image.x86_64-8.0.0.xz
Deploy_ramdisk : openstack-ironic-image.x86_64-8.0.0.iso
```

The `ir-deploy-ramdisk` image is a traditional boot ramdisk used by the `agent_ipmitool`, `pxe_ipmitool`, and `pxe_ilo` drivers while `ir-deploy-iso` is an ISO image that is supplied as virtual media to the host when using the `agent_ilo` driver.

17.3.2 Provisioning a Node

The information required to provision a node varies slightly depending on the driver used. In general the following details are required.

- Network access information and credentials to connect to the management interface of the node.
- Sufficient properties to allow for Nova flavor matching.
- A deployment image to perform the actual deployment of the guest operating system to the bare-metal node.

A combination of the `ironic node-create` and `ironic node-update` commands are used for registering a node's characteristics with the Ironic service. In particular, `ironic node-update <nodeid> add` and `ironic node-update <nodeid> replace` can be used to modify the properties of a node after it has been created while `ironic node-update <nodeid> remove` will remove a property.

17.3.3 Creating a Node Using **agent_ilo**

If you want to use a boot mode of BIOS as opposed to UEFI, then you need to ensure that the boot mode has been set correctly on the IPMI:

While the iLO driver can automatically set a node to boot in UEFI mode via the `boot_mode` defined capability, it cannot set BIOS boot mode once UEFI mode has been set.

Use the `ironic node-create` command to specify the `agent_ilo` driver, network access and credential information for the IPMI, properties of the node and the Glance ID of the supplied ISO IPA image. Note that memory size is specified in megabytes while disk size is specified in gigabytes.

```
ironic node-create -d agent_ilo -i ilo_address=IP_ADDRESS -i \
  ilo_username=Administrator -i ilo_password=PASSWORD \
  -p cpus=2 -p cpu_arch=x86_64 -p memory_mb=64000 -p local_gb=99 \
  -i ilo_deploy_iso=DEPLOY_UUID
```

This will generate output similar to the following:

```
+--------------+---------------------------------------------------------------+
| Property     | Value                                                         |
+--------------+---------------------------------------------------------------+
| uuid         | NODE_UUID                                                     |
| driver_info  | {u'ilo_address': u'IP_ADDRESS', u'ilo_password': u'******',   |
|              | u'ilo_deploy_iso': u'DEPLOY_UUID',                            |
|              | u'ilo_username': u'Administrator'}                            |
| extra        | {}                                                            |
| driver       | agent_ilo                                                     |
| chassis_uuid |                                                               |
| properties   | {u'memory_mb': 64000, u'local_gb': 99, u'cpus': 2,            |
|              | u'cpu_arch': u'x86_64'}                                       |
| name         | None                                                          |
+--------------+---------------------------------------------------------------+
```

Now update the node with `boot_mode` and `boot_option` properties:

```
ironic node-update NODE_UUID add \
```

```
  properties/capabilities="boot_mode:bios,boot_option:local"
```

The `ironic node-update` command returns details for all of the node's characteristics.

```
+------------------------+------------------------------------------------------------------+
| Property               | Value                                                            |
+------------------------+------------------------------------------------------------------+
| target_power_state     | None                                                             |
| extra                  | {}                                                               |
| last_error             | None                                                             |
| updated_at             | None                                                             |
| maintenance_reason     | None                                                             |
| provision_state        | available                                                        |
| clean_step             | {}                                                               |
| uuid                   | NODE_UUID                                                        |
| console_enabled        | False                                                            |
| target_provision_state | None                                                             |
| provision_updated_at   | None                                                             |
| maintenance            | False                                                            |
| inspection_started_at  | None                                                             |
| inspection_finished_at | None                                                             |
| power_state            | None                                                             |
| driver                 | agent_ilo                                                        |
| reservation            | None                                                             |
| properties             | {u'memory_mb': 64000, u'cpu_arch': u'x86_64', u'local_gb': 99,   |
|                        | u'cpus': 2, u'capabilities': u'boot_mode:bios,boot_option:local'}|
| instance_uuid          | None                                                             |
| name                   | None                                                             |
| driver_info            | {u'ilo_address': u'10.1.196.117', u'ilo_password': u'******',    |
|                        | u'ilo_deploy_iso': u'DEPLOY_UUID',                               |
|                        | u'ilo_username': u'Administrator'}                               |
| created_at             | 2016-03-11T10:17:10+00:00                                        |
| driver_internal_info   | {}                                                               |
| chassis_uuid           |                                                                  |
| instance_info          | {}                                                               |
+------------------------+------------------------------------------------------------------+
```

17.3.4 Creating a Node Using **agent_ipmi**

Use the `ironic node-create` command to specify the `agent_ipmi` driver, network access and credential information for the IPMI, properties of the node and the Glance IDs of the supplied kernel and ramdisk images. Note that memory size is specified in megabytes while disk size is specified in gigabytes.

```
ironic node-create -d agent_ipmitool \
  -i ipmi_address=IP_ADDRESS \
  -i ipmi_username=Administrator -i ipmi_password=PASSWORD \
```

```
  -p cpus=2 -p memory_mb=64000 -p local_gb=99 -p cpu_arch=x86_64 \
  -i deploy_kernel=KERNEL_UUID \
  -i deploy_ramdisk=RAMDISK_UUID
```

This will generate output similar to the following:

```
+--------------+--------------------------------------------------------------------------+
| Property     | Value                                                                    |
+--------------+--------------------------------------------------------------------------+
| uuid         | NODE2_UUID                                                               |
| driver_info  | {u'deploy_kernel': u'KERNEL_UUID',                                       |
|              | u'ipmi_address': u'IP_ADDRESS', u'ipmi_username': u'Administrator',      |
|              | u'ipmi_password': u'******',                                             |
|              | u'deploy_ramdisk': u'RAMDISK_UUID'}                                      |
| extra        | {}                                                                       |
| driver       | agent_ipmitool                                                           |
| chassis_uuid |                                                                          |
| properties   | {u'memory_mb': 64000, u'cpu_arch': u'x86_64', u'local_gb': 99,           |
|              | u'cpus': 2}                                                              |
| name         | None                                                                     |
+--------------+--------------------------------------------------------------------------+
```

Now update the node with `boot_mode` and `boot_option` properties:

```
ironic node-update NODE_UUID add \
  properties/capabilities="boot_mode:bios,boot_option:local"
```

The `ironic node-update` command returns details for all of the node's characteristics.

```
+------------------------+------------------------------------------------------------------+
| Property               | Value                                                            |
+------------------------+------------------------------------------------------------------+
| target_power_state     | None                                                             |
| extra                  | {}                                                               |
| last_error             | None                                                             |
| updated_at             | None                                                             |
| maintenance_reason     | None                                                             |
| provision_state        | available                                                        |
| clean_step             | {}                                                               |
| uuid                   | NODE2_UUID                                                       |
| console_enabled        | False                                                            |
| target_provision_state | None                                                             |
| provision_updated_at   | None                                                             |
| maintenance            | False                                                            |
| inspection_started_at  | None                                                             |
| inspection_finished_at | None                                                             |
| power_state            | None                                                             |
| driver                 | agent_ipmitool                                                   |
| reservation            | None                                                             |
| properties             | {u'memory_mb': 64000, u'cpu_arch': u'x86_64',                    |
|                        | u'local_gb': 99, u'cpus': 2,                                     |
```

```
|                        | u'capabilities': u'boot_mode:bios,boot_option:local'}          |
| instance_uuid          | None                                                            |
| name                   | None                                                            |
| driver_info            | {u'ipmi_password': u'******', u'ipmi_address': u'IP_ADDRESS',   |
|                        | u'ipmi_username': u'Administrator', u'deploy_kernel':           |
|                        | u'KERNEL_UUID',                                                 |
|                        | u'deploy_ramdisk': u'RAMDISK_UUID'}                             |
| created_at             | 2016-03-11T14:19:18+00:00                                       |
| driver_internal_info   | {}                                                              |
| chassis_uuid           |                                                                 |
| instance_info          | {}                                                              |
+------------------------+-----------------------------------------------------------------+
```

For more information on node enrollment, see the OpenStack documentation at http://docs.openstack.org/developer/ironic/deploy/install-guide.html#enrollment.

17.3.5 Creating a Flavor

Nova uses flavors when fulfilling requests for bare-metal nodes. The Nova scheduler attempts to match the requested flavor against the properties of the created Ironic nodes. So an administrator needs to set up flavors that correspond to the available bare-metal nodes using the command **nova flavor-create**:

```
nova flavor-create bmtest auto 64000  99 2

+----------------+--------+--------+------+-----------+------+-------+-------------+-----------+
| ID             | Name   | Mem_MB | Disk | Ephemeral | Swap | VCPUs | RXTX_Factor | Is_Public |
+----------------+--------+--------+------+-----------+------+-------+-------------+-----------+
| 645de0...b1348 | bmtest | 64000  | 99   | 0         |      | 2     | 1.0         | True      |
+----------------+--------+--------+------+-----------+------+-------+-------------+-----------+
```

To see a list of all the available flavors, run **nova flavor-list**:

```
nova flavor-list

+-------------+--------------+--------+------+-----------+------+-------+--------+-----------+
| ID          | Name         | Mem_MB | Disk | Ephemeral | Swap | VCPUs |  RXTX  | Is_Public |
|             |              |        |      |           |      |       | Factor |           |
+-------------+--------------+--------+------+-----------+------+-------+--------+-----------+
| 1           | m1.tiny      | 512    | 1    | 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      |
| 6           | m1.baremetal | 4096   | 80   | 0         |      | 2     | 1.0    | True      |
| 645d...1348 | bmtest       | 64000  | 99   | 0         |      | 2     | 1.0    | True      |
+-------------+--------------+--------+------+-----------+------+-------+--------+-----------+
```

Now set the CPU architecture and boot mode and boot option capabilities:

```
nova flavor-key 645de08d-2bc6-43f1-8a5f-2315a75b1348 set cpu_arch=x86_64
nova flavor-key 645de08d-2bc6-43f1-8a5f-2315a75b1348 set capabilities:boot_option="local"
nova flavor-key 645de08d-2bc6-43f1-8a5f-2315a75b1348 set capabilities:boot_mode="bios"
```

For more information on flavor creation, see the OpenStack documentation at http://docs.openstack.org/developer/ironic/deploy/install-guide.html#flavor-creation.

17.3.6 Creating a Network Port

Register the MAC addresses of all connected physical network interfaces intended for use with the bare-metal node.

```
ironic port-create -a 5c:b9:01:88:f0:a4 -n ea7246fd-e1d6-4637-9699-0b7c59c22e67
```

17.3.7 Creating a Glance Image

You can create a complete disk image using the instructions at *Section 17.3.11, "Building Glance Images Using KIWI"*.

The image you create can then be loaded into Glance:

```
glance image-create --name='leap' --disk-format=raw \
  --container-format=bare \
  --file /tmp/myimage/LimeJeOS-Leap-42.3.x86_64-1.42.3.raw

+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| checksum         | 45a4a06997e64f7120795c68beeb0e3c     |
| container_format | bare                                 |
| created_at       | 2018-02-17T10:42:14Z                 |
| disk_format      | raw                                  |
| id               | 17e4915a-ada0-4b95-bacf-ba67133f39a7 |
| min_disk         | 0                                    |
| min_ram          | 0                                    |
| name             | leap                                 |
| owner            | 821b7bb8148f439191d108764301af64     |
| protected        | False                                |
| size             | 372047872                            |
| status           | active                               |
| tags             | []                                   |
```

```
| updated_at       | 2018-02-17T10:42:23Z                 |
| virtual_size     | None                                 |
| visibility       | private                              |
+------------------+--------------------------------------+
```

This image will subsequently be used to boot the bare-metal node.

17.3.8 Generating a Key Pair

Create a key pair that you will use when you login to the newly booted node:

```
nova keypair-add ironic_kp > ironic_kp.pem
```

17.3.9 Determining the Neutron Network ID

```
neutron net-list

+---------------+----------+----------------------------------------------------+
| id            | name     | subnets                                            |
+---------------+----------+----------------------------------------------------+
| c0102...1ca8c | flat-net | 709ee2a1-4110-4b26-ba4d-deb74553adb9 192.3.15.0/24 |
+---------------+----------+----------------------------------------------------+
```

17.3.10 Booting the Node

Before booting, it is advisable to power down the node:

```
ironic node-set-power-state ea7246fd-e1d6-4637-9699-0b7c59c22e67 off
```

You can now boot the bare-metal node with the information compiled in the preceding steps, using the Neutron network ID, the whole disk image ID, the matching flavor and the key name:

```
nova boot --nic net-id=c010267c-9424-45be-8c05-99d68531ca8c \
  --image 17e4915a-ada0-4b95-bacf-ba67133f39a7 \
  --flavor 645de08d-2bc6-43f1-8a5f-2315a75b1348 \
  --key-name ironic_kp leap
```

This command returns information about the state of the node that is booting:

```
+--------------------------------------+------------------------+
| Property                             | Value                  |
+--------------------------------------+------------------------+
| OS-EXT-AZ:availability_zone          |                        |
```

```
| OS-EXT-SRV-ATTR:host                 | -                      |
| OS-EXT-SRV-ATTR:hypervisor_hostname  | -                      |
| OS-EXT-SRV-ATTR:instance_name        | instance-00000001      |
| OS-EXT-STS:power_state               | 0                      |
| OS-EXT-STS:task_state                | scheduling             |
| OS-EXT-STS:vm_state                  | building               |
| OS-SRV-USG:launched_at               | -                      |
| OS-SRV-USG:terminated_at             | -                      |
| accessIPv4                           |                        |
| accessIPv6                           |                        |
| adminPass                            | adpHw3KKTjHk           |
| config_drive                         |                        |
| created                              | 2018-03-11T11:00:28Z   |
| flavor                               | bmtest (645de...b1348) |
| hostId                               |                        |
| id                                   | a9012...3007e          |
| image                                | leap (17e49...f39a7)   |
| key_name                             | ironic_kp              |
| metadata                             | {}                     |
| name                                 | leap                   |
| os-extended-volumes:volumes_attached | []                     |
| progress                             | 0                      |
| security_groups                      | default                |
| status                               | BUILD                  |
| tenant_id                            | d53bcaf...baa60dd      |
| updated                              | 2016-03-11T11:00:28Z   |
| user_id                              | e580c64...4aaf990      |
+--------------------------------------+------------------------+
```

The boot process can take up to 10 minutes. Monitor the progress with the IPMI console or with `nova list`, `nova show <nova_node_id>`, and `ironic node-show <ironic_node_id>` commands.

```
nova list

+---------------+--------+--------+------------+-------------+----------------------+
| ID            | Name   | Status | Task State | Power State | Networks             |
+---------------+--------+--------+------------+-------------+----------------------+
| a9012...3007e | leap   | BUILD  | spawning   | NOSTATE     | flat-net=192.3.15.12 |
+---------------+--------+--------+------------+-------------+----------------------+
```

During the boot procedure, a login prompt will appear for SLES:

Ignore this login screen and wait for the login screen of your target operating system to appear:

If you now run the command **`nova list`**, it should show the node in the running state:

```
nova list
+---------------+--------+--------+------------+-------------+----------------------+
```

```
| ID             | Name   | Status | Task State | Power State | Networks             |
+----------------+--------+--------+------------+-------------+----------------------+
| a9012...3007e | leap   | ACTIVE | -          | Running     | flat-net=192.3.15.14 |
+----------------+--------+--------+------------+-------------+----------------------+
```

You can now log in to the booted node using the key you generated earlier. (You may be prompted to change the permissions of your private key files, so that they are not accessible by others).

```
ssh leap@192.3.15.14 -i ironic_kp.pem
```

17.3.11 Building Glance Images Using KIWI

The following sections show you how to create your own images using KIWI, the command line utility to build Linux system appliances. For information on installing KIWI, see https://osinside.github.io/kiwi/installation.html.

KIWI creates images in a two-step process:

1. The `prepare` operation generates an unpacked image tree using the information provided in the image description.
2. The `create` operation creates the packed image based on the unpacked image and the information provided in the configuration file (`config.xml`).

Instructions for installing KIWI are available at https://osinside.github.io/kiwi/installation.html.

Image creation with KIWI is automated and does not require any user interaction. The information required for the image creation process is provided by the image description.

To use and run KIWI requires:

- A recent Linux distribution such as:
  - openSUSE Leap 42.3
  - SUSE Linux Enterprise 12 SP3
  - openSUSE Tumbleweed
- Enough free disk space to build and store the image (a minimum of 10 GB is recommended).
- Python version 2.7, 3.4 or higher. KIWI supports both Python 2 and 3 versions
- Git (package `git-core`) to clone a repository.
- Virtualization technology to start the image (QEMU is recommended).

17.3.12 Creating an openSUSE Image with KIWI

The following example shows how to build an openSUSE Leap image that is ready to run in QEMU.

1. Retrieve the example image descriptions.

```
git clone https://github.com/SUSE/kiwi-descriptions
```

2. Build the image with KIWI:

```
sudo kiwi-ng --type vmx system build \
  --description kiwi-descriptions/suse/x86_64/suse-leap-42.3-JeOS \
  --target-dir /tmp/myimage
```

   A `.raw` image will be built in the `/tmp/myimage` directory.

3. Test the live image with QEMU:

```
qemu \
  -drive file=LimeJeOS-Leap-42.3.x86_64-1.42.3.raw,format=raw,if=virtio \
  -m 4096
```

4. With a successful test, the image is complete.

By default, KIWI generates a file in the `.raw` format. The `.raw` file is a disk image with a structure equivalent to a physical hard disk. `.raw` images are supported by any hypervisor, but are not compressed and do not offer the best performance.

Virtualization systems support their own formats (such as `qcow2` or `vmdk`) with compression and improved I/O performance. To build an image in a format other than `.raw`, add the format attribute to the type definition in the preferences section of `config.xml`. Using `qcow2` for example:

```
<image ...>
  <preferences>
    <type format="qcow2" .../>
    ...
  </preferences>
  ...
</image
```

More information about KIWI is at https://osinside.github.io/kiwi/ .

17.4 Provisioning Baremetal Nodes with Multi-Tenancy

To enable Ironic multi-tenancy, you must first manually install the `python-networking-generic-switch` package along with all its dependents on all Neutron nodes.

To manually enable the `genericswitch` mechanism driver in Neutron, the `networking-generic-switch` package must be installed first. Do the following steps in each of the controllers where Neutron is running.

1. Comment out the `multi_tenancy_switch_config` section in `~/openstack/my_cloud/definition/data/ironic/ironic_config.yml`.
2. SSH into the controller node
3. Change to root

   ```
   ardana > sudo -i
   ```
4. Activate the neutron venv

   ```
   tux > sudo . /opt/stack/venv/neutron-20180528T093206Z/bin/activate
   ```
5. Install netmiko package

   ```
   tux > sudo pip install netmiko
   ```
6. Clone the `networking-generic-switch` source code into `/tmp`

   ```
   tux > sudo cd /tmp
   tux > sudo git clone
      https://github.com/openstack/networking-generic-switch.git
   ```
7. Install `networking_generic_switch` package

   ```
   tux > sudo python setup.py install
   ```

After the `networking_generic_switch` package is installed, the `genericswitch` settings must be enabled in the input model. The following process must be run again any time a maintenance update is installed that updates the Neutron venv.

1. SSH into the deployer node as the user `ardana`.

2. Edit the Ironic configuration data in the input model `~/openstack/my_cloud/definition/data/ironic/ironic_config.yml`. Make sure the `multi_tenancy_switch_config:` section is uncommented and has the appropriate settings. `driver_type` should be `genericswitch` and `device_type` should be `netmiko_hp_comware`.

```
multi_tenancy_switch_config:
  -
    id: switch1
    driver_type: genericswitch
    device_type: netmiko_hp_comware
    ip_address: 192.168.75.201
    username: IRONICSHARE
    password: 'k27MwbEDGzTm'
```

3. Run the configure process to generate the model

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

4. Run `neutron-reconfigure.yml`

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/localhost neutron-reconfigure.yml
```

5. Run `neutron-status.yml` to make sure everything is OK

```
ardana > ansible-playbook -i hosts/verb_hosts neutron-status.yml
```

With the `networking-generic-switch` package installed and enabled, you can proceed with provisioning baremetal nodes with multi-tenancy.

1. Create a network and a subnet:

```
$ neutron net-create guest-net-1
Created a new network:
+---------------------------+--------------------------------------+
| Field                     | Value                                |
+---------------------------+--------------------------------------+
| admin_state_up            | True                                 |
| availability_zone_hints   |                                      |
| availability_zones        |                                      |
| created_at                | 2017-06-10T02:49:56Z                 |
| description               |                                      |
| id                        | 256d55a6-9430-4f49-8a4c-cc5192f5321e |
```

```
| ipv4_address_scope        |                                      |
| ipv6_address_scope        |                                      |
| mtu                       | 1500                                 |
| name                      | guest-net-1                          |
| project_id                | 57b792cdcdd74d16a08fc7a396ee05b6     |
| provider:network_type     | vlan                                 |
| provider:physical_network | physnet1                             |
| provider:segmentation_id  | 1152                                 |
| revision_number           | 2                                    |
| router:external           | False                                |
| shared                    | False                                |
| status                    | ACTIVE                               |
| subnets                   |                                      |
| tags                      |                                      |
| tenant_id                 | 57b792cdcdd74d16a08fc7a396ee05b6     |
| updated_at                | 2017-06-10T02:49:57Z                 |
+---------------------------+--------------------------------------+

$ neutron  subnet-create guest-net-1 200.0.0.0/24
Created a new subnet:
+-------------------+----------------------------------------------+
| Field             | Value                                        |
+-------------------+----------------------------------------------+
| allocation_pools  | {"start": "200.0.0.2", "end": "200.0.0.254"} |
| cidr              | 200.0.0.0/24                                 |
| created_at        | 2017-06-10T02:53:08Z                         |
| description       |                                              |
| dns_nameservers   |                                              |
| enable_dhcp       | True                                         |
| gateway_ip        | 200.0.0.1                                    |
| host_routes       |                                              |
| id                | 53accf35-ae02-43ae-95d8-7b5efed18ae9         |
| ip_version        | 4                                            |
| ipv6_address_mode |                                              |
| ipv6_ra_mode      |                                              |
| name              |                                              |
| network_id        | 256d55a6-9430-4f49-8a4c-cc5192f5321e         |
| project_id        | 57b792cdcdd74d16a08fc7a396ee05b6             |
| revision_number   | 2                                            |
| service_types     |                                              |
| subnetpool_id     |                                              |
| tenant_id         | 57b792cdcdd74d16a08fc7a396ee05b6             |
| updated_at        | 2017-06-10T02:53:08Z                         |
+-------------------+----------------------------------------------+
```

2. Review glance image list

```
$ glance image list
+--------------------------------------+--------------------------+
| ID                                   | Name                     |
+--------------------------------------+--------------------------+
| 0526d2d7-c196-4c62-bfe5-a13bce5c7f39 | cirros-0.4.0-x86_64      |
+--------------------------------------+--------------------------+
```

3. Create Ironic node

```
$ ironic --ironic-api-version 1.22 node-create -d agent_ipmitool \
  -n test-node-1 -i ipmi_address=192.168.9.69 -i ipmi_username=ipmi_user \
  -i ipmi_password=XXXXXXXX --network-interface neutron -p  memory_mb=4096 \
  -p cpu_arch=x86_64 -p local_gb=80 -p cpus=2 \
  -p capabilities=boot_mode:bios,boot_option:local \
  -p root_device='{"name":"/dev/sda"}' \
  -i deploy_kernel=db3d131f-2fb0-4189-bb8d-424ee0886e4c \
  -i deploy_ramdisk=304cae15-3fe5-4f1c-8478-c65da5092a2c

+-------------------+-------------------------------------------------------------------+
| Property          | Value                                                             |
+-------------------+-------------------------------------------------------------------+
| chassis_uuid      |                                                                   |
| driver            | agent_ipmitool                                                    |
| driver_info       | {u'deploy_kernel': u'db3d131f-2fb0-4189-bb8d-424ee0886e4c',      |
|                   | u'ipmi_address': u'192.168.9.69',                                 |
|                   | u'ipmi_username': u'gozer', u'ipmi_password': u'******',         |
|                   | u'deploy_ramdisk': u'304cae15-3fe5-4f1c-8478-c65da5092a2c'}      |
| extra             | {}                                                                |
| name              | test-node-1                                                       |
| network_interface | neutron                                                           |
| properties        | {u'cpu_arch': u'x86_64', u'root_device': {u'name': u'/dev/sda'},  |
|                   | u'cpus': 2, u'capabilities': u'boot_mode:bios,boot_option:local', |
|                   | u'memory_mb': 4096, u'local_gb': 80}                              |
| resource_class    | None                                                              |
| uuid              | cb4dda0d-f3b0-48b9-ac90-ba77b8c66162                              |
+-------------------+-------------------------------------------------------------------+
```

ipmi_address, ipmi_username and ipmi_password are IPMI access parameters for baremetal Ironic node. Adjust memory_mb, cpus, local_gb to your node size requirements. They also need to be reflected in flavor setting (see below). Use capabilities boot_mode:bios for baremetal nodes operating in Legacy BIOS mode. For UEFI baremetal nodes, use boot_mode:uefi lookup deploy_kernel and deploy_ramdisk in glance image list output above.

> **Important**
>
> Since we are using Ironic API version 1.22, node is created initial state **enroll**. It needs to be explicitly moved to **available** state. This behavior changed in API version 1.11

4. Create port

```
$ ironic --ironic-api-version 1.22 port-create --address f0:92:1c:05:6c:40 \
  --node cb4dda0d-f3b0-48b9-ac90-ba77b8c66162 -l switch_id=e8:f7:24:bf:07:2e -l \
  switch_info=hp59srv1-a-11b -l port_id="Ten-GigabitEthernet 1/0/34" \
  --pxe-enabled true
+-----------------------+--------------------------------------------+
| Property              | Value                                      |
+-----------------------+--------------------------------------------+
| address               | f0:92:1c:05:6c:40                          |
| extra                 | {}                                         |
| local_link_connection | {u'switch_info': u'hp59srv1-a-11b',        |
|                       | u'port_id': u'Ten-GigabitEthernet 1/0/34', |
|                       | u'switch_id': u'e8:f7:24:bf:07:2e'}        |
| node_uuid             | cb4dda0d-f3b0-48b9-ac90-ba77b8c66162       |
| pxe_enabled           | True                                       |
| uuid                  | a49491f3-5595-413b-b4a7-bb6f9abec212       |
+-----------------------+--------------------------------------------+
```

- for `--address`, use MAC of 1st NIC of ironic baremetal node, which will be used for PXE boot
- for `--node`, use ironic node uuid (see above)
- for `-l switch_id`, use switch management interface MAC address. It can be retrieved by pinging switch management IP and looking up MAC address in 'arp -l -n' command output.
- for `-l switch_info`, use switch_id from `data/ironic/ironic_config.yml` file. If you have several switch config definitions, use the right switch your baremetal node is connected to.
- for -l port_id, use port ID on the switch

5. Move ironic node to manage and then available state

```
$ ironic node-set-provision-state test-node-1 manage
$ ironic node-set-provision-state test-node-1 provide
```

6. Once node is successfully moved to available state, its resources should be included into Nova hypervisor statistics

```
$ nova hypervisor-stats
+----------------------+-------+
| Property             | Value |
+----------------------+-------+
| count                | 1     |
| current_workload     | 0     |
| disk_available_least | 80    |
| free_disk_gb         | 80    |
| free_ram_mb          | 4096  |
| local_gb             | 80    |
| local_gb_used        | 0     |
| memory_mb            | 4096  |
| memory_mb_used       | 0     |
| running_vms          | 0     |
| vcpus                | 2     |
| vcpus_used           | 0     |
+----------------------+-------+
```

7. Prepare a keypair, which will be used for logging into the node

```
$ nova keypair-add ironic_kp > ironic_kp.pem
```

8. Obtain user image and upload it to glance. Please refer to OpenStack documentation on user image creation: https://docs.openstack.org/project-install-guide/baremetal/draft/configure-glance-images.html.

Note

Deployed images are already populated by SUSE OpenStack Cloud installer.

```
$ glance image-create --name='Ubuntu Trusty 14.04' --disk-format=qcow2 \
  --container-format=bare --file ~/ubuntu-trusty.qcow2
+------------------+--------------------------------------+
| Property         | Value                                |
+------------------+--------------------------------------+
| checksum         | d586d8d2107f328665760fee4c81caf0     |
| container_format | bare                                 |
| created_at       | 2017-06-13T22:38:45Z                 |
| disk_format      | qcow2                                |
| id               | 9fdd54a3-ccf5-459c-a084-e50071d0aa39 |
| min_disk         | 0                                    |
```

```
| min_ram          | 0                                  |
| name             | Ubuntu Trusty 14.04                |
| owner            | 57b792cdcdd74d16a08fc7a396ee05b6   |
| protected        | False                              |
| size             | 371508736                          |
| status           | active                             |
| tags             | []                                 |
| updated_at       | 2017-06-13T22:38:55Z               |
| virtual_size     | None                               |
| visibility       | private                            |
+------------------+------------------------------------+

$ glance image list
+--------------------------------------+--------------------------+
| ID                                   | Name                     |
+--------------------------------------+--------------------------+
| 0526d2d7-c196-4c62-bfe5-a13bce5c7f39 | cirros-0.4.0-x86_64      |
| 83eecf9c-d675-4bf9-a5d5-9cf1fe9ee9c2 | ir-deploy-iso-EXAMPLE    |
| db3d131f-2fb0-4189-bb8d-424ee0886e4c | ir-deploy-kernel-EXAMPLE |
| 304cae15-3fe5-4f1c-8478-c65da5092a2c | ir-deploy-ramdisk- EXAMPLE |
| 9fdd54a3-ccf5-459c-a084-e50071d0aa39 | Ubuntu Trusty 14.04      |
+--------------------------------------+--------------------------+
```

9. Create a baremetal flavor and set flavor keys specifying requested node size, architecture and boot mode. A flavor can be re-used for several nodes having the same size, architecture and boot mode

```
$ nova flavor-create m1.ironic auto 4096 80 2
+-------------+-----------+--------+------+---------+------+-------+-------------
+-----------+
| ID          | Name      | Mem_MB | Disk | Ephemrl | Swap | VCPUs | RXTX_Factor |
 Is_Public |
+-------------+-----------+--------+------+---------+------+-------+-------------
+-----------+
| ab69...87bf | m1.ironic | 4096   | 80   | 0       |      | 2     | 1.0         | True
  |
+-------------+-----------+--------+------+---------+------+-------+-------------
+-----------+

$ nova flavor-key ab6988...e28694c87bf set cpu_arch=x86_64
$ nova flavor-key ab6988...e28694c87bf set capabilities:boot_option="local"
$ nova flavor-key ab6988...e28694c87bf set capabilities:boot_mode="bios"
```

Parameters must match parameters of ironic node above. Use `capabilities:boot_mode="bios"` for Legacy BIOS nodes. For UEFI nodes, use `capabilities:boot_mode="uefi"`

10. Boot the node

```
$ nova boot --flavor m1.ironic --image 9fdd54a3-ccf5-459c-a084-e50071d0aa39 \
  --key-name ironic_kp --nic net-id=256d55a6-9430-4f49-8a4c-cc5192f5321e \
  test-node-1
+--------------------------------------+-------------------------------------------------+
| Property                             | Value                                           |
+--------------------------------------+-------------------------------------------------+
| OS-DCF:diskConfig                    | MANUAL                                          |
| OS-EXT-AZ:availability_zone          |                                                 |
| OS-EXT-SRV-ATTR:host                 | -                                               |
| OS-EXT-SRV-ATTR:hypervisor_hostname  | -                                               |
| OS-EXT-SRV-ATTR:instance_name        |                                                 |
| OS-EXT-STS:power_state               | 0                                               |
| OS-EXT-STS:task_state                | scheduling                                      |
| OS-EXT-STS:vm_state                  | building                                        |
| OS-SRV-USG:launched_at               | -                                               |
| OS-SRV-USG:terminated_at             | -                                               |
| accessIPv4                           |                                                 |
| accessIPv6                           |                                                 |
| adminPass                            | XXXXXXXXXXXX                                    |
| config_drive                         |                                                 |
| created                              | 2017-06-14T21:25:18Z                            |
| flavor                               | m1.ironic (ab69881...5a-497d-93ae-6e28694c87bf) |
| hostId                               |                                                 |
| id                                   | f1a8c63e-da7b-4d9a-8648-b1baa6929682            |
| image                                | Ubuntu Trusty 14.04 (9fdd54a3-ccf5-4a0...0aa39) |
| key_name                             | ironic_kp                                       |
| metadata                             | {}                                              |
| name                                 | test-node-1                                     |
| os-extended-volumes:volumes_attached | []                                              |
| progress                             | 0                                               |
| security_groups                      | default                                         |
| status                               | BUILD                                           |
| tenant_id                            | 57b792cdcdd74d16a08fc7a396ee05b6                |
| updated                              | 2017-06-14T21:25:17Z                            |
| user_id                              | cc76d7469658401fbd4cf772278483d9                |
+--------------------------------------+-------------------------------------------------+
```

- for `--image`, use the ID of user image created at previous step
- for `--nic net-id`, use ID of the tenant network created at the beginning

> **Note**
>
> During the node provisioning, the following is happening in the background:
>
> Neutron connects to switch management interfaces and assigns provisioning VLAN to baremetal node port on the switch. Ironic powers up the node using IPMI interface. Node is booting IPA image via PXE. IPA image is writing provided user image onto specified root device (`/dev/sda`) and powers node down. Neutron connects to switch management interfaces and assigns tenant VLAN to baremetal node port on the switch. A VLAN ID is selected from provided range. Ironic powers up the node using IPMI interface. Node is booting user image from disk.

11. Once provisioned, node will join the private tenant network. Access to private network from other networks is defined by switch configuration.

17.5 View Ironic System Details

17.5.1 View details about the server using **`nova show <nova-node-id>`**

```
nova show a90122ce-bba8-496f-92a0-8a7cb143007e

+--------------------------------------+-----------------------------------------------+
| Property                             | Value                                         |
+--------------------------------------+-----------------------------------------------+
| OS-EXT-AZ:availability_zone          | nova                                          |
| OS-EXT-SRV-ATTR:host                 | ardana-cp1-ir-compute0001-mgmt                |
| OS-EXT-SRV-ATTR:hypervisor_hostname  | ea7246fd-e1d6-4637-9699-0b7c59c22e67          |
| OS-EXT-SRV-ATTR:instance_name        | instance-0000000a                             |
| OS-EXT-STS:power_state               | 1                                             |
| OS-EXT-STS:task_state                | -                                             |
| OS-EXT-STS:vm_state                  | active                                        |
| OS-SRV-USG:launched_at               | 2016-03-11T12:26:25.000000                    |
| OS-SRV-USG:terminated_at             | -                                             |
| accessIPv4                           |                                               |
| accessIPv6                           |                                               |
| config_drive                         |                                               |
| created                              | 2016-03-11T12:17:54Z                          |
| flat-net network                     | 192.3.15.14                                   |
| flavor                               | bmtest (645de08d-2bc6-43f1-8a5f-2315a75b1348) |
| hostId                               | ecafa4f40eb5f72f7298...3bad47cbc01aa0a076114f |
```

```
| id                                   | a90122ce-bba8-496f-92a0-8a7cb143007e         |
| image                                | ubuntu (17e4915a-ada0-4b95-bacf-ba67133f39a7) |
| key_name                             | ironic_kp                                    |
| metadata                             | {}                                           |
| name                                 | ubuntu                                       |
| os-extended-volumes:volumes_attached | []                                           |
| progress                             | 0                                            |
| security_groups                      | default                                      |
| status                               | ACTIVE                                       |
| tenant_id                            | d53bcaf15afb4cb5aea3adaedbaa60dd             |
| updated                              | 2016-03-11T12:26:26Z                         |
| user_id                              | e580c645bfec4faeadef7dbd24aaf990             |
+--------------------------------------+----------------------------------------------+
```

17.5.2 View detailed information about a node using `ironic node-show <ironic-node-id>`

```
ironic node-show  ea7246fd-e1d6-4637-9699-0b7c59c22e67

+------------------------+-------------------------------------------------------------------------+
| Property               | Value                                                                   |
+------------------------+-------------------------------------------------------------------------+
| target_power_state     | None                                                                    |
| extra                  | {}                                                                      |
| last_error             | None                                                                    |
| updated_at             | 2016-03-11T12:26:25+00:00                                               |
| maintenance_reason     | None                                                                    |
| provision_state        | active                                                                  |
| clean_step             | {}                                                                      |
| uuid                   | ea7246fd-e1d6-4637-9699-0b7c59c22e67                                    |
| console_enabled        | False                                                                   |
| target_provision_state | None                                                                    |
| provision_updated_at   | 2016-03-11T12:26:25+00:00                                               |
| maintenance            | False                                                                   |
| inspection_started_at  | None                                                                    |
| inspection_finished_at | None                                                                    |
| power_state            | power on                                                                |
| driver                 | agent_ilo                                                               |
| reservation            | None                                                                    |
| properties             | {u'memory_mb': 64000, u'cpu_arch': u'x86_64', u'local_gb': 99,          |
|                        | u'cpus': 2, u'capabilities': u'boot_mode:bios,boot_option:local'}       |
| instance_uuid          | a90122ce-bba8-496f-92a0-8a7cb143007e                                    |
| name                   | None                                                                    |
| driver_info            | {u'ilo_address': u'10.1.196.117', u'ilo_password': u'******',           |
|                        | u'ilo_deploy_iso': u'b9499494-7db3-4448-b67f-233b86489c1f',             |
|                        | u'ilo_username': u'Administrator'}                                      |
| created_at             | 2016-03-11T10:17:10+00:00                                               |
| driver_internal_info   | {u'agent_url': u'http://192.3.15.14:9999',                              |
|                        | u'is_whole_disk_image': True, u'agent_last_heartbeat': 1457699159}      |
| chassis_uuid           |                                                                         |
| instance_info          | {u'root_gb': u'99', u'display_name': u'ubuntu', u'image_source': u      |
```

```
|                        | '17e4915a-ada0-4b95-bacf-ba67133f39a7', u'capabilities': u'{"boot_mode": |
|                        | "bios", "boot_option": "local"}', u'memory_mb': u'64000', u'vcpus':      |
|                        | u'2', u'image_url': u'http://192.168.12.2:8080/v1/AUTH_ba121db7732f4ac3a |
|                        | 50cc4999a10d58d/glance/17e4915a-ada0-4b95-bacf-ba67133f39a7?temp_url_sig |
|                        | =ada691726337805981ac002c0fbfc905eb9783ea&temp_url_expires=1457699878',  |
|                        | u'image_container_format': u'bare', u'local_gb': u'99',                  |
|                        | u'image_disk_format': u'qcow2', u'image_checksum':                       |
|                        | u'2d7bb1e78b26f32c50bd9da99102150b', u'swap_mb': u'0'}                   |
+------------------------+--------------------------------------------------------------------------+
```

17.5.3 View detailed information about a port using **ironic port-show <ironic-port-id>**

```
ironic port-show a17a4ef8-a711-40e2-aa27-2189c43f0b67

+------------+-----------------------------------------------------------+
| Property   | Value                                                     |
+------------+-----------------------------------------------------------+
| node_uuid  | ea7246fd-e1d6-4637-9699-0b7c59c22e67                      |
| uuid       | a17a4ef8-a711-40e2-aa27-2189c43f0b67                      |
| extra      | {u'vif_port_id': u'82a5ab28-76a8-4c9d-bfb4-624aeb9721ea'} |
| created_at | 2016-03-11T10:40:53+00:00                                 |
| updated_at | 2016-03-11T12:17:56+00:00                                 |
| address    | 5c:b9:01:88:f0:a4                                         |
+------------+-----------------------------------------------------------+
```

17.5.4 View detailed information about a hypervisor using **nova hypervisor-list** and **nova hypervisor-show**

```
nova hypervisor-list

+-----+--------------------------------------+-------+---------+
| ID  | Hypervisor hostname                  | State | Status  |
+-----+--------------------------------------+-------+---------+
| 541 | ea7246fd-e1d6-4637-9699-0b7c59c22e67 | up    | enabled |
+-----+--------------------------------------+-------+---------+
```

```
nova hypervisor-show ea7246fd-e1d6-4637-9699-0b7c59c22e67

+-------------------------+--------------------------------------+
| Property                | Value                                |
+-------------------------+--------------------------------------+
| cpu_info                |                                      |
```

```
| current_workload          | 0                                    |
| disk_available_least      | 0                                    |
| free_disk_gb              | 0                                    |
| free_ram_mb               | 0                                    |
| host_ip                   | 192.168.12.6                         |
| hypervisor_hostname       | ea7246fd-e1d6-4637-9699-0b7c59c22e67 |
| hypervisor_type           | ironic                               |
| hypervisor_version        | 1                                    |
| id                        | 541                                  |
| local_gb                  | 99                                   |
| local_gb_used             | 99                                   |
| memory_mb                 | 64000                                |
| memory_mb_used            | 64000                                |
| running_vms               | 1                                    |
| service_disabled_reason   | None                                 |
| service_host              | ardana-cp1-ir-compute0001-mgmt       |
| service_id                | 25                                   |
| state                     | up                                   |
| status                    | enabled                              |
| vcpus                     | 2                                    |
| vcpus_used                | 2                                    |
+---------------------------+--------------------------------------+
```

17.5.5 View a list of all running services using **nova service-list**

```
nova service-list

+----+------------------+----------------------+----------+---------+-------+------------+----------+
| Id | Binary           | Host                 | Zone     | Status  | State | Updated_at | Disabled |
|    |                  |                      |          |         |       |            | Reason   |
+----+------------------+----------------------+----------+---------+-------+------------+----------+
| 1  | nova-conductor   | ardana-cp1-c1-m1-mgmt | internal | enabled | up    | date:time  | -        |
| 7  | nova-conductor   |  " -cp1-c1-m2-mgmt   | internal | enabled | up    | date:time  | -        |
| 10 | nova-conductor   |  " -cp1-c1-m3-mgmt   | internal | enabled | up    | date:time  | -        |
| 13 | nova-scheduler   |  " -cp1-c1-m1-mgmt   | internal | enabled | up    | date:time  | -        |
| 16 | nova-scheduler   |  " -cp1-c1-m3-mgmt   | internal | enabled | up    | date:time  | -        |
| 19 | nova-scheduler   |  " -cp1-c1-m2-mgmt   | internal | enabled | up    | date:time  | -        |
| 22 | nova-consoleauth |  " -cp1-c1-m1-mgmt   | internal | enabled | up    | date:time  | -        |
| 25 | nova-compute     |  " -cp1-ir-  | nova  |          | enabled | up    | date:time  | -        |
|    |                  |     compute0001-mgmt |          |         |       |            |          |
+----+------------------+----------------------+----------+---------+-------+------------+----------+
```

17.6 Troubleshooting Ironic Installation

Sometimes the `nova boot` command does not succeed and when you do a `nova list`, you will see output like the following:

```
ardana > nova list

+------------------+--------------+--------+------------+-------------+----------+
| ID               | Name         | Status | Task State | Power State | Networks |
+------------------+--------------+--------+------------+-------------+----------+
| ee08f82...624e5f | OpenSUSE42.3 | ERROR  | -          | NOSTATE     |          |
+------------------+--------------+--------+------------+-------------+----------+
```

You should execute the `nova show <nova-node-id>` and `ironic node-show <ironic-node-id>` commands to get more information about the error.

17.6.1 Error: No valid host was found.

The error `No valid host was found. There are not enough hosts.` is typically seen when performing the `nova boot` where there is a mismatch between the properties set on the node and the flavor used. For example, the output from a `nova show` command may look like this:

```
ardana > nova show ee08f82e-8920-4360-be51-a3f995624e5f

+-------------------------+------------------------------------------------------------------------------+
| Property                | Value                                                                        |
+-------------------------+------------------------------------------------------------------------------+
| OS-EXT-AZ:              |                                                                              |
|   availability_zone     |                                                                              |
| OS-EXT-SRV-ATTR:host    | -                                                                            |
| OS-EXT-SRV-ATTR:        |                                                                              |
|   hypervisor_hostname   | -                                                                            |
| OS-EXT-SRV-ATTR:        |                                                                              |
|   instance_name         | instance-00000001                                                            |
| OS-EXT-STS:power_state  | 0                                                                            |
| OS-EXT-STS:task_state   | -                                                                            |
| OS-EXT-STS:vm_state     | error                                                                        |
| OS-SRV-USG:launched_at  | -                                                                            |
| OS-SRV-USG:             |                                                                              |
|    terminated_at        | -                                                                            |
| accessIPv4              |                                                                              |
| accessIPv6              |                                                                              |
| config_drive            |                                                                              |
| created                 | 2016-03-11T11:00:28Z                                                         |
| fault                   | {"message": "No valid host was found. There are not enough hosts             |
|                         |  available.", "code": 500, "details": "  File \"/opt/stack/                  |
|                         |  venv/nova-20160308T002421Z/lib/python2.7/site-packages/nova/                |
|                         |  conductor/manager.py\", line 739, in build_instances                        |
|                         |     request_spec, filter_properties)                                         |
```

```
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/nova/scheduler/utils.py\", line 343, in wrapped       |
|                        |     return func(*args, **kwargs)                                     |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/nova/scheduler/client/__init__.py\", line 52,          |
|                        |     in select_destinations context, request_spec, filter_properties)  |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/nova/scheduler/client/__init__.py\",line 37,in __run_method |
|                        |     return getattr(self.instance, __name)(*args, **kwargs)            |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/nova/scheduler/client/query.py\", line 34,             |
|                        |     in select_destinations context, request_spec, filter_properties)  |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/nova/scheduler/rpcapi.py\", line 120, in select_destinations |
|                        |     request_spec=request_spec, filter_properties=filter_properties)   |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/oslo_messaging/rpc/client.py\", line 158, in call      |
|                        |     retry=self.retry)                                                 |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/oslo_messaging/transport.py\", line 90, in _send       |
|                        |     timeout=timeout, retry=retry)                                     |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/oslo_messaging/_drivers/amqpdriver.py\", line 462, in send |
|                        |     retry=retry)                                                      |
|                        |   File \"/opt/stack/venv/nova-20160308T002421Z/lib/python2.7/          |
|                        |   site-packages/oslo_messaging/_drivers/amqpdriver.py\", line 453, in _send |
|                        |     raise result                                                      |
|                        | ", "created": "2016-03-11T11:00:29Z"}                                  |
| flavor                 | bmtest (645de08d-2bc6-43f1-8a5f-2315a75b1348)                          |
| hostId                 |                                                                        |
| id                     | ee08f82e-8920-4360-be51-a3f995624e5f                                   |
| image                  | opensuse (17e4915a-ada0-4b95-bacf-ba67133f39a7)                        |
| key_name               | ironic_kp                                                              |
| metadata               | {}                                                                     |
| name                   | opensuse                                                               |
| os-extended-volumes:   |                                                                        |
|    volumes_attached    | []                                                                     |
| status                 | ERROR                                                                  |
| tenant_id              | d53bcaf15afb4cb5aea3adaedbaa60dd                                       |
| updated                | 2016-03-11T11:00:28Z                                                   |
| user_id                | e580c645bfec4faeadef7dbd24aaf990                                       |
+------------------------+------------------------------------------------------------------------+
```

You can find more information about the error by inspecting the log file at `/var/log/nova/nova-scheduler.log` or alternatively by viewing the error location in the source files listed in the stack-trace (in bold above).

To find the mismatch, compare the properties of the Ironic node:

```
+------------------------+---------------------------------------------------------------------+
| Property               | Value                                                               |
+------------------------+---------------------------------------------------------------------+
| target_power_state     | None                                                                |
| extra                  | {}                                                                  |
```

```
| last_error             | None                                                              |
| updated_at             | None                                                              |
| maintenance_reason     | None                                                              |
| provision_state        | available                                                         |
| clean_step             | {}                                                                |
| uuid                   | ea7246fd-e1d6-4637-9699-0b7c59c22e67                              |
| console_enabled        | False                                                             |
| target_provision_state | None                                                              |
| provision_updated_at   | None                                                              |
| maintenance            | False                                                             |
| inspection_started_at  | None                                                              |
| inspection_finished_at | None                                                              |
| power_state            | None                                                              |
| driver                 | agent_ilo                                                         |
| reservation            | None                                                              |
| properties             | {u'memory_mb': 64000, u'local_gb': 99, u'cpus': 2, u'capabilities': |
|                        | u'boot_mode:bios,boot_option:local'}                              |
| instance_uuid          | None                                                              |
| name                   | None                                                              |
| driver_info            | {u'ilo_address': u'10.1.196.117', u'ilo_password': u'******',     |
|                        | u'ilo_deploy_iso': u'b9499494-7db3-4448-b67f-233b86489c1f',       |
|                        | u'ilo_username': u'Administrator'}                                |
| created_at             | 2016-03-11T10:17:10+00:00                                         |
| driver_internal_info   | {}                                                                |
| chassis_uuid           |                                                                   |
| instance_info          | {}                                                                |
+------------------------+-------------------------------------------------------------------+
```

with the flavor characteristics:

```
ardana > nova flavor-show

+----------------------------+-------------------------------------------------------------------
+
| Property                   | Value
 |
+----------------------------+-------------------------------------------------------------------
+
| OS-FLV-DISABLED:disabled   | False
 |
| OS-FLV-EXT-DATA:ephemeral  | 0
 |
| disk                       | 99
 |
| extra_specs                | {"capabilities:boot_option": "local", "cpu_arch": "x86_64",
 |
|                            | "capabilities:boot_mode": "bios"}
 |
| id                         | 645de08d-2bc6-43f1-8a5f-2315a75b1348
 |
| name                       | bmtest
 |
```

```
| os-flavor-access:is_public | True
 |
| ram                        | 64000
 |
| rxtx_factor                | 1.0
 |
| swap                       |
 |
| vcpus                      | 2
 |
+----------------------------+------------------------------------------------------------------
+
```

In this instance, the problem is caused by the absence of the "**cpu_arch**": "**x86_64**" property on the Ironic node. This can be resolved by updating the Ironic node, adding the missing property:

```
ardana > ironic node-update ea7246fd-e1d6-4637-9699-0b7c59c22e67 \
  add properties/cpu_arch=x86_64
```

and then re-running the `nova boot` command.

17.6.2 Node fails to deploy because it has timed out

Possible cause: The Neutron API session timed out before port creation was completed.

Resolution: Switch response time varies by vendor; the value of `url_timeout` must be increased to allow for switch response.

Check Ironic Conductor logs (`/var/log/ironic/ironic-conductor.log`) for `ConnectTimeout` errors while connecting to Neutron for port creation. For example:

```
19-03-20 19:09:14.557 11556 ERROR ironic.conductor.utils
[req-77f3a7b...1b10c5b - default default] Unexpected error while preparing
to deploy to node 557316...84dbdfbe8b0: ConnectTimeout: Request to
https://192.168.75.1:9696/v2.0/ports timed out
```

Use the following steps to increase the value of `url_timeout`.

1. Log in to the deployer node.

2. Edit `./roles/ironic-common/defaults/main.yml`, increasing the value of `url_timeout`.

   ```
   ardana > cd /var/lib/ardana/scratch/ansible/next/ardana/ansible
   ```

```
ardana > vi ./roles/ironic-common/defaults/main.yml
```

Increase the value of the `url_timeout` parameter in the `ironic_neutron:` section. Increase the parameter from the default (60 seconds) to 120 and then in increments of 60 seconds until the node deploys successfully.

3. Reconfigure Ironic.

```
ardana > ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
```

17.6.3 Deployment to a node fails and in "ironic node-list" command, the power_state column for the node is shown as "None"

Possible cause: The IPMI commands to the node take longer to change the power state of the server.

Resolution: Check if the node power state can be changed using the following command

```
ardana > ironic node-set-power-state $NODEUUID on
```

If the above command succeeds and the power_state column is updated correctly, then the following steps are required to increase the power sync interval time.

On the first controller, reconfigure Ironic to increase the power sync interval time. In the example below, it is set to 120 seconds. This value may have to be tuned based on the setup.

1. Go to the `~/openstack/my_cloud/config/ironic/` directory and edit `ironic-conductor.conf.j2` to set the `sync_power_state_interval` value:

```
[conductor]
sync_power_state_interval = 120
```

2. Save the file and then run the following playbooks:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
```

17.6.4 Error Downloading Image

If you encounter the error below during the deployment:

```
"u'message': u'Error downloading image: Download of image id 77700...96551 failed:
Image download failed for all URLs.',
u'code': 500,
u'type': u'ImageDownloadError',
u'details': u'Download of image id 77700b53-9e15-406c-b2d5-13e7d9b96551 failed:
Image download failed for all URLs.'"
```

you should visit the Single Sign-On Settings in the Security page of IPMI and change the Single Sign-On Trust Mode setting from the default of "Trust None (SSO disabled)" to "Trust by Certificate".

17.6.5 Using `node-inspection` can cause temporary claim of IP addresses

Possible cause: Running `node-inspection` on a node discovers all the NIC ports including the NICs that do not have any connectivity. This causes a temporary consumption of the network IPs and increased usage of the allocated quota. As a result, other nodes are deprived of IP addresses and deployments can fail.

Resolution: You can add node properties manually added instead of using the inspection tool.

Note: Upgrade `ipmitool` to a version >= 1.8.15 or it may not return detailed information about the NIC interface for `node-inspection`.

17.6.6 Node permanently stuck in deploying state

Possible causes:

- Ironic conductor service associated with the node could go down.
- There might be a properties mismatch. MAC address registered for the node could be incorrect.

Resolution: To recover from this condition, set the provision state of the node to `Error` and maintenance to `True`. Delete the node and re-register again.

17.6.7 The NICs in the baremetal node should come first in boot order

Possible causes: By default, the boot order of baremetal node is set as NIC1, HDD and NIC2. If NIC1 fails, the nodes starts booting from HDD and the provisioning fails.

Resolution: Set boot order so that all the NICs appear before the hard disk of the baremetal as NIC1, NIC2…, HDD.

17.6.8 Increase in the number of nodes can cause power commands to fail

Possible causes: Ironic periodically performs a power state sync with all the baremetal nodes. When the number of nodes increase, Ironic does not get sufficient time to perform power operations.

Resolution: The following procedure gives a way to increase `sync_power_state_interval`:

1. Edit the file `~/openstack/my_cloud/config/ironic/ironic-conductor.conf.j2` and navigate to the section for `[conductor]`
2. Increase the `sync_power_state_interval`. For example, for 100 nodes, set `sync_power_state_interval = 90` and save the file.
3. Execute the following set of commands to reconfigure Ironic:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
```

17.6.9 DHCP succeeds with PXE but times out with iPXE

If you see DHCP error "No configuration methods succeeded" in iPXE right after successful DHCP performed by embedded NIC firmware, there may be an issue with Spanning Tree Protocol on the switch.

To avoid this error, Rapid Spanning Tree Protocol needs to be enabled on the switch. If this is not an option due to conservative loop detection strategies, use the steps outlined below to install the iPXE binary with increased DHCP timeouts.

1. Clone iPXE source code

```
tux > git clone git://git.ipxe.org/ipxe.git
tux > cd ipxe/src
```

2. Modify lines 22-25 in file `config/dhcp.h`, which declare reduced DHCP timeouts (1-10 secs). Comment out lines with reduced timeouts and uncomment normal PXE timeouts (4-32)

```
//#define DHCP_DISC_START_TIMEOUT_SEC     1
//#define DHCP_DISC_END_TIMEOUT_SEC       10
#define DHCP_DISC_START_TIMEOUT_SEC   4       /* as per PXE spec */
#define DHCP_DISC_END_TIMEOUT_SEC     32      /* as per PXE spec */
```

3. Make `undionly.kpxe` (BIOS) and `ipxe.efi` (UEFI) images

```
tux > make bin/undionly.kpxe
tux > make bin-x86_64-efi/ipxe.efi
```

4. Copy iPXE images to Cloud Lifecycle Manager

```
tux > scp bin/undionly.kpxe bin-x86_64-efi/ipxe.efi stack@10.0.0.4:
stack@10.0.0.4's password:
undionly.kpxe                                     100%   66KB  65.6KB/s   00:00
ipxe.efi                                          100%  918KB 918.2KB/s   00:00
```

5. From deployer, distribute image files onto all 3 controllers

```
stack@ardana-cp1-c1-m1-mgmt:ardana > cd ~/scratch/ansible/next/ardana/ansible/

stack@ardana-cp1-c1-m1-mgmt:ardana > ~/scratch/ansible/next/ardana/ansible$ ansible -i hosts/
verb_hosts \
IRN-CND -m copy -b -a 'src=~/ipxe.efi dest=/tftpboot'
...
stack@ardana-cp1-c1-m1-mgmt:ardana > ~/scratch/ansible/next/ardana/ansible$ ansible -i hosts/
verb_hosts \
IRN-CND -m copy -b -a 'src=~/undionly.kpxe dest=/tftpboot'
...
```

There is no need to restart services. With next PXE boot attempt, iPXE binary with the increased timeout will be downloaded to the target node via TFTP.

17.6.9.1 Ironic Support and Limitations

The following drivers are supported and tested:

- `pxe_ipmitool` (UEFI and Legacy BIOS mode, flat-network)
- `pxe_ipmitool` (UEFI and Legacy BIOS mode, flat-network)
- `pxe_ilo` (UEFI and Legacy BIOS mode, flat-network)
- `agent_ipmitool` (UEFI and Legacy BIOS mode, flat-network)
- `agent_ilo` (UEFI and Legacy BIOS mode, flat-network)

ISO Image Exceeds Free Space

When using the `agent_ilo` driver, provisioning will fail if the size of the user ISO image exceeds the free space available on the ramdisk partition. This will produce an error in the Ironic Conductor logs that may look like as follows:

```
"ERROR root [-] Command failed: prepare_image, error: Error downloading
image: Download of image id 0c4d74e4-58f1-4f8d-8c1d-8a49129a2163 failed: Unable
to write image to /tmp/0c4d74e4-58f1-4f8d-8c1d-8a49129a2163. Error: [Errno 28]
No space left on device: ImageDownloadError: Error downloading image: Download
of image id 0c4d74e4-58f1-4f8d-8c1d-8a49129a2163 failed: Unable to write image
to /tmp/0c4d74e4-58f1-4f8d-8c1d-8a49129a2163. Error: [Errno 28] No space left
on device"
```

By default, the total amount of space allocated to ramdisk is 4GB. To increase the space allocated for the ramdisk, you can update the deploy ISO image using the following workaround.

1. Save the deploy ISO to a file:

   ```
   tux > openstack image save --file deploy.isoIMAGE_ID
   ```

   Replace *`IMAGE_ID`* with the ID of the deploy ISO stored in Glance. The ID can be obtained using the **`openstack image list`**.

2. Mount the saved ISO:

   ```
   tux > mkdir /tmp/mnt
   tux > sudo mount -t iso9660 -o loop deploy.iso /tmp/mnt
   ```

   Since the mount directory is read-only, it is necessary to copy its content to be able to make modifications.

3. Copy the content of the mount directory to a custom directory:

```
tux > mkdir /tmp/custom
tux > cp -aRvf /tmp/mnt/* /tmp/custom/
```

4. Modify the bootloader files to increase the size of the ramdisk:

```
/tmp/custom/boot/x86_64/loader/isolinux.cfg
/tmp/custom/EFI/BOOT/grub.cfg
/tmp/custom/boot/grub2/grub.cfg
```

Find the `openstack-ironic-image` label and modify the `ramdisk_size` parameter in the `append` property. The `ramdisk_size` value must be specified in Kilobytes.

```
label openstack-ironic-image
  kernel linux
  append initrd=initrd ramdisk_size=10485760 ramdisk_blocksize=4096 \
boot_method=vmedia showopts
```

Make sure that your baremetal node has the amount of RAM that equals or exceeds the `ramdisk_size` value.

5. Repackage the ISO using the genisoimage tool:

```
tux > cd /tmp/custom
tux > genisoimage -b boot/x86_64/loader/isolinux.bin -R -J -pad -joliet-long \
-iso-level 4 -A '0xaa2dab53' -no-emul-boot -boot-info-table \
-boot-load-size 4 -c boot/x86_64/boot.catalog -hide boot/x86_64/boot.catalog \
-hide-joliet boot/x86_64/boot.catalog -eltorito-alt-boot -b boot/x86_64/efi \
-no-emul-boot -joliet-long -hide glump -hide-joliet glump -o /tmp/
custom_deploy.iso ./
```

Important

When repackaging the ISO, make sure that you use the same label. You can find the label file in the `/tmp/custom/boot/` directory. The label begins with `0x`. For example, `0x51e568cb`.

6. Delete the existing deploy ISO in Glance:

```
tux > openstack image delete IMAGE_ID
```

7. Create a new image with `custom_deploy.iso`:

```
tux > openstack image create --container-format bare \
--disk-format iso --public --file custom_deploy.iso ir-deploy-iso-ARDANA5.0
```

8. Re-deploy the Ironic node.

Partition Image Exceeds Free Space

The previous procedure applies to ISO images. It does not apply to `partition images`, although there will be a similar error in the Ironic logs. However the resolution is different. An option must be added to the `PXE` line in the `main.yml` file to increase the `/tmp` disk size with the following workaround:

1. Edit `/openstack/ardana/ansible/roles/ironic-common/defaults/main.yml`.

2. Add `suse.tmpsize=4G` to `pxe_append_params`. Adjust the size of `suse.tmpsize` as needed for the partition image.

```
pxe_append_params : "nofb nomodeset vga=normal elevator=deadline
                     security=apparmor crashkernel=256M console=tty0
                     console=ttyS0 suse.tmpsize=4G"
```

3. Update Git and run playbooks:

```
ardana > git add -A
ardana > git commit -m "Add suse.tmpsize variable"
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
ardana > cd /var/lib/ardana/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
```

4. Re-deploy the Ironic node.

17.7 Node Cleaning

Cleaning is the process by which data is removed after a previous tenant has used the node. Cleaning requires use of ironic's agent_ drivers. It is extremely important to note that if the pxe_ drivers are utilized, no node cleaning operations will occur, and a previous tenant's data could be found on the node. The same risk of a previous tenant's data possibly can occur if cleaning is explicitly disabled as part of the installation.

By default, cleaning attempts to utilize ATA secure erase to wipe the contents of the disk. If secure erase is unavailable, the cleaning functionality built into the Ironic Python Agent falls back to an operation referred to as "shred" where random data is written over the contents of the disk, and then followed up by writing "0"s across the disk. This can be a time-consuming process.

An additional feature of cleaning is the ability to update firmware or potentially assert new hardware configuration, however, this is an advanced feature that must be built into the Ironic Python Agent image. Due to the complex nature of such operations, and the fact that no one size fits all, this requires a custom Ironic Python Agent image to be constructed with an appropriate hardware manager. For more information on hardware managers, see http://docs.openstack.org/developer/ironic-python-agent/#hardware-managers

Ironic's upstream documentation for cleaning may be found here: http://docs.openstack.org/developer/ironic/deploy/cleaning.html

17.7.1 Setup

Cleaning is enabled by default in ironic when installed via the Cloud Lifecycle Manager. You can verify this by examining the ironic-conductor.conf file. Look for:

```
[conductor]
clean_nodes=true
```

17.7.2 In use

When enabled, cleaning will be run automatically when nodes go from active to available state or from manageable to available. To monitor what step of cleaning the node is in, run `ironic node-show`:

```
stack@ardana-cp1-c1-m1-mgmt:~$ ironic node-show 4e6d4273-2535-4830-a826-7f67e71783ed
+------------------------+-------------------------------------------------------------------------
+
| Property               | Value
 |
+------------------------+-------------------------------------------------------------------------
+
| target_power_state     | None
 |
| extra                  | {}
 |
| last_error             | None
 |
```

```
| updated_at             | 2016-04-15T09:33:16+00:00
 |
| maintenance_reason     | None
 |
| provision_state        | cleaning
 |
| clean_step             | {}
 |
| uuid                   | 4e6d4273-2535-4830-a826-7f67e71783ed
 |
| console_enabled        | False
 |
| target_provision_state | available
 |
| provision_updated_at   | 2016-04-15T09:33:16+00:00
 |
| maintenance            | False
 |
| inspection_started_at  | None
 |
| inspection_finished_at | None
 |
| power_state            | power off
 |
| driver                 | agent_ilo
 |
| reservation            | ardana-cp1-c1-m1-mgmt
 |
| properties             | {u'memory_mb': 4096, u'cpu_arch': u'amd64', u'local_gb': 80,
 |
|                        | u'cpus': 2, u'capabilities': u'boot_mode:uefi,boot_option:local'}
 |
| instance_uuid          | None
 |
| name                   | None
 |
| driver_info            | {u'ilo_deploy_iso': u'249bf095-e741-441d-bc28-0f44a9b8cd80',
 |
|                        | u'ipmi_username': u'Administrator', u'deploy_kernel':
 |
|                        | u'3a78c0a9-3d8d-4764-9300-3e9c00e167a1', u'ilo_address':
 |
|                        | u'10.1.196.113', u'ipmi_address': u'10.1.196.113', u'deploy_ramdisk':
 |
|                        | u'd02c811c-e521-4926-9f26-0c88bbd2ee6d', u'ipmi_password': u'******',
 |
|                        | u'ilo_password': u'******', u'ilo_username': u'Administrator'}
 |
| created_at             | 2016-04-14T08:30:08+00:00
 |
| driver_internal_info   | {u'clean_steps': None,                      |
```

```
|                       | u'hardware_manager_version': {u'generic_hardware_manager': u'1.0'},
 |
|                       | u'is_whole_disk_image': True, u'agent_erase_devices_iterations': 1,
 |
|                       | u'agent_url': u'http://192.168.246.245:9999',
 |
|                       | u'agent_last_heartbeat': 1460633166}
 |
| chassis_uuid          |
 |
| instance_info         | {}
 |
+-----------------------+--------------------------------------------------------------------
+
```

The status will be in the `driver_internal_info` field. You will also be able to see the `clean_steps` list there.

17.7.3 Troubleshooting

If an error occurs during the cleaning process, the node will enter the clean failed state so that it is not deployed. The node remains powered on for debugging purposes. The node can be moved to the manageable state to attempt a fix using the following command:

```
ironic node-set-provision-state <node id> manage
```

Once you have identified and fixed the issue, you can return the node to available state by executing the following commands:

```
ironic node-set-maintenance <node id> false
ironic node-set-provision-state <node id> provide
```

This will retry the cleaning steps and set the node to available state upon their successful completion.

17.7.4 Disabling Node Cleaning

To disable node cleaning, edit `~/openstack/my_cloud/definition/data/ironic/ironic_config.yml` and set `enable_node_cleaning` to `false`.

Commit your changes:

```
cd ~/openstack/ardana/ansible
```

```
git add -A
git commit -m "disable node cleaning"
```

Deploy these changes by re-running the configuration processor and reconfigure the ironic installation:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml
ansible-playbook -i hosts/localhost ready-deployment.yml
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
```

17.8 Ironic and HPE OneView

17.8.1 Enabling Ironic HPE OneView driver in SUSE OpenStack Cloud

Edit the file `~/openstack/my_cloud/definition/data/ironic/ironicconfig.yml` and set the value

```
enable_oneview: true
```

This will enable the HPE OneView driver for Ironic in SUSE OpenStack Cloud.

17.8.2 Adding HPE OneView Appliance Credentials

```
manage_url: https://<Onview appliance URL>

oneview_username: "<Appliance username>"

oneview_encrypted_password: "<Encrypted password>"

oneview_allow_insecure_connections: <true/false>

tls_cacert_file: <CA certificate for connection>
```

17.8.3 Encrypting the HPE OneView Password

Encryption can be applied using `ardanaencrypt.py` or using `openssl`. On the Cloud Lifecycle Manager node, export the key used for encryption as environment variable:

```
export ARDANA_USER_PASSWORD_ENCRYPT_KEY="ENCRYPTION_KEY"
```

And then execute the following commands:

```
cd ~/openstack/ardana/ansible
python ardanaencrypt.py
```

Enter password to be encrypted when prompted. The script uses the key that was exported in the `ARDANA_USER_PASSWORD_ENCRYPT_KEY` to do the encryption.

For more information, see *Book "Security Guide", Chapter 9 "Encryption of Passwords and Sensitive Data"*.

17.8.4 Decrypting the HPE OneView Password

Before running the `site.yml` playbook, export the key used for encryption as environment variable:

```
export ARDANA_USER_PASSWORD_ENCRYPT_KEY="ENCRYPTION_KEY"
```

The decryption of the password is then automatically handled in ironic-ansible playbooks.

17.8.5 Registering Baremetal Node for HPE OneView Driver

```
ironic node-create -d agent_pxe_oneview
```

Update node driver-info:

```
 ironic node-update $NODE_UUID add driver_info/server_hardware_uri=$SH_URI
```

17.8.6 Updating Node Properties

```
ironic node-update $NODE_UUID add \
```

```
properties/capabilities=server_hardware_type_uri:$SHT_URI,\
      enclosure_group_uri:$EG_URI,server_profile_template_uri=$SPT_URI
```

17.8.7 Creating Port for Driver

```
ironic port-create -n $NODE_UUID -a $MAC_ADDRESS
```

17.8.8 Creating a Node

Create Node:

```
ironic node-create -n ovbay7 -d agent_pxe_oneview
```

Update driver info:

```
ironic node-update $ID add driver_info/server_hardware_uri="/rest/
server-hardware/3037...464B" \
driver_info/deploy_kernel="$KERNELDISK" driver_info/
deploy_ramdisk="$RAMDISK"
```

Update node properties:

```
ironic node-update $ID add properties/local_gb=10
ironic node-update $ID add properties/cpus=24 properties/memory_mb=262144 \
properties/cpu_arch=x86_64
```

```
ironic node-update \
$ID add properties/capabilities=server_hardware_type_uri:'/rest/server-hardware-types/B31...F69E',\
enclosure_group_uri:'/rest/enclosure-groups/80efe...b79fa',\
server_profile_template_uri:'/rest/server-profile-templates/faafc3c0-6c81-47ca-a407-f67d11262da5'
```

17.8.9 Getting Data using REST API

GET login session auth id:

```
curl -k https://ONEVIEW_MANAGER_URL/rest/login-sessions \
  -H "content-type:application/json" \
  -X POST \
  -d '{"userName":"USER_NAME", "password":"PASSWORD"}'
```

Get the complete node details in JSON format:

```
curl -k "https://ONEVIEW_MANAGER_URL;/rest/server-
hardware/30373237-3132-4753-4835-32325652464B" -H "content-type:application/json" -H
 "Auth:<auth_session_id>"| python -m json.tool
```

17.8.10 Ironic HPE OneView CLI

`ironic-oneview-cli` is already installed in `ironicclient` venv with a symbolic link to it. To generate an `rc` file for the HPE OneView CLI, follow these steps:

1. Run the following commands:

   ```
   source ~/service.osrc
   glance image list
   ```

2. Note the `deploy-kernel` and `deploy-ramdisk` UUID and then run the following command to generate the `rc` file:

   ```
   ironic-oneview genrc
   ```

   You will be prompted to enter:

   - HPE OneView Manager URL
   - Username
   - deploy-kernel
   - deploy-ramdisk
   - allow_insecure_connection
   - cacert file

   The `ironic-oneview.rc` file will be generated in the current directory, by default. It is possible to specify a different location.

3. Source the generated file:

   ```
   source ironic-oneview.rc
   ```

   Now enter the password of the HPE OneView appliance.

4. You can now use the CLI for node and flavor creation as follows:

```
ironic-oneview node-create
ironic-oneview flavor-create
```

17.9 RAID Configuration for Ironic

1. Node Creation:

   Check the raid capabilities of the driver:

   ```
   ironic --ironic-api-version 1.15 driver-raid-logical-disk-properties pxe_ilo
   ```

   This will generate output similar to the following:

   ```
   +----------------------+-------------------------------------------------------------------------+
   | Property             | Description                                                             |
   +----------------------+-------------------------------------------------------------------------+
   | controller           | Controller to use for this logical disk. If not specified, the          |
   |                      | driver will choose a suitable RAID controller on the bare metal node.   |
   |                      | Optional.                                                               |
   | disk_type            | The type of disk preferred. Valid values are 'hdd' and 'ssd'. If this   |
   |                      | is not specified, disk type will not be a selection criterion for       |
   |                      | choosing backing physical disks. Optional.                              |
   | interface_type       | The interface type of disk. Valid values are 'sata', 'scsi' and 'sas'.  |
   |                      | If this is not specified, interface type will not be a selection        |
   |                      | criterion for choosing backing physical disks. Optional.                |
   | is_root_volume       | Specifies whether this disk is a root volume. By default, this is False.|
   |                      | Optional.                                                               |
   | #_of_physical_disks  | Number of physical disks to use for this logical disk. By default, the  |
   |                      | driver uses the minimum number of disks required for that RAID level.   |
   |                      | Optional.                                                               |
   | physical_disks       | The physical disks to use for this logical disk. If not specified, the  |
   |                      | driver will choose suitable physical disks to use. Optional.            |
   | raid_level           | RAID level for the logical disk. Valid values are '0', '1', '2', '5',   |
   |                      | '6', '1+0', '5+0' and '6+0'. Required.                                  |
   | share_physical_disks | Specifies whether other logical disks can share physical disks with this|
   |                      | logical disk. By default, this is False. Optional.                      |
   | size_gb              | Size in GiB (Integer) for the logical disk. Use 'MAX' as size_gb if     |
   |                      | this logical disk is supposed to use the rest of                        |
   |                      | the space available. Required.                                          |
   | volume_name          | Name of the volume to be created. If this is not specified, it will be  |
   |                      | auto-generated. Optional.                                               |
   +----------------------+-------------------------------------------------------------------------+
   ```

   Node State will be **Available**

   ```
   ironic node-create -d pxe_ilo -i ilo_address=<ip_address> \
     -i ilo_username=<username> -i ilo_password=<password> \
   ```

```
  -i ilo_deploy_iso=<iso_id> -i deploy_kernel=<kernel_id> \
  -i deploy_ramdisk=<ramdisk_id> -p cpus=2 -p memory_mb=4096 \
  -p local_gb=80  -p cpu_arch=amd64 \
  -p capabilities="boot_option:local,boot_mode:bios"
```

```
ironic port-create -a <port> -n <node-uuid>
```

2. Apply the target raid configuration on the node:
   See the OpenStack documentation for RAID configuration at http://docs.openstack.org/developer/ironic/deploy/raid.html.
   Set the target RAID configuration by editing the file `raid_conf.json` and setting the appropriate values, for example:

```
{ "logical_disks": [ {"size_gb": 5, "raid_level": "0", "is_root_volume": true} ] }
```

   and then run the following command:

```
ironic --ironic-api-version 1.15 node-set-target-raid-config <node-uuid>
 raid_conf.json
```

   The output produced should be similar to the following:

```
+-----------------------+-------------------------------------------------------------------------
+
| Property              | Value
 |
+-----------------------+-------------------------------------------------------------------------
+
| chassis_uuid          |
 |
| clean_step            | {}
 |
| console_enabled       | False
 |
| created_at            | 2016-06-14T14:58:07+00:00
 |
| driver                | pxe_ilo
 |
| driver_info           | {u'ilo_deploy_iso': u'd43e589a-07db-4fce-a06e-98e2f38340b4',
 |
|                       | u'deploy_kernel': u'915c5c74-1ceb-4f78-bdb4-8547a90ac9c0',
 |
|                       | u'ilo_address': u'10.1.196.116', u'deploy_ramdisk':
 |
|                       | u'154e7024-bf18-4ad2-95b0-726c09ce417a', u'ilo_password': u'******',
 |
|                       | u'ilo_username': u'Administrator'}
 |
```

```
| driver_internal_info  | {u'agent_cached_clean_steps_refreshed': u'2016-06-15 07:16:08.264091',
 |
|                       | u'agent_cached_clean_steps': {u'raid': [{u'interface': u'raid',
 |
|                       | u'priority': 0, u'step': u'delete_configuration'}, {u'interface':
 |
|                       | u'raid', u'priority': 0, u'step': u'create_configuration'}], u'deploy':
 |
|                       | [{u'priority': 10, u'interface': u'deploy', u'reboot_requested': False,
 |
|                       | u'abortable': True, u'step': u'erase_devices'}]}, u'clean_steps': None,
 |
|                       | u'hardware_manager_version': {u'generic_hardware_manager': u'3'},
 |
|                       | u'agent_erase_devices_iterations': 1, u'agent_url':
 |
|                       | u'http://192.168.245.143:9999', u'agent_last_heartbeat': 1465974974}
 |
| extra                 | {}
 |
| inspection_finished_at| None
 |
| inspection_started_at | None
 |
| instance_info         | {u'deploy_key': u'XXN2ON0V9ER429MECETJMUG5YHTKOQOZ'}
 |
| instance_uuid         | None
 |
| last_error            | None
 |
| maintenance           | False
 |
| maintenance_reason    | None
 |
| name                  | None
 |
| power_state           | power off
 |
| properties            | {u'cpu_arch': u'amd64', u'root_device': {u'wwn':
u'0x600508b1001ce286'},|
|                       | u'cpus': 2, u'capabilities':
 |
|                       | u'boot_mode:bios,raid_level:6,boot_option:local', u'memory_mb': 4096,
 |
|                       | u'local_gb': 4}
 |
| provision_state       | available
 |
| provision_updated_at  | 2016-06-15T07:16:27+00:00
 |
| reservation           | padawan-ironic-cp1-c1-m2-mgmt
 |
| target_power_state    | power off
 |
```

```
| target_provision_state| None
 |
| target_raid_config    | {u'logical_disks': [{u'size_gb': 5, u'raid_level': u'6',
 |
|                       | u'is_root_volume': True}]}
 |
| updated_at            | 2016-06-15T07:44:22+00:00
 |
| uuid                  | 22ab9f85-71a1-4748-8d6b-f6411558127e
 |
+-----------------------+-------------------------------------------------------------------
+
```

Now set the state of the node to **manageable**:

```
ironic --ironic-api-version latest node-set-provision-state <node-uuid> manage
```

3. Manual cleaning steps:
   Manual cleaning is enabled by default in production - the following are the steps to enable cleaning if the manual cleaning has been disabled.

   a. Provide `cleaning_network_uuid` in `ironic-conductor.conf`

   b. Edit the file `~/openstack/my_cloud/definition/data/ironic/ironic_config.yml` and set `enable_node_cleaning` to `true`.

   c. Then run the following set of commands:

   ```
   cd ~/openstack/ardana/ansible
   git add -A
   git commit -m "enabling node cleaning"
   cd ~/openstack/ardana/ansible
   ansible-playbook -i hosts/localhost config-processor-run.yml
   ansible-playbook -i hosts/localhost ready-deployment.yml
   cd ~/scratch/ansible/next/ardana/ansible
   ansible-playbook -i hosts/verb_hosts ironic-reconfigure.yml
   ```

   After performing these steps, the state of the node will become **Cleaning**.

   Run the following command:

   ```
   ironic --ironic-api-version latest node-set-provision-state 2123254e-8b31...aa6fd \
     clean --clean-steps '[{ "interface": "raid","step": "delete_configuration"}, \
     { "interface": "raid" ,"step": "create_configuration"}]'
   ```

Node-information after a Manual cleaning:

```
+-----------------------+-----------------------------------------------------------------------
+
| Property              | Value
 |
+-----------------------+-----------------------------------------------------------------------
+
| chassis_uuid          |
 |
| clean_step            | {}
 |
| console_enabled       | False
 |
| created_at            | 2016-06-14T14:58:07+00:00
 |
| driver                | pxe_ilo
 |
| driver_info           | {u'ilo_deploy_iso': u'd43e589a-07db-4fce-a06e-98e2f38340b4',
 |
|                       | u'deploy_kernel': u'915c5c74-1ceb-4f78-bdb4-8547a90ac9c0',
 |
|                       | u'ilo_address': u'10.1.196.116', u'deploy_ramdisk':
 |
|                       | u'154e7024-bf18-4ad2-95b0-726c09ce417a', u'ilo_password': u'******',
 |
|                       | u'ilo_username': u'Administrator'}
 |
| driver_internal_info  | {u'agent_cached_clean_steps_refreshed': u'2016-06-15 07:16:08.264091',
 |
|                       | u'agent_cached_clean_steps': {u'raid': [{u'interface': u'raid',
 |
|                       | u'priority': 0, u'step': u'delete_configuration'}, {u'interface':
 |
|                       | u'raid', u'priority': 0, u'step': u'create_configuration'}], u'deploy':
 |
|                       | [{u'priority': 10, u'interface': u'deploy', u'reboot_requested': False,
 |
|                       | u'abortable': True, u'step': u'erase_devices'}]}, u'clean_steps': None,
 |
|                       | u'hardware_manager_version': {u'generic_hardware_manager': u'3'},
 |
|                       | u'agent_erase_devices_iterations': 1, u'agent_url':
 |
|                       | u'http://192.168.245.143:9999', u'agent_last_heartbeat': 1465974974}
 |
| extra                 | {}
 |
| inspection_finished_at| None
 |
| inspection_started_at | None
 |
| instance_info         | {u'deploy_key': u'XXN2ON0V9ER429MECETJMUG5YHTKOQOZ'}
 |
```

```
| instance_uuid         | None
 |
| last_error            | None
 |
| maintenance           | False
 |
| maintenance_reason    | None
 |
| name                  | None
 |
| power_state           | power off
 |
| properties            | {u'cpu_arch': u'amd64', u'root_device': {u'wwn':
 u'0x600508b1001ce286'},|
|                       | u'cpus': 2, u'capabilities':
 |
|                       | u'boot_mode:bios,raid_level:6,boot_option:local', u'memory_mb': 4096,
 |
|                       | u'local_gb': 4}
 |
| provision_state       | manageable
 |
| provision_updated_at  | 2016-06-15T07:16:27+00:00
 |
| raid_config           | {u'last_updated': u'2016-06-15 07:16:14.584014', u'physical_disks':
 |
|                       | [{u'status': u'ready', u'size_gb': 1024, u'interface_type': u'sata',
 |
|                       | u'firmware': u'HPGC', u'controller': u'Smart Array P440ar in Slot 0
 |
|                       | (Embedded)', u'model': u'ATA     MM1000GBKAL', u'disk_type': u'hdd',
 |
|                       | u'id': u'1I:3:3'}, {u'status': u'ready', u'size_gb': 1024,
 |
|                       | u'interface_type': u'sata', u'firmware': u'HPGC', u'controller':
 u'Smart|
|                       | Array P440ar in Slot 0 (Embedded)', u'model': u'ATA     MM1000GBKAL',
 |
|                       | u'disk_type': u'hdd', u'id': u'1I:3:1'}, {u'status': u'active',
 |
|                       | u'size_gb': 1024, u'interface_type': u'sata', u'firmware': u'HPGC',
 |
|                       | u'controller': u'Smart Array P440ar in Slot 0 (Embedded)', u'model':
 |
|                       | u'ATA     MM1000GBKAL', u'disk_type': u'hdd', u'id': u'1I:3:2'},
 |
|                       | {u'status': u'active', u'size_gb': 1024, u'interface_type': u'sata',
 |
|                       | u'firmware': u'HPGC', u'controller': u'Smart Array P440ar in Slot 0
 |
|                       | (Embedded)', u'model': u'ATA     MM1000GBKAL', u'disk_type': u'hdd',
 |
|                       | u'id': u'2I:3:6'}, {u'status': u'active', u'size_gb': 1024,
 |
```

```
|                       | u'interface_type': u'sata', u'firmware': u'HPGC', u'controller':
 u'Smart|
|                       | Array P440ar in Slot 0 (Embedded)', u'model': u'ATA     MM1000GBKAL',
 |
|                       | u'disk_type': u'hdd', u'id': u'2I:3:5'}, {u'status': u'active',
 |
|                       | u'size_gb': 1024, u'interface_type': u'sata', u'firmware': u'HPGC',
 |
|                       | u'controller': u'Smart Array P440ar in Slot 0 (Embedded)', u'model':
 |
|                       | u'ATA     MM1000GBKAL', u'disk_type': u'hdd', u'id': u'1I:3:4'}],
 |
|                       | u'logical_disks': [{u'size_gb': 4, u'physical_disks': [u'1I:3:2',
 |
|                       | u'2I:3:6', u'2I:3:5', u'1I:3:4'], u'raid_level': u'6',
 |
|                       | u'is_root_volume': True, u'root_device_hint': {u'wwn':
 |
|                       | u'0x600508b1001ce286'}, u'controller': u'Smart Array P440ar in Slot 0
 |
|                       | (Embedded)', u'volume_name': u'015E795CPDNLH0BRH8N406AAB7'}]}
 |
| reservation           | padawan-ironic-cp1-c1-m2-mgmt
 |
| target_power_state    | power off
 |
| target_provision_state| None
 |
| target_raid_config    | {u'logical_disks': [{u'size_gb': 5, u'raid_level': u'6',
 |
|                       | u'is_root_volume': True}]}
 |
| updated_at            | 2016-06-15T07:44:22+00:00
 |
| uuid                  | 22ab9f85-71a1-4748-8d6b-f6411558127e
 |
+-----------------------+-----------------------------------------------------------------------
+
```

After the manual cleaning, run the following command to change the state of a node to **available**:

```
ironic --ironic-api-version latest node-set-provision-state <node-uuid> \
  provide
```

17.10 Audit Support for Ironic

17.10.1 API Audit Logging

Audit middleware supports delivery of CADF audit events via Oslo messaging notifier capability. Based on `notification_driver` configuration, audit events can be routed to messaging infrastructure (`notification_driver = messagingv2`) or can be routed to a log file (`notification_driver = log`).

Audit middleware creates two events per REST API interaction. The first event has information extracted from request data and the second one contains information on the request outcome (response).

17.10.2 Enabling API Audit Logging

You can enable audit logging for Ironic by changing the configuration in the input model. Edit the file `~/openstack/my_cloud/definition/cloudConfig.yml` and in the `audit-settings` section, change the `default` value to `enabled`. The ironic-ansible playbooks will now enable audit support for Ironic.

API audit events will be logged in the corresponding audit directory, for example, `/var/audit/ironic/ironic-api-audit.log`. An audit event will be logged in the log file for every request and response for an API call.

17.10.3 Sample Audit Event

The following output is an example of an audit event for an `ironic node-list` command:

```
{
   "event_type":"audit.http.request",
   "timestamp":"2016-06-15 06:04:30.904397",
   "payload":{
      "typeURI":"http://schemas.dmtf.org/cloud/audit/1.0/event",
      "eventTime":"2016-06-15T06:04:30.903071+0000",
      "target":{
         "id":"ironic",
         "typeURI":"unknown",
         "addresses":[
            {
```

```
               "url":"http://{ironic_admin_host}:6385",
               "name":"admin"
            },
           {
               "url":"http://{ironic_internal_host}:6385",
               "name":"private"
           },
           {
               "url":"http://{ironic_public_host}:6385",
               "name":"public"
           }
         ],
         "name":"ironic"
      },
      "observer":{
         "id":"target"
      },
      "tags":[
         "correlation_id?value=685f1abb-620e-5d5d-b74a-b4135fb32373"
      ],
      "eventType":"activity",
      "initiator":{
         "typeURI":"service/security/account/user",
         "name":"admin",
         "credential":{
            "token":"***",
            "identity_status":"Confirmed"
         },
         "host":{
            "agent":"python-ironicclient",
            "address":"10.1.200.129"
         },
         "project_id":"d8f52dd7d9e1475dbbf3ba47a4a83313",
         "id":"8c1a948bad3948929aa5d5b50627a174"
      },
      "action":"read",
      "outcome":"pending",
      "id":"061b7aa7-5879-5225-a331-c002cf23cb6c",
      "requestPath":"/v1/nodes/?associated=True"
   },
   "priority":"INFO",
   "publisher_id":"ironic-api",
   "message_id":"2f61ebaa-2d3e-4023-afba-f9fca6f21fc2"
}
```

18 Installation for SUSE OpenStack Cloud Entry-scale Cloud with Swift Only

This page describes the installation step requirements for the SUSE OpenStack Cloud Entry-scale Cloud with Swift Only model.

18.1 Important Notes

- For information about when to use the GUI installer and when to use the command line (CLI), see *Chapter 1, Overview*.
- Review the *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 2 "Hardware and Software Support Matrix"* that we have listed.
- Review the release notes to make yourself aware of any known issues and limitations.
- The installation process can occur in different phases. For example, you can install the control plane only and then add Compute nodes afterwards if you would like.
- If you run into issues during installation, we have put together a list of *Chapter 23, Troubleshooting the Installation* you can reference.
- Make sure all disks on the system(s) are wiped before you begin the install. (For Swift, refer to *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 11 "Modifying Example Configurations for Object Storage using Swift", Section 11.6 "Swift Requirements for Device Group Drives"*.)
- There is no requirement to have a dedicated network for OS-install and system deployment, this can be shared with the management network. More information can be found in *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations"*.
- The terms deployer and Cloud Lifecycle Manager are used interchangeably. They refer to the same nodes in your cloud environment.
- When running the Ansible playbook in this installation guide, if a runbook fails you will see in the error response to use the `--limit` switch when retrying a playbook. This should be avoided. You can simply re-run any playbook without this switch.
- DVR is not supported with ESX compute.

- When you attach a Cinder volume to the VM running on the ESXi host, the volume will not get detected automatically. Make sure to set the image metadata **vmware_adapter-type=lsiLogicsas** for image before launching the instance. This will help to discover the volume change appropriately.
- The installation process will create several OpenStack roles. Not all roles will be relevant for a cloud with Swift only, but they will not cause problems.

18.2 Before You Start

1. Review the *Chapter 2, Pre-Installation Checklist* about recommended pre-installation tasks.
2. Prepare the Cloud Lifecycle Manager node. The Cloud Lifecycle Manager must be accessible either directly or via `ssh`, and have SUSE Linux Enterprise Server 12 SP3 installed. All nodes must be accessible to the Cloud Lifecycle Manager. If the nodes do not have direct access to online Cloud subscription channels, the Cloud Lifecycle Manager node will need to host the Cloud repositories.

   a. If you followed the installation instructions for Cloud Lifecycle Manager server (see *Chapter 3, Installing the Cloud Lifecycle Manager server*), SUSE OpenStack Cloud software should already be installed. Double-check whether SUSE Linux Enterprise and SUSE OpenStack Cloud are properly registered at the SUSE Customer Center by starting YaST and running *Software* › *Product Registration*.
   If you have not yet installed SUSE OpenStack Cloud, do so by starting YaST and running *Software* › *Product Registration* › *Select Extensions*. Choose *SUSE OpenStack Cloud* and follow the on-screen instructions. Make sure to register SUSE OpenStack Cloud during the installation process and to install the software pattern `patterns-cloud-ardana`.

   ```
   tux > sudo zypper -n in patterns-cloud-ardana
   ```

   b. Ensure the SUSE OpenStack Cloud media repositories and updates repositories are made available to all nodes in your deployment. This can be accomplished either by configuring the Cloud Lifecycle Manager server as an SMT mirror as described in *Chapter 4, Installing and Setting Up an SMT Server on the Cloud Lifecycle Manager server (Optional)* or by syncing or mounting the Cloud and updates repositories to the Cloud Lifecycle Manager server as described in *Chapter 5, Software Repository Setup*.

c. Configure passwordless **`sudo`** for the user created when setting up the node (as described in *Section 3.4, "Creating a User"*). Note that this is *not* the user `ardana` that will be used later in this procedure. In the following we assume you named the user `cloud`. Run the command **`visudo`** as user `root` and add the following line to the end of the file:

```
CLOUD ALL = (root) NOPASSWD:ALL
```

Make sure to replace `CLOUD` with your user name choice.

d. Set the password for the user `ardana`:

```
tux > sudo passwd ardana
```

e. Become the user `ardana`:

```
tux > su - ardana
```

f. Place a copy of the SUSE Linux Enterprise Server 12 SP3 `.iso` in the `ardana` home directory, `var/lib/ardana`, and rename it to `sles12sp3.iso`.

g. Install the templates, examples, and working model directories:

```
ardana > /usr/bin/ardana-init
```

18.3 Setting Up the Cloud Lifecycle Manager

18.3.1 Installing the Cloud Lifecycle Manager

Running the **`ARDANA_INIT_AUTO=1`** command is optional to avoid stopping for authentication at any step. You can also run **`ardana-init`** to launch the Cloud Lifecycle Manager. You will be prompted to enter an optional SSH passphrase, which is used to protect the key used by Ansible when connecting to its client nodes. If you do not want to use a passphrase, press **Enter** at the prompt.

If you have protected the SSH key with a passphrase, you can avoid having to enter the passphrase on every attempt by Ansible to connect to its client nodes with the following commands:

```
ardana > eval $(ssh-agent)
ardana > ssh-add ~/.ssh/id_rsa
```

The Cloud Lifecycle Manager will contain the installation scripts and configuration files to deploy your cloud. You can set up the Cloud Lifecycle Manager on a dedicated node or you do so on your first controller node. The default choice is to use the first controller node as the Cloud Lifecycle Manager.

1. Download the product from:
   - SUSE Customer Center (https://scc.suse.com/)
2. Boot your Cloud Lifecycle Manager from the SLES ISO contained in the download.
3. Enter `install` (all lower-case, exactly as spelled out here) to start installation.
4. Select the language. Note that only the English language selection is currently supported.
5. Select the location.
6. Select the keyboard layout.
7. Select the primary network interface, if prompted:
   - Assign IP address, subnet mask, and default gateway
8. Create new account:
   a. Enter a username.
   b. Enter a password.
   c. Enter time zone.

Once the initial installation is finished, complete the Cloud Lifecycle Manager setup with these steps:

1. Ensure your Cloud Lifecycle Manager has a valid DNS nameserver specified in `/etc/resolv.conf`.

2. Set the environment variable LC_ALL:

```
export LC_ALL=C
```

> **Note**
>
> This can be added to `~/.bashrc` or `/etc/bash.bashrc`.

The node should now have a working SLES setup.

18.4 Configure Your Environment

This part of the install is going to depend on the specific cloud configuration you are going to use.

Setup your configuration files, as follows:

1. See the sample sets of configuration files in the `~/openstack/examples/` directory. Each set will have an accompanying README.md file that explains the contents of each of the configuration files.

2. Copy the example configuration files into the required setup directory and edit them to contain the details of your environment:

```
cp -r ~/openstack/examples/entry-scale-swift/* \
  ~/openstack/my_cloud/definition/
```

3. Begin inputting your environment information into the configuration files in the `~/openstack/my_cloud/definition` directory.

Full details of how to do this can be found here: *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 11 "Modifying Example Configurations for Object Storage using Swift", Section 11.10 "Understanding Swift Ring Specifications", Section 11.10.1 "Ring Specifications in the Input Model"*.

In many cases, the example models provide most of the data you need to create a valid input model. However, there are two important aspects you must plan and configure before starting a deploy as follows:

- Check the disk model used by your nodes. Specifically, check that all disk drives are correctly named and used as described in *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 11 "Modifying Example Configurations for Object Storage using Swift", Section 11.6 "Swift Requirements for Device Group Drives"*.
- Select an appropriate partition power for your rings. Detailed information about this is provided at *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 11 "Modifying Example Configurations for Object Storage using Swift", Section 11.10 "Understanding Swift Ring Specifications"*.

Optionally, you can use the `ardanaencrypt.py` script to encrypt your IPMI passwords. This script uses OpenSSL.

1. Change to the Ansible directory:

```
cd ~/openstack/ardana/ansible
```

2. Put the encryption key into the following environment variable:

```
export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>
```

3. Run the python script below and follow the instructions. Enter a password that you want to encrypt.

```
ardanaencrypt.py
```

4. Take the string generated and place it in the `"ilo_password"` field in your `~/openstack/my_cloud/definition/data/servers.yml` file, remembering to enclose it in quotes.
5. Repeat the above for each server.

Note

Before you run any playbooks, remember that you need to export the encryption key in the following environment variable: `export ARDANA_USER_PASSWORD_ENCRYPT_KEY=<encryption key>`

Commit your configuration to the local git repo (*Chapter 10, Using Git for Configuration Management*), as follows:

```
cd ~/openstack/ardana/ansible
git add -A
git commit -m "My config or other commit message"
```

Important

This step needs to be repeated any time you make changes to your configuration files before you move onto the following steps. See *Chapter 10, Using Git for Configuration Management* for more information.

18.5 Provisioning Your Baremetal Nodes

To provision the baremetal nodes in your cloud deployment you can either use the automated operating system installation process provided by SUSE OpenStack Cloud or you can use the 3rd party installation tooling of your choice. We will outline both methods below:

18.5.1 Using Third Party Baremetal Installers

If you do not wish to use the automated operating system installation tooling included with SUSE OpenStack Cloud then the requirements that have to be met using the installation tooling of your choice are:

- The operating system must be installed via the SLES ISO provided on the SUSE Customer Center (https://scc.suse.com/).
- Each node must have SSH keys in place that allows the same user from the Cloud Lifecycle Manager node who will be doing the deployment to SSH to each node without a password.
- Passwordless sudo needs to be enabled for the user.

- There should be a LVM logical volume as `/root` on each node.
- If the LVM volume group name for the volume group holding the `root` LVM logical volume is `ardana-vg`, then it will align with the disk input models in the examples.
- Ensure that `openssh-server`, `python`, `python-apt`, and `rsync` are installed.

If you chose this method for installing your baremetal hardware, skip forward to the step *Running the Configuration Processor*.

18.5.2 Using the Automated Operating System Installation Provided by SUSE OpenStack Cloud

If you would like to use the automated operating system installation tools provided by SUSE OpenStack Cloud, complete the steps below.

18.5.2.1 Deploying Cobbler

This phase of the install process takes the baremetal information that was provided in `servers.yml` and installs the Cobbler provisioning tool and loads this information into Cobbler. This sets each node to `netboot-enabled: true` in Cobbler. Each node will be automatically marked as `netboot-enabled: false` when it completes its operating system install successfully. Even if the node tries to PXE boot subsequently, Cobbler will not serve it. This is deliberate so that you cannot reimage a live node by accident.

The `cobbler-deploy.yml` playbook prompts for a password - this is the password that will be encrypted and stored in Cobbler, which is associated with the user running the command on the Cloud Lifecycle Manager, that you will use to log in to the nodes via their consoles after install. The username is the same as the user set up in the initial dialogue when installing the Cloud Lifecycle Manager from the ISO, and is the same user that is running the cobbler-deploy play.

Note

When imaging servers with your own tooling, it is still necessary to have ILO/IPMI settings for all nodes. Even if you are not using Cobbler, the username and password fields in `servers.yml` need to be filled in with dummy settings. For example, add the following to `servers.yml`:

```
ilo-user: manual
```

```
ilo-password: deployment
```

1. Run the following playbook which confirms that there is IPMI connectivity for each of your nodes so that they are accessible to be re-imaged in a later step:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost bm-power-status.yml
   ```

2. Run the following playbook to deploy Cobbler:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost cobbler-deploy.yml
   ```

18.5.2.2 Imaging the Nodes

This phase of the install process goes through a number of distinct steps:

1. Powers down the nodes to be installed
2. Sets the nodes hardware boot order so that the first option is a network boot.
3. Powers on the nodes. (The nodes will then boot from the network and be installed using infrastructure set up in the previous phase)
4. Waits for the nodes to power themselves down (this indicates a successful install). This can take some time.
5. Sets the boot order to hard disk and powers on the nodes.
6. Waits for the nodes to be reachable by SSH and verifies that they have the signature expected.

Deploying nodes has been automated in the Cloud Lifecycle Manager and requires the following:

- All of your nodes using SLES must already be installed, either manually or via Cobbler.
- Your input model should be configured for your SLES nodes, according to the instructions at *Book* “Planning an Installation with Cloud Lifecycle Manager”, *Chapter 10 “Modifying Example Configurations for Compute Nodes”, Section 10.1 “SLES Compute Nodes”*.
- You should have run the configuration processor and the `ready-deployment.yml` playbook.

Execute the following steps to re-image one or more nodes after you have run the `ready-deployment.yml` playbook.

1. Run the following playbook, specifying your SLES nodes using the nodelist. This playbook will reconfigure Cobbler for the nodes listed.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook prepare-sles-grub2.yml -e \
      nodelist=node1[,node2,node3]
```

2. Re-image the node(s) with the following command:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost bm-reimage.yml \
      -e nodelist=node1[,node2,node3]
```

If a nodelist is not specified then the set of nodes in Cobbler with `netboot-enabled: True` is selected. The playbook pauses at the start to give you a chance to review the set of nodes that it is targeting and to confirm that it is correct.

You can use the command below which will list all of your nodes with the `netboot-enabled: True` flag set:

```
sudo cobbler system find --netboot-enabled=1
```

18.6 Running the Configuration Processor

Once you have your configuration files setup, you need to run the configuration processor to complete your configuration.

When you run the configuration processor, you will be prompted for two passwords. Enter the first password to make the configuration processor encrypt its sensitive data, which consists of the random inter-service passwords that it generates and the ansible `group_vars` and `host_vars` that it produces for subsequent deploy runs. You will need this password for subsequent Ansible deploy and configuration processor runs. If you wish to change an encryption password that you have already used when running the configuration processor then enter the new password at the second prompt, otherwise just press **Enter** to bypass this.

Run the configuration processor with this command:

```
ardana > cd ~/openstack/ardana/ansible
```

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

For automated installation (for example CI), you can specify the required passwords on the ansible command line. For example, the command below will disable encryption by the configuration processor:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml \
  -e encrypt="" -e rekey=""
```

If you receive an error during this step, there is probably an issue with one or more of your configuration files. Verify that all information in each of your configuration files is correct for your environment. Then commit those changes to Git using the instructions in the previous section before re-running the configuration processor again.

For any troubleshooting information regarding these steps, see *Section 23.2, "Issues while Updating Configuration Files"*.

18.7 Deploying the Cloud

1. Use the playbook below to create a deployment directory:

   ```
   cd ~/openstack/ardana/ansible
   ansible-playbook -i hosts/localhost ready-deployment.yml
   ```

2. [OPTIONAL] - Run the `wipe_disks.yml` playbook to ensure all of your non-OS partitions on your nodes are completely wiped before continuing with the installation. The `wipe_disks.yml` playbook is only meant to be run on systems immediately after running `bm-reimage.yml`. If used for any other case, it may not wipe all of the expected partitions. If you are using fresh machines this step may not be necessary.

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible
   ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml
   ```

   If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

   ```
   ardana > ansible-playbook -i hosts/verb_hosts wipe_disks.yml --ask-vault-pass
   ```

3. Run the `site.yml` playbook below:

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible
   ardana > ansible-playbook -i hosts/verb_hosts site.yml
   ```

If you have used an encryption password when running the configuration processor use the command below and enter the encryption password when prompted:

```
ardana > ansible-playbook -i hosts/verb_hosts site.yml --ask-vault-pass
```

Note

The step above runs `osconfig` to configure the cloud and `ardana-deploy` to deploy the cloud. Therefore, this step may run for a while, perhaps 45 minutes or more, depending on the number of nodes in your environment.

4. Verify that the network is working correctly. Ping each IP in the `/etc/hosts` file from one of the controller nodes.

For any troubleshooting information regarding these steps, see *Section 23.3, "Issues while Deploying the Cloud"*.

Note

- HPE Smart Storage Administrator (HPE SSA) CLI component will have to be installed on all control nodes that are Swift nodes, in order to generate the following Swift metrics:
  - swiftlm.hp_hardware.hpssacli.smart_array
  - swiftlm.hp_hardware.hpssacli.logical_drive
  - swiftlm.hp_hardware.hpssacli.smart_array.firmware
  - swiftlm.hp_hardware.hpssacli.physical_drive
- HPE-specific binaries that are not based on open source are distributed directly from and supported by HPE. To download and install the SSACLI utility to enable management of disk controllers, please refer to: https://support.hpe.com/hpsc/swd/public/detail?swItemId=MTX_3d16386b418a443388c18da82f
- After the HPE SSA CLI component is installed on the Swift nodes, the metrics will be generated automatically during the next agent polling cycle. Manual reboot of the node is not required.

18.8 Post-Installation Verification and Administration

We recommend verifying the installation using the instructions in *Chapter 26, Cloud Verification*.

There are also a list of other common post-installation administrative tasks listed in the *Chapter 32, Other Common Post-Installation Tasks* list.

19 Installing SLES Compute

19.1 SLES Compute Node Installation Overview

SUSE OpenStack Cloud 8 supports SLES compute nodes, specifically SUSE Linux Enterprise Server 12 SP3. SUSE does not ship a SLES ISO with SUSE OpenStack Cloud so you will need to download a copy of the SLES ISO (`SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso`) and the SLES SDK ISO (`SLE-12-SP3-SDK-DVD-x86_64-GM-DVD1.iso`) from SUSE. You can use the following link to download the ISO. To do so, either log in or create a SUSE account before downloading: https://www.suse.com/products/server/download/ ↗.

There are two approaches for deploying SLES compute nodes in SUSE OpenStack Cloud:

- Using the Cloud Lifecycle Manager to automatically deploy SLES Compute Nodes.
- Provisioning SLES nodes yourself, either manually or using a third-party tool, and then providing the relevant information to the Cloud Lifecycle Manager.

These two approaches can be used whether you are installing a cloud for the first time or adding a compute node to an existing cloud. Regardless of your approach, you should be certain to register your SLES compute nodes in order to get product updates as they come available. For more information, see *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 1 "Registering SLES"*.

19.2 SLES Support

SUSE Linux Enterprise Server (SLES) Host OS KVM and/or supported SLES guests have been tested and qualified by SUSE to run on SUSE OpenStack Cloud.

19.3 Using the Cloud Lifecycle Manager to Deploy SLES Compute Nodes

The method used for deploying SLES compute nodes using Cobbler on the Cloud Lifecycle Manager uses legacy BIOS.

Note

UEFI and Secure boot are not supported on SLES Compute.

19.3.1 Deploying legacy BIOS SLES Compute nodes

The installation process for legacy BIOS SLES Compute nodes is similar to that described in *Chapter 12, Installing Mid-scale and Entry-scale KVM* with some additional requirements:

- The standard SLES ISO (SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso) must be accessible as `~/sles12sp3.iso`. Rename the ISO or create a symbolic link:

```
mv SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso ~/sles12sp3.iso
```

- You must identify the node(s) on which you want to install SLES, by adding the key/value pair `distro-id: sles12sp3-x86_64` to server details in `servers.yml`. If there are any network interface or disk layout differences in the new server compared to the servers already in the model, you may also need to update `net_interfaces.yml`, `server_roles.yml`, `disk_compute.yml` and `control_plane.yml`. For more information on configuration of the Input Model for SLES, see *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 10 "Modifying Example Configurations for Compute Nodes", Section 10.1 "SLES Compute Nodes"*.
- Run the playbook `config-processor-run.yml` to check for errors in the updated model.
- Run the `ready-deployment.yml` playbook to build the new `scratch` directory.
- Record the management network IP address that is used for the new server. It will be used in the installation process.

19.3.2 Deploying UEFI SLES compute nodes

Deploying UEFI nodes has been automated in the Cloud Lifecycle Manager and requires the following to be met:

- All of your nodes using SLES must already be installed, either manually or via Cobbler.
- Your input model should be configured for your SLES nodes, per the instructions at *Book "Planning an Installation with Cloud Lifecycle Manager", Chapter 10 "Modifying Example Configurations for Compute Nodes", Section 10.1 "SLES Compute Nodes"*.
- You should have run the configuration processor and the `ready-deployment.yml` playbook.

Execute the following steps to re-image one or more nodes after you have run the `ready-deployment.yml` playbook.

1. Run the following playbook, ensuring that you specify only your UEFI SLES nodes using the nodelist. This playbook will reconfigure Cobbler for the nodes listed.

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible
   ardana > ansible-playbook prepare-sles-grub2.yml -e nodelist=node1[,node2,node3]
   ```

2. Re-image the node(s), ensuring that you only specify your UEFI SLES nodes using the nodelist.

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost bm-reimage.yml \
   -e nodelist=node1[,node2,node3]
   ```

3. Back up the `grub.cfg-*` files in `/srv/tftpboot/` as they will be overwritten when running the cobbler-deploy playbook on the next step. You will need these files if you need to reimage the nodes in the future.

4. Run the `cobbler-deploy.yml` playbook, which will reset Cobbler back to the default values:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost cobbler-deploy.yml
   ```

19.3.2.1 UEFI Secure Boot

Secure Boot is a method used to restrict binary execution for booting the system. With this option enabled, system BIOS will only allow boot loaders with trusted cryptographic signatures to be executed, thus preventing malware from hiding embedded code in the boot chain. Each boot loader launched during the boot process is digitally signed and that signature is validated against a set of trusted certificates embedded in the UEFI BIOS. Secure Boot is completely implemented in the BIOS and does not require special hardware.

Thus Secure Boot is:

- Intended to prevent boot-sector malware or kernel code injection.
- Hardware-based code signing.
- Extension of the UEFI BIOS architecture.
- Optional with the ability to enable or disable it through the BIOS.

In Boot Options of RBSU, *Boot Mode* needs to be set to `UEFI Mode` and *UEFI Optimized Boot* should be `Enabled` >.

Secure Boot is enabled at *System Configuration* › *BIOS/Platform Configuration (RBSU)* › *Server Security* › *Secure Boot Configuration* › *Secure Boot Enforcement*.

19.4 Provisioning SLES Yourself

This section outlines the steps needed to manually provision a SLES node so that it can be added to a new or existing SUSE OpenStack Cloud 8 cloud.

19.4.1 Configure Cloud Lifecycle Manager to Enable SLES

1. Take note of the IP address of the Cloud Lifecycle Manager node. It will be used below during *Section 19.4.6, "Add zypper repository"*.
2. Mount or copy the contents of `SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso` to `/srv/www/suse-12.3/x86_64/repos/ardana/sles12/zypper/OS/`

Note

If you choose to mount an ISO, we recommend creating an `/etc/fstab` entry to ensure the ISO is mounted after a reboot.

19.4.2 Install SUSE Linux Enterprise Server 12 SP3

Install SUSE Linux Enterprise Server 12 SP3 using the standard iso (`SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso`)

1. Boot the SUSE Linux Enterprise Server 12 SP3 ISO.
2. Agree to the license
3. Edit the network settings, enter the the management network IP address recorded earlier. It is not necessary to enter a *Hostname/*. For product registration to work correctly, you must provide a DNS server. Enter the *Name Server* IP address and the *Default IPv4 Gateway*.
4. Additional `System Probing` will occur.
5. On the `Registration` page, you can skip registration if the database server does not have a external interface or if there is no SMT server on the MGMT LAN.
6. No `Add On Products` are needed.
7. For `System Role`, select *Default System*. Do not select *KVM Virtualization Host*.
8. Partitioning
    a. Select *Expert Partitioner* and *Rescan Devices* to clear *Proposed Settings*.
    b. Delete all `Volume Groups`.
    c. Under the root of the directory tree, delete `/dev/sda`.
    d. Delete any other partitions on any other drives.
    e. *Add Partition* under `sda`, called `ardana`, with a *Custom Size* of 250MB.
    f. Add an *EFI Boot Partition*. Partition should be formatted as `FAT` and mounted at */boot/efi*.

g. *Add Partition* with all the remaining space (*Maximum Size*). The role for this partition is *Raw Volume (unformatted)*. It should not be mounted. It should not be formatted.

h. Select *Volume Management* and add a volume group to `/dev/sda2` called `ardana-vg`.

i. Add an LV to `ardana-vg` called `root`, `Type` of *Normal Volume*, *Custom Size* of 50GB, *Raw Volume (unformatted)*. Format as *Ext4 File System* and mount at `/`.

j. Acknowledge the warning about having no swap partition.

k. Press *Next* on the `Suggested Partitioning` page.

9. Pick your *Time Zone* and check `Hardware Clock Set to UTC`.

10. Create a user named `ardana` and a password for `system administrator`. Do not check *Automatic Login*.

11. On the `Installation Settings` page:

    - Disable firewall
    - Enable SSH service
    - Set `text` as the *Default systemd target*.

12. Press *Install* and `Confirm Installation` with the *Install* button.

13. Installation will begin and the system will reboot automatically when installation is complete.

14. When the system is booted, log in as `root`, using the system administrator set during installation.

15. Set up the `ardana` user and add `ardana` to the `sudoers` group.

```
root # useradd -s /bin/bash -d /var/lib/ardana -m
    ardana
root # passwd ardana
```

    Enter and retype the password for user `ardana`.

```
root # echo "ardana ALL=(ALL) NOPASSWD:ALL" | sudo tee -a \
    /etc/sudoers.d/ardana
```

16. Add an ardana group (id 1000) and change group owner to `ardana`.

```
root # groupadd --gid 1000 ardana
root # chown -R ardana:ardana /var/lib/ardana
```

17. Disconnect the installation ISO. List repositories and remove the repository that was used for the installation.

```
root # zypper lr
```

Identify the `Name` of the repository to remove.

```
root # zypper rr REPOSITORY_NAME
```

18. Copy the SSH key from the Cloud Lifecycle Manager.

```
root # ssh-copy-id ardana@DEPLOYER_IP_ADDRESS
```

19. Log in to the SLES via SSH.

20. Continue with the `site.yml` playbook to scale out the node.

19.4.3 Assign a static IP

1. Use the `ip addr` command to find out what network devices are on your system:

```
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eno1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen 1000
    link/ether f0:92:1c:05:89:70 brd ff:ff:ff:ff:ff:ff
    inet 10.13.111.178/26 brd 10.13.111.191 scope global eno1
       valid_lft forever preferred_lft forever
    inet6 fe80::f292:1cff:fe05:8970/64 scope link
       valid_lft forever preferred_lft forever
3: eno2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen 1000
    link/ether f0:92:1c:05:89:74 brd ff:ff:ff:ff:ff:ff
```

2. Identify the one that matches the MAC address of your server and edit the corresponding config file in `/etc/sysconfig/network-scripts`.

```
vi /etc/sysconfig/network-scripts/ifcfg-eno1
```

3. Edit the `IPADDR` and `NETMASK` values to match your environment. Note that the `IPADDR` is used in the corresponding stanza in `servers.yml`. You may also need to set `BOOTPROTO` to `none`.

```
TYPE=Ethernet
BOOTPROTO=none
DEFROUTE=yes
PEERDNS=yes
PEERROUTES=yes
IPV4_FAILURE_FATAL=no
IPV6INIT=yes
IPV6_AUTOCONF=yes
IPV6_DEFROUTE=yes
IPV6_PEERDNS=yes
IPV6_PEERROUTES=yes
IPV6_FAILURE_FATAL=no
NAME=eno1
UUID=36060f7a-12da-469b-a1da-ee730a3b1d7c
DEVICE=eno1
ONBOOT=yes
NETMASK=255.255.255.192
IPADDR=10.13.111.14
```

4. [OPTIONAL] Reboot your SLES node and ensure that it can be accessed from the Cloud Lifecycle Manager.

19.4.4 Add ardana user and home directory

```
useradd -m ardana
passwd ardana
```

19.4.5 Allow user ardana to sudo without password

Setting up sudo on SLES is covered in the *SLES Administration Guide* at https://documentation.suse.com/sles/12-SP5/single-html/SLES-admin/#sec-sudo-conf.

The recommendation is to create user specific **`sudo`** config files under `/etc/sudoers.d`, therefore creating an `/etc/sudoers.d/ardana` config file with the following content will allow sudo commands without the requirement of a password.

```
ardana ALL=(ALL) NOPASSWD:ALL
```

19.4.6 Add zypper repository

Using the ISO-based repositories created above, add the zypper repositories.

Follow these steps. Update the value of deployer_ip as necessary.

```
deployer_ip=192.168.10.254
tux > sudo zypper addrepo --no-gpgcheck --refresh http://$deployer_ip:79/ardana/sles12/zypper/OS
 SLES-OS
tux > sudo zypper addrepo --no-gpgcheck --refresh http://$deployer_ip:79/ardana/sles12/zypper/SDK
 SLES-SDK
```

To verify that the repositories have been added, run:

```
tux > sudo zypper repos --detail
```

For more information about Zypper, see the *SLES Administration Guide* at https://documentation.suse.com/sles/12-SP5/single-html/SLES-admin/#sec-zypper.

> **Warning**
>
> If you intend on attaching encrypted volumes to any of your SLES Compute nodes, install the cryptographic libraries through cryptsetup on each node. Run the following command to install the necessary cryptographic libraries:
>
> ```
> tux > sudo zypper in cryptsetup
> ```

19.4.7 Add Required Packages

As documented in *Section 12.4, "Provisioning Your Baremetal Nodes"*, you need to add extra packages. Ensure that `openssh-server`, `python`, and `rsync` are installed.

19.4.8 Set up passwordless SSH access

Once you have started your installation using the Cloud Lifecycle Manager, or if you are adding a SLES node to an existing cloud, you need to copy the Cloud Lifecycle Manager public key to the SLES node. One way of doing this is to copy the `/home/ardana/.ssh/authorized_keys` from another node in the cloud to the same location on the SLES node. If you are installing a new cloud, this file will be available on the nodes after running the `bm-reimage.yml` playbook.

> **Important**
>
> Ensure that there is global read access to the file `/home/ardana/.ssh/authorized_keys`.

Now test passwordless SSH from the deployer and check your ability to remotely execute sudo commands:

```
ssh ardana@IP_OF_SLES_NODE "sudo tail -5 /var/log/messages"
```

20 Installing Manila and Creating Manila Shares

20.1 Installing Manila

The OpenStack Shared File Systems service (Manila) provides file storage to a virtual machine. The Shared File Systems service provides a storage provisioning control plane for shared or distributed file systems. The service enables management of share types and share snapshots if you have a driver that supports them.

The Manila service consists of the following components:

- manila-api
- manila-data
- manila-scheduler
- manila-share
- messaging queue

These Manila components are included in example SUSE OpenStack Cloud models based on Nova KVM, such as `entry-scale-kvm`, `entry-scale-kvm-mml`, and `mid-scale-kvm`. General installation instructions are available at *Chapter 12, Installing Mid-scale and Entry-scale KVM*.

If you modify one of these cloud models to set up a dedicated Cloud Lifecycle Manager, add `manila-client` item to the list of service components for the Cloud Lifecycle Manager cluster.

The following steps install Manila if it is not already present in your cloud data model:

1. Log in to the Cloud Lifecycle Manager.
2. Apply Manila changes in `control_plane.yml`.

   ```
   ardana > cd /var/lib/ardana/openstack/my_cloud/definition/data/
   ```

   Add `manila-client` to the list of service components for Cloud Lifecycle Manager, and both `manila-api` and `manila-share` to the Control Node.
3. Run the Configuration Processor.

   ```
   ardana > cd ~/openstack
   ```

```
ardana > git add -A
ardana > git commit -m "manila config"
ardana > cd ~/openstack/ardana/ansible/
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

4. Deploy Manila

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts percona-deploy.yml
ardana > ansible-playbook -i hosts/verb_hosts manila-deploy.yml
```

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ardana-gen-hosts-file.yml
ardana > ansible-playbook -i hosts/verb_hosts ardana-reconfigure.yml
ardana > ansible-playbook -i hosts/verb_hosts clients-deploy.yml
```

If Manila has already been installed and is being reconfigured, run the following for the changes to take effect:

```
ardana > ansible-playbook -i hosts/verb_hosts manila-stop.yml
ardana > ansible-playbook -i hosts/verb_hosts manila-start.yml
```

5. Verify the Manila installation

```
ardana > cd
ardana > . manila.osrc
ardana > . service.osrc
ardana > manila api-version
ardana > manila service-list
```

The Manila CLI can be run from Cloud Lifecycle Manager or controller nodes.

Note

The `manila-share` service component is not started by the `manila-deploy.yml` playbook when run under default conditions. This component requires that a valid backend be configured, which is described in *Section 20.3, “Configure Manila Backend”*.

20.2 Adding Manila to an Existing SUSE OpenStack Cloud Environment

Add Manila to an existing SUSE OpenStack Cloud installation or as part of an upgrade with the following steps:

1. Add the items listed below to the list of service components in `~/openstack/my_cloud/definition/data/control_plane.yml`. Add them to clusters that have `server-role` set to `CONTROLLER-ROLE` (applies to entry-scale models).

   - manila-client
   - manila-api

2. If your environment uses a dedicated Cloud Lifecycle Manager, add `magnum-client` to the list of service components for the Cloud Lifecycle Manager in `~/openstack/my_cloud/definition/data/control_plane.yml`.

3. Commit your configuration to the local git repo.

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > git add -A
   ardana > git commit -m "My config or other commit message"
   ```

4. Run the configuration processor.

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
   ```

5. Update deployment directory.

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
   ```

6. Deploy Manila.

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible
   ardana > ansible-playbook -i hosts/verb_hosts percona-deploy.yml
   ardana > ansible-playbook -i hosts/verb_hosts manila-deploy.yml
   ardana > ansible-playbook -i hosts/verb_hosts ardana-gen-hosts-file.yml
   ardana > ansible-playbook -i hosts/verb_hosts ardana-reconfigure.yml
   ardana > ansible-playbook -i hosts/verb_hosts clients-deploy.yml
   ```

7. Verify the Manila installation.

```
ardana > cd
ardana > . manila.osrc
ardana > . service.osrc
ardana > manila api-version
ardana > manila service-list
```

The Manila CLI can be run from the Cloud Lifecycle Manager or controller nodes.

Proceed to *Section 20.3, "Configure Manila Backend"*.

20.3 Configure Manila Backend

20.3.1 Configure NetaApp Manila Back-end

Note

An account with cluster administrator privileges must be used with the `netapp_login` option when using Share Server management. Share Server management creates Storage Virtual Machines (SVM), thus SVM administrator privileges are insufficient.

There are two modes for the NetApp Manila back-end:

- `driver_handles_share_servers = True`
- `driver_handles_share_servers = False` This value must be set to `False` if you want the driver to operate without managing share servers.

More information is available from NetApp OpenStack (https://netapp-openstack-dev.github.io/openstack-docs/rocky/manila/configuration/manila_config_files/section_unified-driver-without-share-server.html)

The steps to configure a NetApp Manila back-end are:

1. Configure a back-end in the Manila configuration file, following the directions and comments in the file.

```
ardana > cd ~/openstack/my_cloud
```

```
ardana > vi config/manila/manila.conf.j2
```

2. Commit your configuration to the local Git repo.

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "My config or other commit message"
```

3. Run the configuration processor.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

4. Update deployment directory.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

5. Run reconfiguration playbook.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts manila-reconfigure.yml
```

6. Restart Manila services.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts manila-stop.yml
ardana > ansible-playbook -i hosts/verb_hosts manila-start.yml
```

Note

After the `manila-share` service has been initialized with a backend, it can be controlled independently of `manila-api` by using the playbooks `manila-share-start.yml`, `manila-share-stop.yml`, and `manila-share-status.yml`.

20.3.2 Configure CephFS Manila Backend

Configure a back-end in the Manila configuration file, `~/openstack/my_cloud vi config/manila/manila.conf.j2`.

1. To define a CephFS native back-end, create a section like the following:

```
[cephfsnative1]
```

```
driver_handles_share_servers = False
share_backend_name = CEPHFSNATIVE1
share_driver = manila.share.drivers.cephfs.driver.CephFSDriver
cephfs_conf_path = /etc/ceph/ceph.conf
cephfs_protocol_helper_type = CEPHFS
cephfs_auth_id = manila
cephfs_cluster_name = ceph
cephfs_enable_snapshots = False
```

2. Add CephFS to `enabled_share_protocols`:

```
enabled_share_protocols = NFS,CIFS,CEPHFS
```

3. Edit the `enabled_share_backends` option in the `DEFAULT` section to point to the driver's back-end section name.

4. According to the environment, modify back-end specific lines in `~/openstack/my_cloud vi config/manila/manila.conf.j2`.

5. Commit your configuration to the local Git repo.

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "My config or other commit message"
```

6. Run the configuration processor.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

7. Update deployment directory.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

8. Run reconfiguration playbook.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts manila-reconfigure.yml
```

9. Restart Manila services.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts manila-stop.yml
ardana > ansible-playbook -i hosts/verb_hosts manila-start.yml
```

> **Note**
>
> After the `manila-share` service has been initialized with a back-end, it can be controlled independently of `manila-api` by using the playbooks `manila-share-start.yml`, `manila-share-stop.yml`, and `manila-share-status.yml`.

For more details of the CephFS Manila back-end, see OpenStack CephFS driver (https://docs.openstack.org/manila/rocky/admin/cephfs_driver.html).

20.4 Creating Manila Shares

Manila can support two modes, with and without the handling of share servers. The mode depends on driver support.

Mode 1: The back-end is a generic driver, `driver_handles_share_servers = False` (DHSS is disabled). The following example creates a VM using Manila share image.

1. ```
   ardana > wget http://tarballs.openstack.org/manila-image-elements/images/manila-
   service-image-master.qcow2
   ardana > . service.osrc;openstack image create --name
   "manila-service-image-new" \
   --file manila-service-image-master.qcow2 --disk-format qcow2 \
   --container-format bare --visibility public --progress
   ardana > openstack image list (verify manila image)
   ardana > openstack security group create manila-security-group \
   --description "Allows web and NFS traffic to manila server."
   ardana > openstack security group rule create manila-security-group \
   --protocol tcp --dst-port 2049
   ardana > openstack security group rule create manila-security-group \
   --protocol udp --dst-port 2049
   ardana > openstack security group rule create manila-security-group \
   --protocol tcp --dst-port 22
   ardana > openstack security group rule create manila-security-group \
   --protocol icmp
   ardana > openstack security group rule list manila-security-group (verify manila
    security group)
   ardana > openstack keypair create --public-key ~/.ssh/id_rsa.pub mykey
   ardana > openstack network create n1
   ardana > openstack subnet create s1 --network n1 --subnet-range 11.11.11.0/24
   ardana > openstack router create r1
   ardana > openstack router add subnet r1 s1
   ardana > openstack router set r1 ext-net
   ```
   ```

```
ardana > openstack network list
ardana > openstack server create manila-vm --flavor m1.small \
--image IMAGE_ID --nic net-id=N1_ID --security-group manila-security-group \
--key-name myKey
ardana > oenstack floating ip create EXT-NET_ID
ardana > openstack server add floating ip manila-vm EXT-NET_ID
```

2. Validate your ability to ping or connect by SSH to `manila-vm` with credentials `manila/manila`.

3. Modify the configuration:

```
ardana > vi
    /etc/manila/manila.conf.d/100-manila.conf
```

   Make changes in [generic1] section

```
service_instance_name_or_id = MANILA_VM_ID
service_net_name_or_ip = MANILA_VM_FLOATING_IP
tenant_net_name_or_ip = MANILA_VM_FLOATING_IP
```

4. Create a share type. OpenStack docs has [detailed instructions (https://docs.openstack.org/manila/rocky/install/post-install.html)](https://docs.openstack.org/manila/rocky/install/post-install.html). Use the instructions for `manila type-create default_share_type False`

5. Restart Manila services and verify they are up.

```
ardana > systemctl restart openstack-manila-api \
openstack-manila-share openstack-manila-scheduler
ardana > manila service-list
```

6. Continue creating a share

```
ardana > manila create NFS 1 --name SHARE
ardana > manila list (status will change from  creating to available)
ardana > manila show share1
ardana > manila access-allow SHARE ip INSTANCE_IP
```

7. Mount the share on a Compute instance

```
ardana > mkdir ~/test_directory
tux > sudo mount -vt nfs EXT-NET_ID:/shares/SHARE-SHARE-ID ~/test_folder
```

Mode 2: The back-end is `NetApp`, `driver_handles_share_servers = True` (DHSS is enabled). Procedure for driver_handles_share_servers = False is similar to Mode 1.

1. Modify the configuration

```
ardana > vi /etc/manila/manila.conf.d/100-manila.conf
```

Add a `backendNetApp` section

```
share_driver = manila.share.drivers.netapp.common.NetAppDriver
driver_handles_share_servers = True
share_backend_name=backendNetApp
netapp_login=NetApp_USERNAME
netapp_password=NetApp_PASSWORD
netapp_server_hostname=NETAPP_HOSTNAME
netapp_root_volume_aggregate=AGGREGATE_NAME
```

Add to [DEFAULT] section

```
enabled_share_backends = backendNetApp
default_share_type = default1
```

2. Create a Manila share image and verify it

```
ardana > wget http://tarballs.openstack.org/manila-image-elements/images/manila-
service-image-master.qcow2
ardana > . service.osrc;openstack image create manila-service-image-new \
--file manila-service-image-master.qcow2 --disk-format qcow2 \
--container-format bare --visibility public --progress
ardana > openstack image list (verify a Manila image)
```

3. Create a share type. OpenStack docs has detailed instructions (https://docs.openstack.org/manila/rocky/install/post-install.html). Use the instructions for `manila type-create default_share_type True`.

4. Restart services

```
ardana > systemctl restart openstack-manila-api openstack-manila-share \openstack-
manila-scheduler
ardana > manila service-list (verify services are up)
```

5. Continue creating a share. `OCTAVIA-MGMT-NET` can be used as *`PRIVATE_NETWORK`* in this example.

```
ardana > manila share-network-create --name demo-share-network1 \
--neutron-net-id PRIVATE_NETWORK_ID --neutron-subnet-id PRIVATE_NETWORK_SUBNET_ID
ardana > manila create NFS 1 --name share2 --share-network demo-share-network1
```

20.5 Troubleshooting

If manila-list shows share status in error, use `storage aggregate show` to list available aggregates. Errors may be found in `/var/log/manila/manila-share.log`

if the compute nodes do not have access to Manila back-end server, use the `manila-share` service on controller nodes instead. You can do so by either running `sudo systemctl stop openstack-manila-share` on compute to turn off its share service or skipping adding "manila-share" to compute hosts in the input-model (`control_plane.yml` in `/var/lib/ardana/openstack/my_cloud/definition/data`).

21 Installing SUSE CaaS Platform Heat Templates

This chapter describes how to install SUSE CaaS Platform Heat template on SUSE OpenStack Cloud.

21.1 SUSE CaaS Platform Heat Installation Procedure

PROCEDURE 21.1: PREPARATION

1. Download the latest SUSE CaaS Platform for OpenStack image (for example, `SUSE-CaaS-Platform-3.0-OpenStack-Cloud.x86_64-1.0.0-GM.qcow2`) from https://download.suse.com.
2. Upload the image to Glance:

```
openstack image create --public --disk-format qcow2 --container-format \
bare --file SUSE-CaaS-Platform-3.0-OpenStack-Cloud.x86_64-1.0.0-GM.qcow2 \
CaaSP-3
```

3. Install the `caasp-openstack-heat-templates` package on a machine with SUSE OpenStack Cloud repositories:

```
zypper in caasp-openstack-heat-templates
```

The installed templates are located in `/usr/share/caasp-openstack-heat-templates`.
Alternatively, you can get official Heat templates by cloning the appropriate Git repository:

```
git clone https://github.com/SUSE/caasp-openstack-heat-templates
```

PROCEDURE 21.2: INSTALLING TEMPLATES VIA HORIZON

1. In Horizon, go to *Project* › *Stacks* › *Launch Stack*.
2. Select *File* from the *Template Source* drop-down box and upload the `caasp-stack.yaml` file.
3. In the *Launch Stack* dialog, provide the required information (stack name, password, flavor size, external network of your environment, etc.).
4. Click *Launch* to launch the stack. This creates all required resources for running SUSE CaaS Platform in an OpenStack environment. The stack creates one Admin Node, one Master Node, and server worker nodes as specified.

PROCEDURE 21.3: INSTALL TEMPLATES FROM THE COMMAND LINE

1. Specify the appropriate flavor and network settings in the `caasp-environment.yaml` file.
2. Create a stack in Heat by passing the template, environment file, and parameters:

```
openstack stack create -t caasp-stack.yaml -e caasp-environment.yaml \
--parameter image=CaaSP-3 caasp-stack
```

PROCEDURE 21.4: ACCESSING VELUM SUSE CAAS PLATFORM DASHBOARD

1. After the stack has been created, the Velum SUSE CaaS Platform dashboard runs on the Admin Node. You can access it using the Admin Node's floating IP address.
2. Create an account and follow the steps in the Velum SUSE CaaS Platform dashboard to complete the SUSE CaaS Platform installation.

When you have successfully accessed the admin node web interface via the floating IP, follow the instructions at https://documentation.suse.com/suse-caasp/3/single-html/caasp-deployment/ to continue the setup of SUSE CaaS Platform.

21.2 Installing SUSE CaaS Platform with Multiple Masters

Note

A Heat stack with load balancing and multiple master nodes can only be created from the command line, because Horizon does not have support for nested Heat templates.

Install the `caasp-openstack-heat-templates` package on a machine with SUSE OpenStack Cloud repositories:

```
zypper in caasp-openstack-heat-templates
```

The installed templates are located in `/usr/share/caasp-openstack-heat-templates`.

A working load balancer is needed in your SUSE OpenStack Cloud deployment. SUSE OpenStack Cloud uses HAProxy.

Verify that load balancing with HAProxy is working correctly in your OpenStack installation by creating a load balancer manually and checking that the `provisioning_status` changes to `Active`.

```
ardana > openstack loadbalancer show
<LOAD_BALANCER_ID>
```

HAProxy is the default load balancer provider in SUSE OpenStack Cloud.

The steps below can be used to set up a network, subnet, router, security and IPs for a test `lb_net1` network with `lb_subnet1` subnet.

```
ardana > openstack network create lb_net1
  ardana > openstack subnet create --name lb_subnet1 lb_net1 \
--subnet-range 172.29.0.0/24 --gateway 172.29.0.2
ardana > openstack router create lb_router1
ardana > openstack router add subnet lb_router1 lb_subnet1
ardana > openstack router set lb_router1 --external-gateway ext-net
ardana > openstack network list
```

PROCEDURE 21.5: STEPS TO INSTALL SUSE CAAS PLATFORM WITH MULTIPLE MASTERS

1. Specify the appropriate flavor and network settings in the `caasp-multi-master-environment.yaml` file.

2. Set `master_count` to the desired number in the `caasp-multi-master-environment.yaml` file. The master count must be set to an odd number of nodes.

   ```
   master_count: 3
   ```

3. Create a stack in Heat by passing the template, environment file, and parameters:

   ```
   ardana > openstack stack create -t caasp-multi-master-stack.yaml \
   -e caasp-multi-master-environment.yaml --parameter image=CaaSP-3 caasp-multi-master-
   stack
   ```

4. Find the floating IP address of the load balancer. This is necessary for accessing the Velum SUSE CaaS Platform dashboard.

   a.
      ```
      ardana > openstack loadbalancer list --provider
      ```

b. From the output, copy the `id` and enter it in the following command as shown in the following example:

```
ardana > openstack loadbalancer show id
```

```
+---------------------+------------------------------------------------+
| Field               | Value                                          |
+---------------------+------------------------------------------------+
| admin_state_up      | True                                           |
| description         |                                                |
| id                  | 0d973d80-1c79-40a4-881b-42d111ee9625           |
| listeners           | {"id": "c9a34b63-a1c8-4a57-be22-75264769132d"} |
|                     | {"id": "4fa2dae0-126b-4eb0-899f-b2b6f5aab461"} |
| name                | caasp-stack-master_lb-bhr66gtrx3ue             |
| operating_status    | ONLINE                                         |
| pools               | {"id": "8c011309-150c-4252-bb04-6550920e0059"} |
|                     | {"id": "c5f55af7-0a25-4dfa-a088-79e548041929"} |
| provider            | haproxy                                        |
| provisioning_status | ACTIVE                                         |
| tenant_id           | fd7ffc07400642b1b05dbef647deb4c1               |
| vip_address         | 172.28.0.6                                     |
| vip_port_id         | 53ad27ba-1ae0-4cd7-b798-c96b53373e8b           |
| vip_subnet_id       | 87d18a53-ad0c-4d71-b82a-050c229b710a           |
+---------------------+------------------------------------------------+
```

c. Search the floating IP list for `vip_address`

```
ardana > openstack floating ip list | grep 172.28.0.6
| d636f3...481b0c | fd7ff...deb4c1 | 172.28.0.6  | 10.84.65.37  |
 53ad2...373e8b |
```

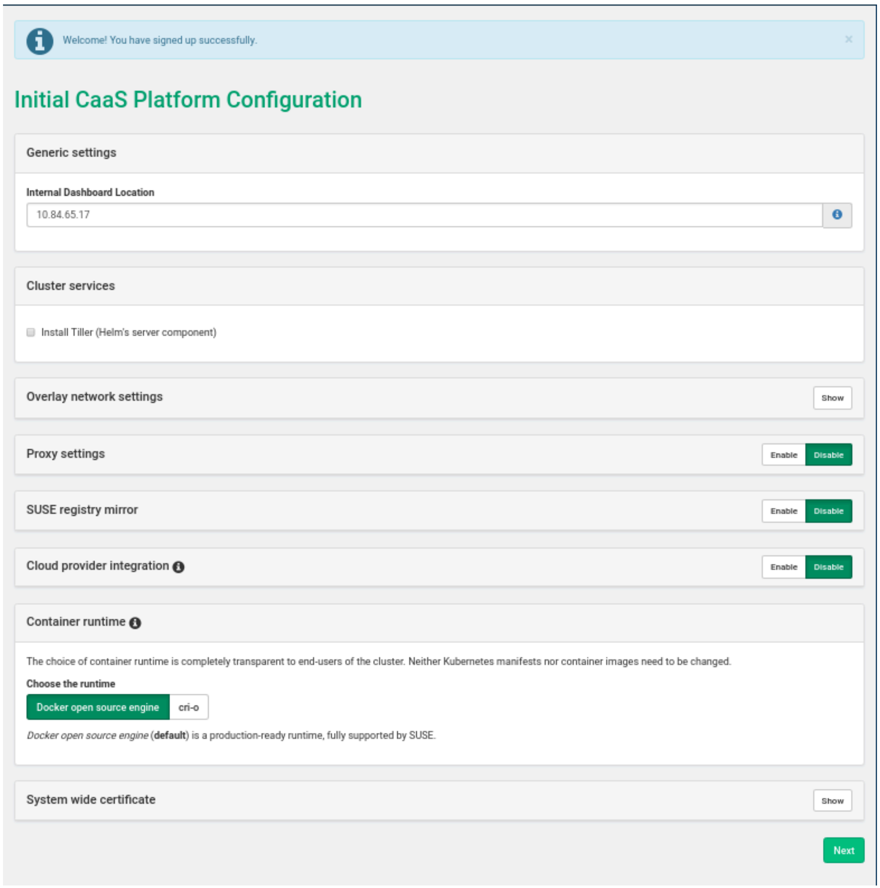
d. The load balancer floating ip address is 10.84.65.37

Accessing the Velum SUSE CaaS Platform Dashboard

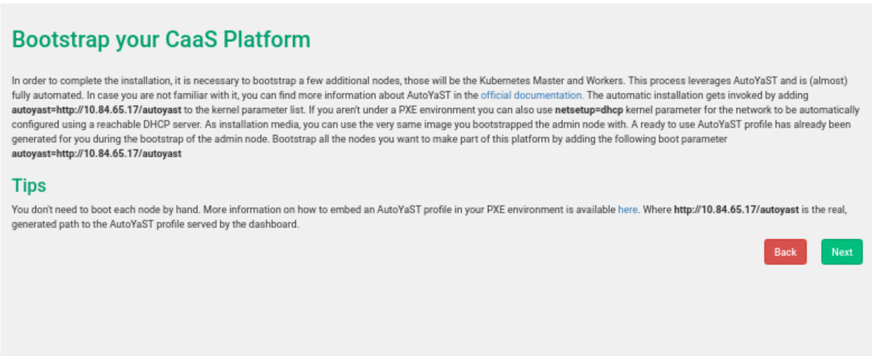
After the stack has been created, the Velum SUSE CaaS Platform dashboard runs on the admin node. You can access it using the floating IP address of the admin node.

Create an account and follow the steps in the Velum SUSE CaaS Platform dashboard to complete the SUSE CaaS Platform installation.

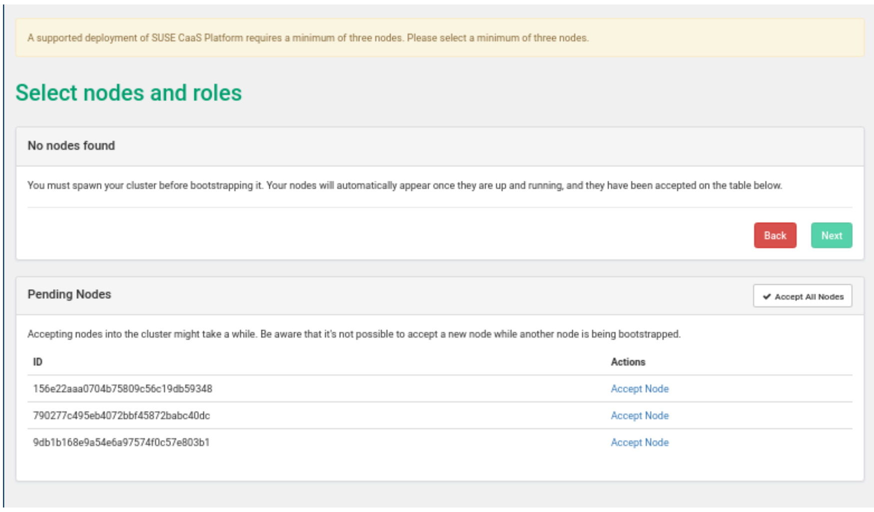
SUSE CaaS Platform Admin Node Install: Screen 1



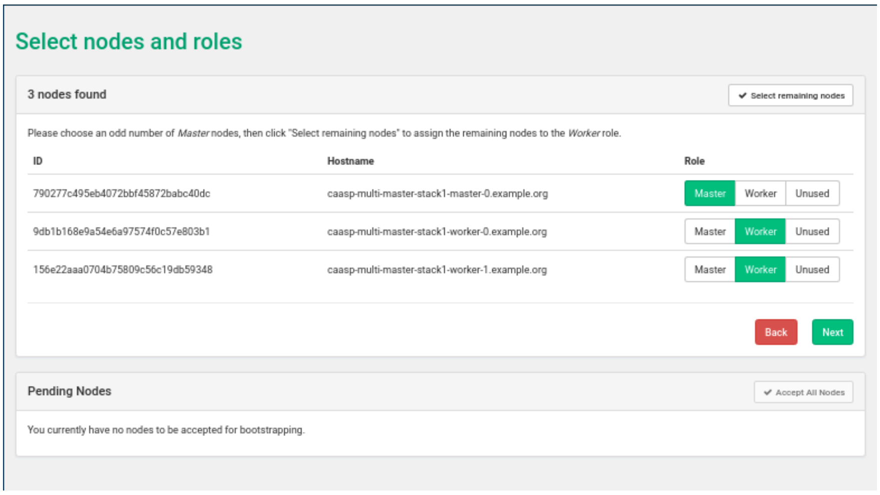
SUSE CaaS Platform Admin Node Install: Screen 2



SUSE CaaS Platform Admin Node Install: Screen 3

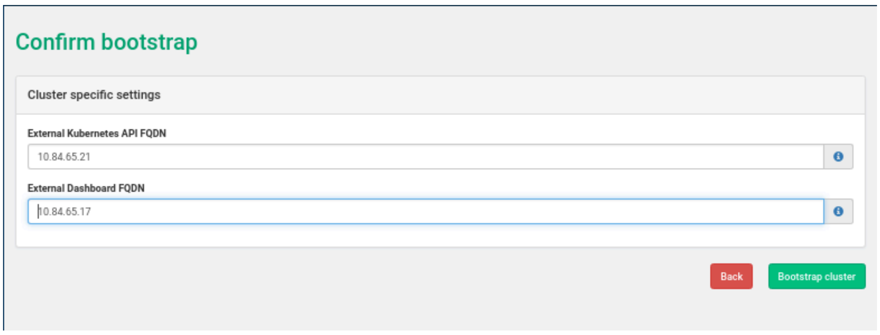


SUSE CaaS Platform Admin Node Install: Screen 4

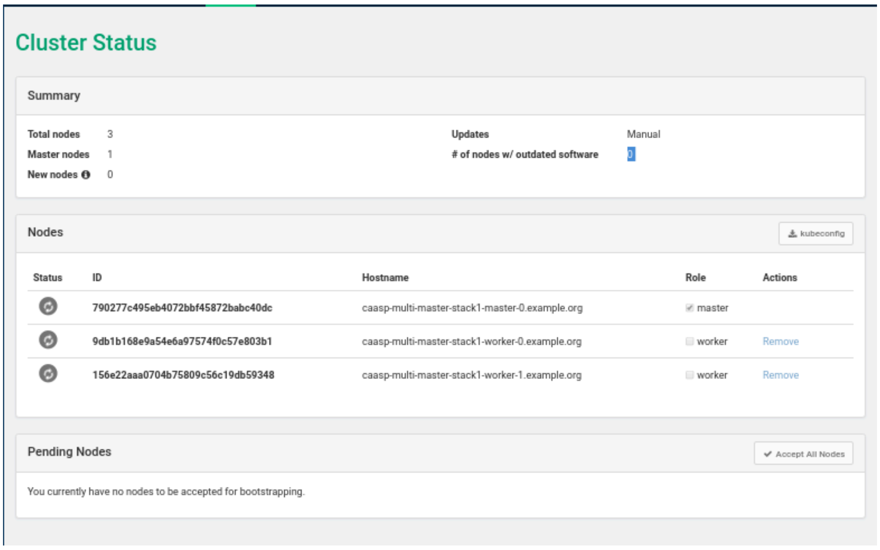


SUSE CaaS Platform Admin Node Install: Screen 5

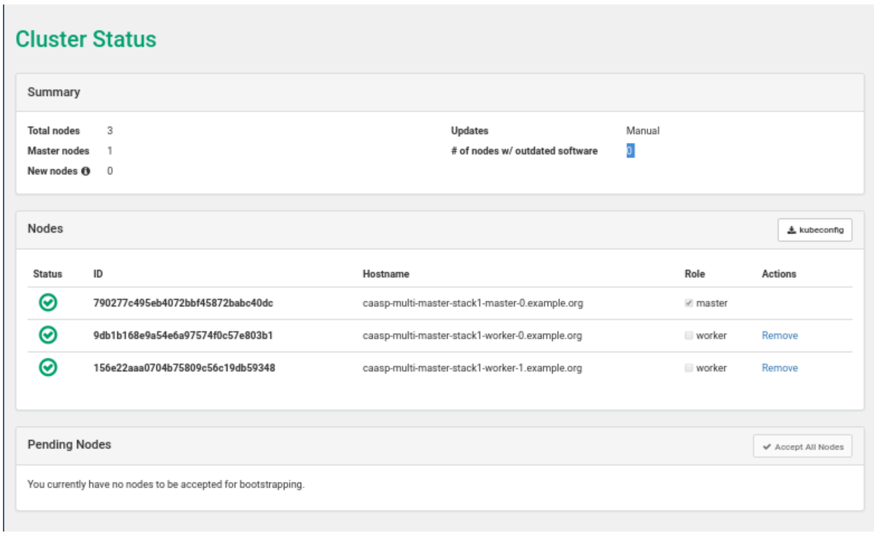
Set External Kubernetes API to `LOADBALANCER_FLOATING_IP`, External Dashboard FQDN to `ADMIN_NODE_FLOATING_IP`



SUSE CaaS Platform Admin Node Install: Screen 6



SUSE CaaS Platform Admin Node Install: Screen 7



21.3 Deploy SUSE CaaS Platform Stack Using Heat SUSE CaaS Platform Playbook

1. Install the `caasp-openstack-heat-templates` package on a machine with SUSE OpenStack Cloud repositories:

```
ardana > zypper in caasp-openstack-heat-templates
```

The installed templates are located in `/usr/share/caasp-openstack-heat-templates`.

2. Run `heat-caasp-deploy.yml` on the Cloud Lifecycle Manager to create a SUSE CaaS Platform cluster with Heat templates from the `caasp-openstack-heat-templates` package.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/localhost heat-caasp-deploy.yml
```

3. In a browser, navigate to the Horizon UI to determine the floating IP address assigned to the admin node.

4. Go to http://*ADMIN-NODE-FLOATING-IP*/ to bring up the Velum dashboard.

5. Follow the steps for `bootstrap` and `add nodes to the cluster` to bring up the SUSE CaaS Platform Kubernetes cluster.

21.4 Deploy SUSE CaaS Platform Cluster with Multiple Masters Using Heat CaasP Playbook

1. Install the `caasp-openstack-heat-templates` package on a machine with SUSE OpenStack Cloud repositories:

```
ardana > zypper in caasp-openstack-heat-templates
```

The installed templates are located in `/usr/share/caasp-openstack-heat-templates`.

2. On the Cloud Lifecycle Manager, run the `heat-caasp-deploy.yml` playbook and pass parameters for `caasp_stack_name`, `caasp_stack_yaml_file` and `caasp_stack_env_yaml_file`.

```
ardana > ansible-playbook -i hosts/localhost heat-caasp-deploy.yml -e
 "caasp_stack_name=caasp_multi-master caasp_stack_yaml_file=caasp-multi-master-stack.yaml caasp_stack_env_yaml_file=caasp-multi-master-environment.yaml"
```

21.5 SUSE CaaS Platform OpenStack Image for Heat SUSE CaaS Platform Playbook

By default the Heat SUSE CaaS Platform playbook downloads the SUSE CaaS Platform image from http://download.suse.de/install/SUSE-CaaSP-3-GM/SUSE-CaaS-Platform-3.0-for-OpenStack-Cloud.x86_64-3.0.0-GM.qcow2. If this URL is not accessible, the SUSE CaaS Platform image can be downloaded from https://download.suse.com/Download?buildid=z7ezhywXXRc and copied to the deployer.

To create a SUSE CaaS Platform cluster and pass the path to the downloaded image, run the following commands:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/localhost heat-caasp-deploy.yml -e
 "caasp_image_tmp_path=~/SUSE-CaaS-Platform-3.0-for-OpenStack-Cloud.x86_64-3.0.0-
GM.qcow2"
```

To create a SUSE CaaS Platform cluster with multiple masters and pass the path to the downloaded image, run the following commands:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/localhost heat-caasp-deploy.yml -e
 "caasp_image_tmp_path=caasp_image_tmp_path=~/SUSE-CaaS-Platform-3.0-for-OpenStack-
Cloud.x86_64-3.0.0-GM.qcow2
 caasp_stack_name=caasp_multi-master caasp_stack_yaml_file=caasp-multi-master-stack.yaml
 caasp_stack_env_yaml_file=caasp-multi-master-environment.yaml"
```

21.6 Enabling the Cloud Provider Integration (CPI) Feature

When deploying a CaaaSP cluster using SUSE CaaS Platform OpenStack Heat templates, the following CPI parameters can be set in `caasp-environment.yaml` or `caasp-multi-master-environment.yaml`.

cpi_auth_url

The URL of the Keystone API used to authenticate the user. This value can be found on OpenStack Dashboard under *Access and Security* › *API Access* › *Credentials* (for example, https://api.keystone.example.net:5000/v3/)

cpi_domain_name

Name of the domain the user belongs to

cpi_tenant_name

Name of the project the user belongs to. This is the project where the resources will be created.

cpi_region

Name of the region to use when running a multi-region OpenStack cloud. The region is a general division of an OpenStack deployment.

cpi_username

Username of a valid user that has been set in Keystone. Default: admin

cpi_password

Password of a valid user that has been set in Keystone.

cpi_monitor_max_retries

Neutron load balancer monitoring max retries. Default: 3

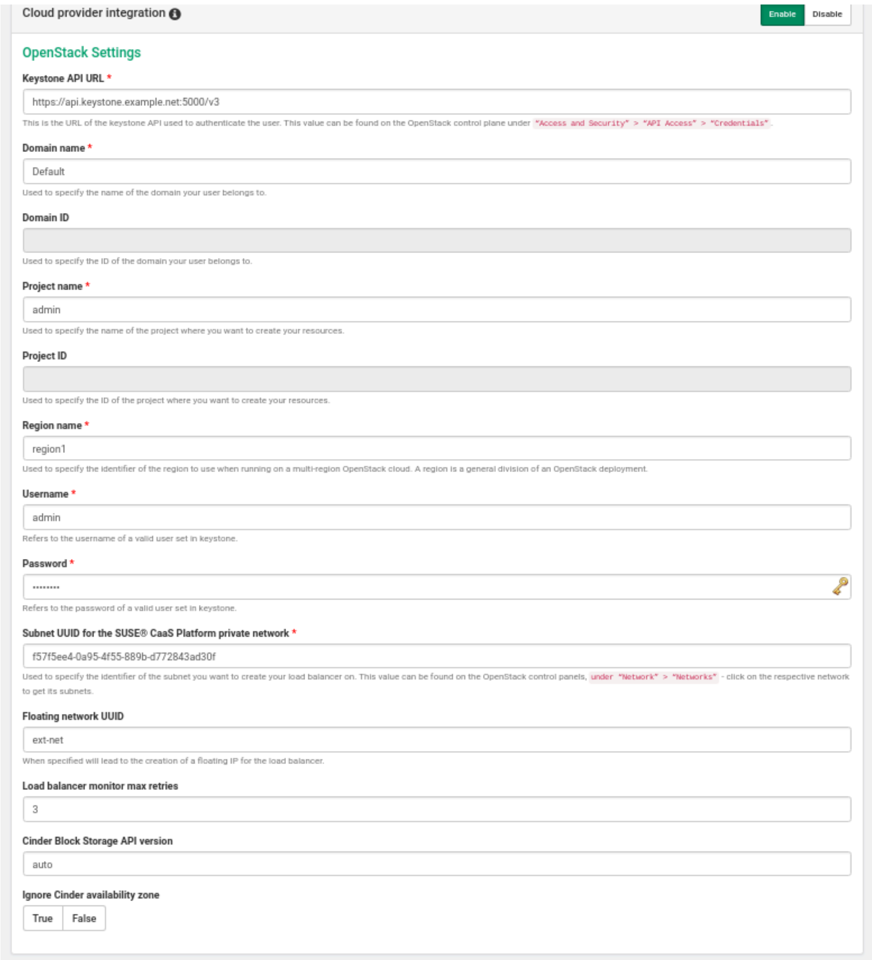
cpi_bs_version

Cinder Block Storage API version. Possible values are v1, v2 , v3 or auto. Default: auto

cpi_ignore_volume_az

Ignore Cinder and Nova availability zones. Default: true

When the SUSE CaaS Platform cluster has been deployed by the Heat templates, the Velum dashboard on the admin node (https://*ADMIN-NODE-IP*/) will have entries for *Cloud Provider Integration* (CPI). The OpenStack settings form will show the values that were set in the `caasp-environment.yaml` or `caasp-multi-master-environment.yaml` files.



After the SUSE CaaS Platform cluster comes up, install the latest SUSE CaaS Platform 3.0 Maintenance Update using the following steps:

1. Spin up a SUSE CaaS Platform cluster using Heat templates following the instructions in *Section 21.1, "SUSE CaaS Platform Heat Installation Procedure"*. Do not go through the bootstrapping steps, because the SUSE CaaS Platform Maintenance Update (MU) must be applied first. After the maintenance update process below succeeds, return to the SUSE CaaS Platform installation instructions and follow the admin node bootstrapping steps.
   Apply the SUSE CaaS Platform 3.0 Maintenance Update with the following steps:

   a. Log in to each node and add the update repository.

   ```
   ardana > sudo zypper ar http://nu.novell.com/SUSE/Updates/SUSE-CAASP/3.0/
   x86_64/update/ caasp_update
   ```

   b. With root privileges, run `transactional-update` on each node.

c. Reboot each node

d. Verify that the Velum image packages were updated

```
ardana > zypper se --detail velum-image
i | sles12-velum-image | package    | 3.1.7-3.27.3  | x86_64 | update_caasp
```

2. Upload a valid trust certificate that can validate a certificate presented by Keystone at the specified `keystone_auth_url` in the `system-wide certificate` section of Velum. The certificate must be uploaded to avoid bootstrapping failure with a `x509: certificate signed by unknown authority` error message.
   Get SUSE Root CA certificate with the following steps:

   a. From the RPM provided in the repos:

      i. Add a repository for your distribution at `http://download.suse.de/ibs/SUSE:/CA/`. For example, with `openSUSE Leap`, use `http://download.suse.de/ibs/SUSE:/CA/openSUSE_Leap_15.0/SUSE:CA.repo`

      ii. Install certificates and find the `.pem` file.

      ```
      ardana > sudo zypper in ca-certificates-suse
      ardana > rpm -ql ca-certificates-suse
      ```

      The path to the cert is `/usr/share/pki/trust/anchors/SUSE_Trust_Root.crt.pem`

   b. In `system wide certificate` during setup in Velum, upload this certificate so you can bootstrap with CPI.

3. After the nodes come up, continue with the installation instructions in *Section 21.1, “SUSE CaaS Platform Heat Installation Procedure”* following the admin node cluster bootstrapping steps.

21.7 More Information about SUSE CaaS Platform

More information about the SUSE CaaS Platform is available at https://documentation.suse.com/suse-caasp/3/single-html/caasp-deployment/

22 Integrations

Once you have completed your cloud installation, these are some of the common integrations you may want to perform.

22.1 Configuring for 3PAR Block Storage Backend

This page describes how to configure your 3PAR backend for the SUSE OpenStack Cloud Entry-scale with KVM cloud model.

22.1.1 Prerequisites

- You must have the license for the following software before you start your 3PAR backend configuration for the SUSE OpenStack Cloud Entry-scale with KVM cloud model:
  - Thin Provisioning
  - Virtual Copy
  - System Reporter
  - Dynamic Optimization
  - Priority Optimization
- Your SUSE OpenStack Cloud Entry-scale KVM Cloud should be up and running. Installation steps can be found in *Chapter 12, Installing Mid-scale and Entry-scale KVM*.
- Your 3PAR Storage Array should be available in the cloud management network or routed to the cloud management network and the 3PAR FC and iSCSI ports configured.
- The 3PAR management IP and iSCSI port IPs must have connectivity from the controller and compute nodes.
- Please refer to the system requirements for 3PAR in the OpenStack configuration guide, which can be found here: 3PAR System Requirements (http://docs.openstack.org/liberty/config-reference/content/hp-3par-sys-reqs.html).

22.1.2 Notes

The `cinder_admin` role must be added in order to configure 3Par ICSI as a volume type in Horizon.

```
ardana > source ~/service.osrc
ardana > openstack role add --user admin --project admin cinder_admin
```

Encrypted 3Par Volume: Attaching an encrypted 3Par volume is possible after installation by setting `volume_use_multipath = true` under the libvirt stanza in the `nova/kvm-hypervisor.conf.j2` file and reconfigure nova.

Concerning using multiple backends: If you are using multiple backend options, ensure that you specify each of the backends you are using when configuring your `cinder.conf.j2` file using a comma-delimited list. Also create multiple volume types so you can specify a backend to utilize when creating volumes. Instructions are included below. You can also read the OpenStack documentation about Cinder multiple storage backends (https://wiki.openstack.org/wiki/Cinder-multi-backend).

Concerning iSCSI and Fiber Channel: You should not configure cinder backends so that multipath volumes are exported over both iSCSI and Fiber Channel from a 3PAR backend to the same Nova compute server.

3PAR driver correct name: In a previous release, the 3PAR driver used for SUSE OpenStack Cloud integration had its name updated from `HP3PARFCDriver` and `HP3PARISCSIDriver` to `HPE3PARFCDriver` and `HPE3PARISCSIDriver` respectively (`HP` changed to `HPE`). You may get a warning or an error if the deprecated filenames are used. The correct values are those in `~/openstack/my_cloud/config/cinder/cinder.conf.j2`.

22.1.3 Multipath Support

Setting up multipath support is highly recommended for 3PAR FC/iSCSI backends, and should be considered a default best practice. For instructions on this process, refer to the `~/openstack/ardana/ansible/roles/multipath/README.md` file on the Cloud Lifecycle Manager. The `README.md` file contains detailed procedures for configuring multipath for 3PAR FC/iSCSI Cinder volumes.

Warning

If multipath functionality is enabled, ensure that all 3PAR fibre channel ports are active and zoned correctly in the 3PAR storage for proper operation.

In addition, take the following steps to enable 3PAR FC/iSCSI multipath support in OpenStack configuration files:

1. Log in to the Cloud Lifecycle Manager.
2. Edit the `~/openstack/my_cloud/config/nova/kvm-hypervisor.conf.j2` file and add this line under the `[libvirt]` section:
   Example:

   ```
   [libvirt]
   ...
   iscsi_use_multipath=true
   ```

   Additionally, if you are planning on attaching an encrypted 3PAR volume after installation, set `volume_use_multipath=true` in the same section.
3. Edit the file `~/openstack/my_cloud/config/cinder/cinder.conf.j2` and add the following lines in the `[3par]` section:
   Example:

   ```
   [3par]
   ...
   enforce_multipath_for_image_xfer=True
   use_multipath_for_image_xfer=True
   ```

4. Commit your configuration to the local git repo (*Chapter 10, Using Git for Configuration Management*), as follows:

   ```
   cd ~/openstack/ardana/ansible
   git add -A
   git commit -m "My config or other commit message"
   ```

5. Run the configuration processor:

   ```
   cd ~/openstack/ardana/ansible
   ansible-playbook -i hosts/localhost config-processor-run.yml
   ```

6. Use the playbook below to create a deployment directory:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost ready-deployment.yml
```

7. Run the Nova reconfigure playbook:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts nova-reconfigure.yml
```

22.1.4 Configure 3PAR FC as a Cinder Backend

You must modify the `cinder.conf.j2` to configure the FC details.

Perform the following steps to configure 3PAR FC as Cinder backend:

1. Log in to Cloud Lifecycle Manager.

2. Make the following changes to the `~/openstack/my_cloud/config/cinder/cinder.conf.j2` file:

   a. Add your 3PAR backend to the `enabled_backends` section:

   ```
   # Configure the enabled backends
   enabled_backends=3par_FC
   ```

   > **Important**
   >
   > If you are using multiple backend types, you can use a comma-delimited list here.

   b. `[OPTIONAL]` If you want your volumes to use a default volume type, then enter the name of the volume type in the `[DEFAULT]` section with the syntax below. **Remember this value for when you create your volume type in the next section.**

   > **Important**
   >
   > If you do not specify a default type then your volumes will default unpredictably. We recommended that you create a volume type that meets the needs of your environment and specify it here.

```
[DEFAULT]
# Set the default volume type
default_volume_type = <your new volume type>
```

c. Uncomment the `StoreServ (3par) iscsi cluster` section and fill the values per your cluster information. Storage performance can be improved by enabling the `Image-Volume` cache. Here is an example:

```
[3par_FC]
san_ip: <3par-san-ipaddr>
san_login: <3par-san-username>
san_password: <3par-san-password>
hpe3par_username: <3par-username>
hpe3par_password: <hpe3par_password>
hpe3par_api_url: https://<3par-san-ipaddr>:8080/api/v1
hpe3par_cpg: <3par-cpg-name-1>[,<3par-cpg-name-2>, ...]
volume_backend_name: <3par-backend-name>
volume_driver = cinder.volume.drivers.hpe.hpe_3par_iscsi.HPE3PARISCSIDriver
image_volume_cache_enabled = True
```

Important

Do not use `backend_host` variable in `cinder.conf` file. If `backend_host` is set, it will override the [DEFAULT]/host value which SUSE OpenStack Cloud 8 is dependent on.

3. Commit your configuration to the local git repo (*Chapter 10, Using Git for Configuration Management*), as follows:

```
cd ~/openstack/ardana/ansible
git add -A
git commit -m "My config or other commit message"
```

4. Run the configuration processor:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml
```

5. Update your deployment directory:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost ready-deployment.yml
```

6. Run the following playbook to complete the configuration:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts cinder-reconfigure.yml
```

22.1.5 Configure 3PAR iSCSI as Cinder backend

You must modify the `cinder.conf.j2` to configure the iSCSI details.

Perform the following steps to configure 3PAR iSCSI as Cinder backend:

1. Log in to Cloud Lifecycle Manager.
2. Make the following changes to the `~/openstack/my_cloud/config/cinder/cinder.conf.j2` file:
   a. Add your 3PAR backend to the `enabled_backends` section:

   ```
   # Configure the enabled backends
   enabled_backends=3par_iSCSI
   ```

   b. Uncomment the `StoreServ (3par) iscsi cluster` section and fill the values per your cluster information. Here is an example:

   ```
   [3par_iSCSI]
   san_ip: <3par-san-ipaddr>
   san_login: <3par-san-username>
   san_password: <3par-san-password>
   hpe3par_username: <3par-username>
   hpe3par_password: <hpe3par_password>
   hpe3par_api_url: https://<3par-san-ipaddr>:8080/api/v1
   hpe3par_cpg: <3par-cpg-name-1>[,<3par-cpg-name-2>, ...]
   volume_backend_name: <3par-backend-name>
   volume_driver: cinder.volume.drivers.san.hp.hp_3par_iscsi.hpe3parISCSIDriver
   hpe3par_iscsi_ips: <3par-ip-address-1>[,<3par-ip-address-2>,<3par-ip-address-3>, ...]
   hpe3par_iscsi_chap_enabled=true
   ```

   Important

   Do not use `backend_host` variable in `cinder.conf` file. If `backend_host` is set, it will override the [DEFAULT]/host value which SUSE OpenStack Cloud 8 is dependent on.

3. Commit your configuration your local git repository:

```
cd ~/openstack/ardana/ansible
git add -A
git commit -m "<commit message>"
```

4. Run the configuration processor:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml
```

When you run the configuration processor you will be prompted for two passwords. Enter the first password to make the configuration processor encrypt its sensitive data, which consists of the random inter-service passwords that it generates and the Ansible group_vars and host_vars that it produces for subsequent deploy runs. You will need this key for subsequent Ansible deploy runs and subsequent configuration processor runs. If you wish to change an encryption password that you have already used when running the configuration processor then enter the new password at the second prompt, otherwise press **Enter** . For CI purposes you can specify the required passwords on the ansible command line. For example, the command below will disable encryption by the configuration processor

```
ansible-playbook -i hosts/localhost config-processor-run.yml \
  -e encrypt="" -e rekey=""
```

If you receive an error during either of these steps then there is an issue with one or more of your configuration files. We recommend that you verify that all of the information in each of your configuration files is correct for your environment and then commit those changes to git using the instructions above.

5. Run the following command to create a deployment directory.

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost ready-deployment.yml
```

6. Run the following command to complete the configuration:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts cinder-reconfigure.yml
```

22.1.6 Post-Installation Tasks

After configuring 3PAR as your Block Storage backend, perform the following tasks:

- *Book "Operations Guide", Chapter 7 "Managing Block Storage", Section 7.1 "Managing Block Storage using Cinder", Section 7.1.2 "Creating a Volume Type for your Volumes"*
- *Section 27.1, "Verifying Your Block Storage Backend"*

22.2 Ironic HPE OneView Integration

SUSE OpenStack Cloud 8 supports integration of Ironic (Baremetal) service with HPE OneView using *agent_pxe_oneview* driver. Please refer to OpenStack Documentation (https://docs.openstack.org/developer/ironic/drivers/oneview.html) for more information.

22.2.1 Prerequisites

1. Installed SUSE OpenStack Cloud 8 with entry-scale-ironic-flat-network or entry-scale-ironic-multi-tenancy model.
2. HPE OneView 3.0 instance is running and connected to management network.
3. HPE OneView configuration is set into `definition/data/ironic/ironic_config.yml` (and `ironic-reconfigure.yml` playbook ran if needed). This should enable *agent_pxe_oneview* driver in ironic conductor.
4. Managed node(s) should support PXE booting in legacy BIOS mode.
5. Managed node(s) should have PXE boot NIC listed first. That is, embedded 1Gb NIC must be disabled (otherwise it always goes first).

22.2.2 Integrating with HPE OneView

1. On the Cloud Lifecycle Manager, open the file `~/openstack/my_cloud/definition/data/ironic/ironic_config.yml`

```
~$ cd ~/openstack
```

```
vi my_cloud/definition/data/ironic/ironic_config.yml
```

2. Modify the settings listed below:

   a. `enable_oneview`: should be set to "true" for HPE OneView integration

   b. `oneview_manager_url`: HTTPS endpoint of HPE OneView management interface, for example: **https://10.0.0.10/**

   c. `oneview_username`: HPE OneView username, for example: **Administrator**

   d. `oneview_encrypted_password`: HPE OneView password in encrypted or clear text form. The encrypted form is distinguished by presence of `@ardana@` at the beginning of the string. The encrypted form can be created by running the **`ardanaencrypt.py`** program. This program is shipped as part of SUSE OpenStack Cloud and can be found in `~/openstack/ardana/ansible` directory on Cloud Lifecycle Manager.

   e. `oneview_allow_insecure_connections`: should be set to "true" if HPE OneView is using self-generated certificate.

3. Once you have saved your changes and exited the editor, add files, commit changes to local git repository, and run `config-processor-run.yml` and `ready-deployment.yml` playbooks, as described in *Chapter 10, Using Git for Configuration Management*.

```
~/openstack$ git add my_cloud/definition/data/ironic/ironic_config.yml
~/openstack$ cd ardana/ansible
~/openstack/ardana/ansible$ ansible-playbook -i hosts/localhost \
  config-processor-run.yml
...
~/openstack/ardana/ansible$ ansible-playbook -i hosts/localhost \
  ready-deployment.yml
```

4. Run ironic-reconfigure.yml playbook.

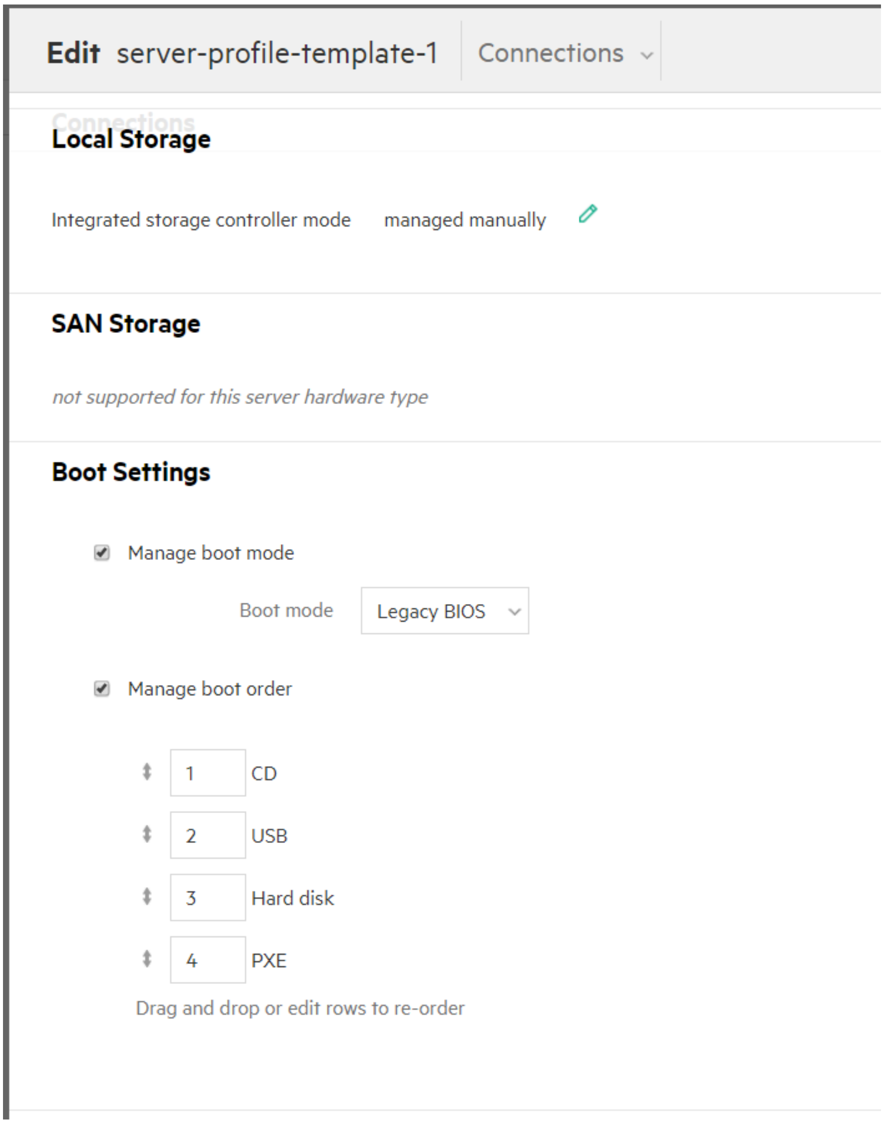
```
$ cd ~/scratch/ansible/next/ardana/ansible/

# This is needed if password was encrypted in ironic_config.yml file
~/scratch/ansible/next/ardana/ansible$ export
 ARDANA_USER_PASSWORD_ENCRYPT_KEY=your_password_encrypt_key
~/scratch/ansible/next/ardana/ansible$ ansible-playbook -i hosts/verb_hosts ironic-
reconfigure.yml
...
```

22.2.3 Registering Node in HPE OneView

In the HPE OneView web interface:

1. Navigate to *Menu* › *Server Hardware*. Add new *Server Hardware* item, using managed node IPMI IP and credentials. If this is the first node of this type being added, corresponding *Server Hardware Type* will be created automatically.
2. Navigate to *Menu* › *Server Profile Template*. Add *Server Profile Template*. Use *Server Hardware Type* corresponding to node being registered. In *BIOS Settings* section, set *Manage Boot Mode* and *Manage Boot Order* options must be turned on:



3. Verify that node is powered off. Power the node off if needed.

22.2.4 Provisioning Ironic Node

1. Login to the Cloud Lifecycle Manager and source respective credentials file (for example `service.osrc` for admin account).

2. Review glance images with `glance image list`

```
$ glance image list
+--------------------------------------+--------------------------+
| ID                                   | Name                     |
+--------------------------------------+--------------------------+
| c61da588-622c-4285-878f-7b86d87772da | cirros-0.3.4-x86_64      |
+--------------------------------------+--------------------------+
```

   Ironic deploy images (boot image, `ir-deploy-kernel`, `ir-deploy-ramdisk`, `ir-deploy-iso`) are created automatically. The `agent_pxe_oneview` Ironic driver requires `ir-deploy-kernel` and `ir-deploy-ramdisk` images.

3. Create node using `agent_pxe_oneview` driver.

```
$ ironic --ironic-api-version 1.22 node-create -d agent_pxe_oneview --name test-node-1 \
  --network-interface neutron -p memory_mb=131072 -p cpu_arch=x86_64 -p local_gb=80 -p cpus=2 \
  -p 'capabilities=boot_mode:bios,boot_option:local,server_hardware_type_uri:\
     /rest/server-hardware-types/E5366BF8-7CBF-48DF-A752-8670CF780BB2,server_profile_template_uri:
\
     /rest/server-profile-templates/00614918-77f8-4146-a8b8-9fc276cd6ab2' \
  -i 'server_hardware_uri=/rest/server-hardware/32353537-3835-584D-5135-313930373046' \
  -i dynamic_allocation=True \
  -i deploy_kernel=633d379d-e076-47e6-b56d-582b5b977683 \
  -i deploy_ramdisk=d5828785-edf2-49fa-8de2-3ddb7f3270d5

+-------------------+-------------------------------------------------------------------------+
| Property          | Value                                                                   |
+-------------------+-------------------------------------------------------------------------+
| chassis_uuid      |                                                                         |
| driver            | agent_pxe_oneview                                                       |
| driver_info       | {u'server_hardware_uri': u'/rest/server-                                |
|                   | hardware/32353537-3835-584D-5135-313930373046', u'dynamic_allocation':  |
|                   | u'True', u'deploy_ramdisk': u'd5828785-edf2-49fa-8de2-3ddb7f3270d5',    |
|                   | u'deploy_kernel': u'633d379d-e076-47e6-b56d-582b5b977683'}              |
| extra             | {}                                                                      |
| name              | test-node-1                                                             |
| network_interface | neutron                                                                 |
| properties        | {u'memory_mb': 131072, u'cpu_arch': u'x86_64', u'local_gb': 80, u'cpus': |
|                   | 2, u'capabilities':                                                     |
|                   | u'boot_mode:bios,boot_option:local,server_hardware_type_uri:/rest       |
|                   | /server-hardware-types/E5366BF8-7CBF-                                   |
|                   | 48DF-A752-8670CF780BB2,server_profile_template_uri:/rest/server-profile- |
|                   | templates/00614918-77f8-4146-a8b8-9fc276cd6ab2'}                        |
| resource_class    | None                                                                    |
| uuid              | c202309c-97e2-4c90-8ae3-d4c95afdaf06                                    |
```

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

> **Note**
>
> - For deployments created via Ironic/HPE OneView integration, `memory_mb` property must reflect physical amount of RAM installed in the managed node. That is, for a server with 128 Gb of RAM it works out to 132*1024=13072.
> - Boot mode in capabilities property must reflect boot mode used by the server, that is 'bios' for Legacy BIOS and 'uefi' for UEFI.
> - Values for `server_hardware_type_uri`, `server_profile_template_uri` and `server_hardware_uri` can be grabbed from browser URL field while navigating to respective objects in HPE OneView UI. URI corresponds to the part of URL which starts form the token `/rest`. That is, the URL `https://oneview.mycorp.net/#/profile-templates/show/overview/r/rest/server-profile-templates/12345678-90ab-cdef-0123-012345678901` corresponds to the URI `/rest/server-profile-templates/12345678-90ab-cdef-0123-012345678901`.
> - Grab IDs of `deploy_kernel` and `deploy_ramdisk` from **glance image list** output above.

4. Create port.

```
$ ironic --ironic-api-version 1.22 port-create \
  --address aa:bb:cc:dd:ee:ff \
  --node c202309c-97e2-4c90-8ae3-d4c95afdaf06 \
  -l switch_id=ff:ee:dd:cc:bb:aa \
  -l switch_info=MY_SWITCH \
  -l port_id="Ten-GigabitEthernet 1/0/1" \
  --pxe-enabled true
+-----------------------+----------------------------------------------------------------+
| Property              | Value                                                          |
+-----------------------+----------------------------------------------------------------+
| address               | 8c:dc:d4:b5:7d:1c                                              |
| extra                 | {}                                                             |
| local_link_connection | {u'switch_info': u'C20DATA', u'port_id': u'Ten-GigabitEthernet |
|                       | 1/0/1',    u'switch_id': u'ff:ee:dd:cc:bb:aa'}                 |
| node_uuid             | c202309c-97e2-4c90-8ae3-d4c95afdaf06                           |
| pxe_enabled           | True                                                           |
| uuid                  | 75b150ef-8220-4e97-ac62-d15548dc8ebe                           |
```

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

> **Warning**
>
> Ironic Multi-Tenancy networking model is used in this example. Therefore, ironic port-create command contains information about the physical switch. HPE OneView integration can also be performed using the Ironic Flat Networking model. For more information, see *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 9 "Example Configurations", Section 9.6 "Ironic Examples"*.

5. Move node to manageable provisioning state. The connectivity between Ironic and HPE OneView will be verified, Server Hardware Template settings validated, and Server Hardware power status retrieved from HPE OneView and set into the Ironic node.

```
$ ironic node-set-provision-state test-node-1 manage
```

6. Verify that node power status is populated.

```
$ ironic node-show test-node-1
+----------------------+-----------------------------------------------------------------------+
| Property             | Value                                                                 |
+----------------------+-----------------------------------------------------------------------+
| chassis_uuid         |                                                                       |
| clean_step           | {}                                                                    |
| console_enabled      | False                                                                 |
| created_at           | 2017-06-30T21:00:26+00:00                                             |
| driver               | agent_pxe_oneview                                                     |
| driver_info          | {u'server_hardware_uri': u'/rest/server-                              |
|                      | hardware/32353537-3835-584D-5135-313930373046', u'dynamic_allocation':|
|                      | u'True', u'deploy_ramdisk': u'd5828785-edf2-49fa-8de2-3ddb7f3270d5',  |
|                      | u'deploy_kernel': u'633d379d-e076-47e6-b56d-582b5b977683'}            |
| driver_internal_info | {}                                                                    |
| extra                | {}                                                                    |
| inspection_finished_at| None                                                                 |
| inspection_started_at | None                                                                 |
| instance_info        | {}                                                                    |
| instance_uuid        | None                                                                  |
| last_error           | None                                                                  |
| maintenance          | False                                                                 |
| maintenance_reason   | None                                                                  |
| name                 | test-node-1                                                           |
| network_interface    |                                                                       |
| power_state          | power off                                                             |
| properties           | {u'memory_mb': 131072, u'cpu_arch': u'x86_64', u'local_gb': 80,       |
|                      | u'cpus': 2, u'capabilities':                                          |
|                      | u'boot_mode:bios,boot_option:local,server_hardware_type_uri:/rest     |
|                      | /server-hardware-types/E5366BF8-7CBF-                                 |
|                      | 48DF-A752-86...BB2,server_profile_template_uri:/rest/server-profile-  |
|                      | templates/00614918-77f8-4146-a8b8-9fc276cd6ab2'}                      |
```

```
| provision_state       | manageable                                                            |
| provision_updated_at  | 2017-06-30T21:04:43+00:00                                             |
| raid_config           |                                                                       |
| reservation           | None                                                                  |
| resource_class        |                                                                       |
| target_power_state    | None                                                                  |
| target_provision_state| None                                                                  |
| target_raid_config    |                                                                       |
| updated_at            | 2017-06-30T21:04:43+00:00                                             |
| uuid                  | c202309c-97e2-4c90-8ae3-d4c95afdaf06                                  |
+-----------------------+-----------------------------------------------------------------------+
```

7. Move node to available provisioning state. The Ironic node will be reported to Nova as available.

```
$ ironic node-set-provision-state test-node-1 provide
```

8. Verify that node resources were added to Nova hypervisor stats.

```
$ nova hypervisor-stats
+----------------------+--------+
| Property             | Value  |
+----------------------+--------+
| count                | 1      |
| current_workload     | 0      |
| disk_available_least | 80     |
| free_disk_gb         | 80     |
| free_ram_mb          | 131072 |
| local_gb             | 80     |
| local_gb_used        | 0      |
| memory_mb            | 131072 |
| memory_mb_used       | 0      |
| running_vms          | 0      |
| vcpus                | 2      |
| vcpus_used           | 0      |
+----------------------+--------+
```

9. Create Nova flavor.

```
$ nova flavor-create m1.ironic auto 131072 80 2
+-------------+-----------+--------+------+-----------+------+-------+-------------+-----------+
| ID          | Name      | Mem_MB | Disk | Ephemeral | Swap | VCPUs | RXTX_Factor | Is_Public |
+-------------+-----------+--------+------+-----------+------+-------+-------------+-----------+
| 33c8...f8d8 | m1.ironic | 131072 | 80   | 0         |      | 2     | 1.0         | True      |
+-------------+-----------+--------+------+-----------+------+-------+-------------+-----------+
$ nova flavor-key m1.ironic set capabilities:boot_mode="bios"
$ nova flavor-key m1.ironic set capabilities:boot_option="local"
$ nova flavor-key m1.ironic set cpu_arch=x86_64
```

> **Note**
>
> All parameters (specifically, amount of RAM and boot mode) must correspond to ironic node parameters.

10. Create Nova keypair if needed.

```
$ nova keypair-add ironic_kp --pub-key ~/.ssh/id_rsa.pub
```

11. Boot Nova instance.

```
$ nova boot --flavor m1.ironic --image d6b5...e942 --key-name ironic_kp \
  --nic net-id=5f36...dcf3 test-node-1
+-------------------------------+-----------------------------------------------------+
| Property                      | Value                                               |
+-------------------------------+-----------------------------------------------------+
| OS-DCF:diskConfig             | MANUAL                                              |
| OS-EXT-AZ:availability_zone   |                                                     |
| OS-EXT-SRV-ATTR:host          | -                                                   |
| OS-EXT-SRV-ATTR:              |                                                     |
|       hypervisor_hostname     | -                                                   |
| OS-EXT-SRV-ATTR:instance_name |                                                     |
| OS-EXT-STS:power_state        | 0                                                   |
| OS-EXT-STS:task_state         | scheduling                                          |
| OS-EXT-STS:vm_state           | building                                            |
| OS-SRV-USG:launched_at        | -                                                   |
| OS-SRV-USG:terminated_at      | -                                                   |
| accessIPv4                    |                                                     |
| accessIPv6                    |                                                     |
| adminPass                     | pE3m7wRACvYy                                        |
| config_drive                  |                                                     |
| created                       | 2017-06-30T21:08:42Z                                |
| flavor                        | m1.ironic (33c81884-b8aa-46...3b72f8d8)             |
| hostId                        |                                                     |
| id                            | b47c9f2a-e88e-411a-abcd-6172aea45397                |
| image                         | Ubuntu Trusty 14.04 BIOS (d6b5d971-42...5f2d88e942) |
| key_name                      | ironic_kp                                           |
| metadata                      | {}                                                  |
| name                          | test-node-1                                         |
| os-extended-volumes:          |                                                     |
|       volumes_attached        | []                                                  |
| progress                      | 0                                                   |
| security_groups               | default                                             |
| status                        | BUILD                                               |
| tenant_id                     | c8573f7026d24093b40c769ca238fddc                    |
| updated                       | 2017-06-30T21:08:42Z                                |
| user_id                       | 2eae99221545466d8f175eeb566cc1b4                    |
+-------------------------------+-----------------------------------------------------+
```

During nova instance boot, the following operations will be performed by Ironic via HPE OneView REST API.

- In HPE OneView, new Server Profile is generated for specified Server Hardware, using specified Server Profile Template. Boot order in Server Profile is set to list PXE as the first boot source.
- The managed node is powered on and boots IPA image from PXE.
- IPA image writes user image onto disk and reports success back to Ironic.
- Ironic modifies Server Profile in HPE OneView to list 'Disk' as default boot option.
- Ironic reboots the node (via HPE OneView REST API call).

22.3 SUSE Enterprise Storage Integration

The current version of SUSE OpenStack Cloud supports integration with SUSE Enterprise Storage (SES). Integrating SUSE Enterprise Storage enables Ceph block storage as well as object and image storage services in SUSE OpenStack Cloud.

22.3.1 Enabling SUSE Enterprise Storage Integration

The SUSE Enterprise Storage integration is provided through the `ardana-ses` RPM package. This package is included in the `patterns-cloud-ardana` pattern, its installation is covered in *Chapter 3, Installing the Cloud Lifecycle Manager server*. The update repositories and the installation covered there are required to support SUSE Enterprise Storage integration. The latest updates should be applied before proceeding.

22.3.2 Configuration

After the SUSE Enterprise Storage integration package has been installed, it must be configured. Files that contain relevant SUSE Enterprise Storage/Ceph deployment information must be placed into a directory on the deployer node. This includes the configuration file that describes various aspects of the Ceph environment as well as keyrings for each user and pool created in the Ceph environment. In addition to that, you need to edit the `settings.yml` file to enable the SUSE Enterprise Storage integration to run and update all of the SUSE OpenStack Cloud service configuration files.

The `settings.yml` file resides in the `~/openstack/my_cloud/config/ses/` directory. Open the file for editing, uncomment the `ses_config_path:` parameter to specify the location on the deployer host containing the `ses_config.yml` file and all Ceph keyring files. For example:

```
# the directory where the ses config files are.
ses_config_path: /var/lib/ardana/openstack/my_cloud/config/ses/
ses_config_file: ses_config.yml

# Allow nova libvirt images_type to be set to rbd?
# Set this to false, if you only want rbd_user and rbd_secret to be set
# in the [libvirt] section of hypervisor.conf
ses_nova_set_images_type: True

# The unique uuid for use with virsh for cinder and nova
ses_secret_id: 457eb676-33da-42ec-9a8c-9293d545c337
```

Important

If you are integrating with SUSE Enterprise Storage and do not want to store Nova images in Ceph, change the line in `settings.yml` from `ses_nova_set_images_type: True` to `ses_nova_set_images_type: False`

For security reasons, you should use a unique UUID in the `settings.yml` file for `ses_secret_id`, replacing the fixed, hard-coded UUID in that file. You can generate a UUID that will be unique to your deployment using the command **`uuidgen`**.

For SES deployments that have version 5.5 and higher, there is a Salt runner that can create all the users, keyrings, and pools. It will also generate a yaml configuration that is needed to integrate with SUSE OpenStack Cloud. The integration runner will create the `cinder`, `cinder-backup`, and `glance` Ceph users. Both the Cinder and Nova services will have the same user, as Cinder needs access to create objects that Nova uses.

Login in as root to run the SES 5.5 Salt runner on the salt admin host.

```
root # salt-run --out=yaml openstack.integrate prefix=mycloud
```

The prefix parameter allows pools to be created with the specified prefix. In this way, multiple cloud deployments can use different users and pools on the same SES deployment.

The sample yaml output:

```
ceph_conf:
 cluster_network: 10.84.56.0/21
 fsid: d5d7c7cb-5858-3218-a36f-d028df7b0673
 mon_host: 10.84.56.8, 10.84.56.9, 10.84.56.7
 mon_initial_members: ses-osd1, ses-osd2, ses-osd3
 public_network: 10.84.56.0/21
 cinder:
 key: AQCdfIRaxefEMxAAW4zp2My/5HjoST2Y8mJg8A==
 rbd_store_pool: mycloud-cinder
 rbd_store_user: cinder
 cinder-backup:
 key: AQBb8hdbrY2bNRAAqJC2ZzR5Q4yrionh7V5PkQ==
 rbd_store_pool: mycloud-backups
 rbd_store_user: cinder-backup
 glance:
 key: AQD9eYRachg1NxAAiT6Hw/xYDA1vwSWLItLpgA==
 rbd_store_pool: mycloud-glance
 rbd_store_user: glance
 nova:
 rbd_store_pool: mycloud-nova
 radosgw_urls:
     - http://10.84.56.7:80/swift/v1
     - http://10.84.56.8:80/swift/v1
```

After you have run the `openstack.integrate` runner, copy the yaml output into the new `ses_config.yml` file, and save this file in the path specified in the `settings.yml` file on the deployer node. In this case, the file `ses_config.yml` must be saved in the `/var/lib/ardana/openstack/my_cloud/config/ses/` directory on the deployer node.

For SUSE Enterprise Storage/Ceph deployments that have version older than 5.5, the following applies. For Ceph, it is necessary to create pools and users to allow the SUSE OpenStack Cloud services to use the SUSE Enterprise Storage/Ceph cluster. Pools and users must be created for the Cinder, Cinder backup, and Glance services. Both the Cinder and Nova services must have the same user, as Cinder needs access to create objects that Nova uses. Instructions for creating and managing pools, users and keyrings is covered in the SUSE Enterprise Storage documentation under Key Management (https://documentation.suse.com/en-us/ses/5.5/single-html/ses-admin/#storage-cephx-keymgmt).

Example of `ses_config.yml`:

```
ses_cluster_configuration:
    ses_cluster_name: ceph
```

```
    ses_radosgw_url: "https://192.168.56.8:8080/swift/v1"

    conf_options:
        ses_fsid: d5d7c7cb-5858-3218-a36f-d028df7b1111
        ses_mon_initial_members: ses-osd2, ses-osd3, ses-osd1
        ses_mon_host: 192.168.56.8, 192.168.56.9, 192.168.56.7
        ses_public_network: 192.168.56.0/21
        ses_cluster_network: 192.168.56.0/21

    cinder:
        rbd_store_pool: cinder
        rbd_store_pool_user: cinder
        keyring_file_name: ceph.client.cinder.keyring

    cinder-backup:
        rbd_store_pool: backups
        rbd_store_pool_user: cinder_backup
        keyring_file_name: ceph.client.cinder-backup.keyring

    # Nova uses the cinder user to access the nova pool, cinder pool
    # So all we need here is the nova pool name.
    nova:
        rbd_store_pool: nova

    glance:
        rbd_store_pool: glance
        rbd_store_pool_user: glance
        keyring_file_name: ceph.client.glance.keyring
```

Example contents of the directory specified in `settings.yml` file:

```
ardana > ~/openstack/my_cloud/config/ses> ls -al
ceph.client.cinder-backup.keyring
ceph.client.cinder.keyring
ceph.client.glance.keyring
ses_config.yml
```

Modify the `glance_default_store` option in `~/openstack/my_cloud/definition/data/control_plane.yml`:

```
.
.
            - rabbitmq
#            - glance-api
            - glance-api:
```

```
            glance_default_store: 'rbd'
        - glance-registry
        - glance-client
```

1. Commit your configuration to your local git repo:

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > git add -A
   ardana > git commit -m "add SES integration"
   ```

2. Run the configuration processor.

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
   ```

3. Create a deployment directory.

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
   ```

4. Run a series of reconfiguration playbooks.

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible
   ardana > ansible-playbook -i hosts/verb_hosts ses-deploy.yml
   ardana > ansible-playbook -i hosts/verb_hosts cinder-reconfigure.yml
   ardana > ansible-playbook -i hosts/verb_hosts glance-reconfigure.yml
   ardana > ansible-playbook -i hosts/verb_hosts nova-reconfigure.yml
   ```

Configuring SUSE Enterprise Storage for Integration with RADOS Gateway

RADOS gateway integration can be enabled (disabled) by adding (removing) the following line in the `ses_config.yml`:

```
ses_radosgw_url: "https://192.168.56.8:8080/swift/v1"
```

If RADOS gateway integration is enabled, additional SUSE Enterprise Storage configuration is needed. RADOS gateway must be configured to use Keystone for authentication. This is done by adding the configuration statements below to the rados section of `ceph.conf` on the RADOS node.

```
[client.rgw.HOSTNAME]
rgw frontends = "civetweb port=80+443s"
rgw enable usage log = true
rgw keystone url = KEYSTONE_ENDPOINT (for example:
https://192.168.24.204:5000)
```

```
rgw keystone admin user = KEYSTONE_ADMIN_USER
rgw keystone admin password = KEYSTONE_ADMIN_PASSWORD
rgw keystone admin project = KEYSTONE_ADMIN_PROJECT
rgw keystone admin domain = KEYSTONE_ADMIN_DOMAIN
rgw keystone api version = 3
rgw keystone accepted roles = admin,Member,_member_
rgw keystone accepted admin roles = admin
rgw keystone revocation interval = 0
rgw keystone verify ssl = false # If keystone is using self-signed
   certificate
```

After making these changes to `ceph.conf`, the RADOS gateway service needs to be restarted.

Enabling RADOS gateway replaces the existing Object Storage endpoint with the RADOS gateway endpoint.

Enabling HTTPS, Creating and Importing a Certificate

SUSE Enterprise Storage integration uses the HTTPS protocol to connect to the RADOS gateway. However, with SUSE Enterprise Storage 5, HTTPS is not enabled by default. To enable the gateway role to communicate securely using SSL, you need to either have a CA-issued certificate or create a self-signed one. Instructions for both are available in the SUSE Enterprise Storage documentation (https://documentation.suse.com/ses/5.5/single-html/ses-admin/#ceph-rgw-access).

The certificate needs to be installed on your Cloud Lifecycle Manager. On the Cloud Lifecycle Manager, copy the cert to `/tmp/ardana_tls_cacerts`. Then deploy it.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts tls-trust-deploy.yml
ardana > ansible-playbook -i hosts/verb_hosts tls-reconfigure.yml
```

When creating the certificate, the `subjectAltName` must match the `ses_radosgw_url` entry in `ses_config.yml`. Either an IP address or FQDN can be used, but these values must be the same in both places.

22.3.3 Deploying SUSE Enterprise Storage Configuration for RADOS Integration

The following steps will deploy your configuration.

1. Commit your configuration to your local git repo.

   ```
   ardana > cd ~/openstack/ardana/ansible
   ardana > git add -A
   ```

```
ardana > git commit -m "add SES integration"
```

2. Run the configuration processor.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

3. Create a deployment directory.

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

4. Run a series of reconfiguration playbooks.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ses-deploy.yml
ardana > ansible-playbook -i hosts/verb_hosts cinder-reconfigure.yml
ardana > ansible-playbook -i hosts/verb_hosts glance-reconfigure.yml
ardana > ansible-playbook -i hosts/verb_hosts nova-reconfigure.yml
```

5. Reconfigure the Cloud Lifecycle Manager to complete the deployment.

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ardana-reconfigure.yml
```

22.3.4 Enable Copy-On-Write Cloning of Images

Due to a security issue described in http://docs.ceph.com/docs/master/rbd/rbd-openstack/?highlight=uuid#enable-copy-on-write-cloning-of-images, we do not recommend the copy-on-write cloning of images when Glance and Cinder are both using a Ceph back-end. However, if you want to use this feature for faster operation, you can enable it as follows.

1. Open the `~/openstack/my_cloud/config/glance/glance-api.conf.j2` file for editing and add `show_image_direct_url = True` under the `[DEFAULT]` section.

2. Commit changes:

```
git add -A
git commit -m "Enable Copy-on-Write Cloning"
```

3. Run the required playbooks:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

```
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
cd /var/lib/ardana/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts glance-reconfigure.yml
```

Warning

Note that this exposes the back-end location via Glance's API, so the end-point should not be publicly accessible when Copy-On-Write image cloning is enabled.

22.3.5 Improve SUSE Enterprise Storage Storage Performance

SUSE Enterprise Storage performance can be improved with Image-Volume cache. Be aware that Image-Volume cache and Copy-on-Write cloning cannot be used for the same storage back-end. For more information, see the OpenStack documentation (https://docs.openstack.org/cinder/pike/admin/blockstorage-image-volume-cache.html).

Enable Image-Volume cache with the following steps:

1. Open the `~/openstack/my_cloud/config/cinder/cinder.conf.j2` file for editing.
2. Add `image_volume_cache_enabled = True` option under the `[ses_ceph]` section.
3. Commit changes:

```
ardana > git add -A
ardana > git commit -m "Enable Image-Volume cache"
```

4. Run the required playbooks:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
ardana > cd /var/lib/ardana/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts cinder-reconfigure.yml
```

23 Troubleshooting the Installation

We have gathered some of the common issues that occur during installation and organized them by when they occur during the installation. These sections will coincide with the steps labeled in the installation instructions.

- *Section 23.1, "Issues during Cloud Lifecycle Manager Setup"*
- *Section 23.2, "Issues while Updating Configuration Files"*
- *Section 23.3, "Issues while Deploying the Cloud"*

23.1 Issues during Cloud Lifecycle Manager Setup

Issue: Running the ardana-init.bash script when configuring your Cloud Lifecycle Manager does not complete

Part of what the `ardana-init.bash` script does is install Git. So if your DNS server(s) is/are not specified in your `/etc/resolv.conf` file, is not valid, or is not functioning properly on your Cloud Lifecycle Manager, it will not be able to complete.

To resolve this issue, double check your nameserver in your `/etc/resolv.conf` file and then re-run the script.

23.2 Issues while Updating Configuration Files

Configuration Processor Fails Due to Wrong yml Format

If you receive the error below when running the configuration processor then you may have a formatting error:

```
TASK: [fail msg="Configuration processor run failed, see log output above for
details"]
```

First you should check the Ansible log in the location below for more details on which yml file in your input model has the error:

```
~/.ansible/ansible.log
```

Check the configuration file to locate and fix the error, keeping in mind the following tips below. Check your files to ensure that they do not contain the following:

- Non-ascii characters
- Unneeded spaces

Once you have fixed the formatting error in your files, commit the changes with these steps:

1. Commit your changes to Git:

   ```
   cd ~/openstack/ardana/ansible
   git add -A
   git commit -m "My config or other commit message"
   ```

2. Re-run the configuration processor playbook and confirm the error is not received again.

Configuration processor fails with provider network OCTAVIA-MGMT-NET error

If you receive the error below when running the configuration processor then you have not correctly configured your VLAN settings for Octavia.

```
################################################################################,
# The configuration processor failed.
#   config-data-2.0           ERR: Provider network OCTAVIA-MGMT-NET host_routes:
# destination '192.168.10.0/24' is not defined as a Network in the input model.
# Add 'external: True' to this host_route if this is for an external network.
################################################################################
```

To resolve the issue, ensure that your settings in `~/openstack/my_cloud/definition/data/neutron/neutron_config.yml` are correct for the VLAN setup for Octavia.

Changes Made to your Configuration Files

If you have made corrections to your configuration files and need to re-run the Configuration Processor, the only thing you need to do is commit your changes to your local Git repository:

```
cd ~/openstack/ardana/ansible
```

```
git add -A
git commit -m "commit message"
```

You can then re-run the configuration processor:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml
```

Configuration Processor Fails Because Encryption Key Does Not Meet Requirements

If you choose to set an encryption password when running the configuration processor, you may receive the following error if the chosen password does not meet the complexity requirements:

```
################################################################################
# The configuration processor failed.
#   encryption-key ERR: The Encryption Key does not meet the following requirement(s):
#       The Encryption Key must be at least 12 characters
#       The Encryption Key must contain at least 3 of following classes of characters:
#                           Uppercase Letters, Lowercase Letters, Digits, Punctuation
################################################################################
```

If you receive the above error, run the configuration processor again and select a password that meets the complexity requirements detailed in the error message:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml
```

23.3 Issues while Deploying the Cloud

Issue: If the site.yml playbook fails, you can query the log for the reason

Ansible is good about outputting the errors into the command line output, however if you would like to view the full log for any reason the location is:

```
~/.ansible/ansible.log
```

This log is updated real time as you run Ansible playbooks.

> **Tip**
>
> Use grep to parse through the log. Usage: `grep <text> ~/.ansible/ansible.log`

Issue: How to Wipe the Disks of your Machines

If you have re-run the `site.yml` playbook, you may need to wipe the disks of your nodes

You should run the `wipe_disks.yml` playbook only after re-running the `bm-reimage.yml` playbook but before you re-run the `site.yml` playbook.

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts wipe_disks.yml
```

The playbook will show you the disks to be wiped in the output and allow you to confirm that you want to complete this action or abort it if you do not want to proceed. You can optionally use the `--limit <NODE_NAME>` switch on this playbook to restrict it to specific nodes. This action will not affect the OS partitions on the servers.

If you receive an error stating that `osconfig` has already run on your nodes then you will need to remove the `/etc/ardana/osconfig-ran` file on each of the nodes you want to wipe with this command:

```
sudo rm /etc/ardana/osconfig-ran
```

That will clear this flag and allow the disk to be wiped.

Issue: Freezer installation fails if an independent network is used for the External_API

The Freezer installation fails if an independent network is used for the External_API. If you intend to deploy the External API on an independent network, the following changes need to be made:

In `roles/freezer-agent/defaults/main.yml` add the following line:

```
backup_freezer_api_url: "{{ FRE_API | item('advertises.vips.private[0].url', default=' ') }}"
```

In `roles/freezer-agent/templates/backup.osrc.j2` add the following line:

```
export OS_FREEZER_URL={{ backup_freezer_api_url }}
```

Error Received if Root Logical Volume is Too Small

When running the `site.yml` playbook, you may receive a message that includes the error below if your root logical volume is too small. This error needs to be parsed out and resolved.

```
2015-09-29 15:54:03,022 p=26345 u=stack | stderr: New size given (7128 extents)
not larger than existing size (7629 extents)
```

The error message may also reference the root volume:

```
"name": "root", "size": "10%"
```

The problem here is that the root logical volume, as specified in the `disks_controller.yml` file, is set to `10%` of the overall physical volume and this value is too small.

To resolve this issue you need to ensure that the percentage is set properly for the size of your logical-volume. The default values in the configuration files is based on a 500 GB disk, so if your logical volumes are smaller you may need to increase the percentage so there is enough room.

Multiple Keystone Failures Received during site.yml

If you receive the Keystone error below during your `site.yml` run then follow these steps:

```
TASK: [OPS-MON | _keystone_conf | Create Ops Console service in Keystone] *****
failed:
[...]
msg: An unexpected error prevented the server from fulfilling your request.
(HTTP 500) (Request-ID: req-23a09c72-5991-4685-b09f-df242028d742), failed

FATAL: all hosts have already failed -- aborting
```

The most likely cause of this error is that the virtual IP address is having issues and the Keystone API communication through the virtual IP address is not working properly. You will want to check the Keystone log on the controller where you will likely see authorization failure errors.

Verify that your virtual IP address is active and listening on the proper port on all of your controllers using this command:

```
netstat -tplan | grep 35357
```

Ensure that your Cloud Lifecycle Manager did not pick the wrong (unusable) IP address from the list of IP addresses assigned to your Management network.

The Cloud Lifecycle Manager will take the first available IP address after the `gateway-ip` defined in your `~/openstack/my_cloud/definition/data/networks.yml` file. This IP will be used as the virtual IP address for that particular network. If this IP address is used and reserved for another purpose outside of your SUSE OpenStack Cloud deployment then you will receive the error above.

To resolve this issue we recommend that you utilize the `start-address` and possibly the `end-address` (if needed) options in your `networks.yml` file to further define which IP addresses you want your cloud deployment to use. For more information, see *Book* “Planning an Installation with Cloud Lifecycle Manager”, *Chapter 6 “Configuration Objects”, Section 6.14 “Networks”*.

After you have made changes to your `networks.yml` file, follow these steps to commit the changes:

1. Ensuring that you stay within the `~/openstack` directory, commit the changes you just made:

```
cd ~/openstack
git commit -a -m "commit message"
```

2. Run the configuration processor:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml
```

3. Update your deployment directory:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost ready-deployment.yml
```

4. Re-run the site.yml playbook:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts site.yml
```

24 Troubleshooting the ESX

This section contains troubleshooting tasks for your SUSE® OpenStack Cloud 8 for ESX.

24.1 Issue: ardana-service.service is not running

If you perform any maintenance work or reboot the Cloud Lifecycle Manager/deployer node, make sure to restart the Cloud Lifecycle Manager API service for standalone deployer node and shared Cloud Lifecycle Manager/controller node based on your environment.

For standalone deployer node, execute `ardana-start.yml` playbook to restart the Cloud Lifecycle Manager API service on the deployer node after a reboot.

For shared deployer/controller node, execute `ardana-start.yml` playbook on all the controllers to restart Cloud Lifecycle Manager API service.

For example:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts ardana-start.yml --limit HOST_NAME
```

Replace *`HOST_NAME`* with the host name of the Cloud Lifecycle Manager node or the Cloud Lifecycle Manager Node/Shared Controller.

24.2 Issue: ESX Cluster shows UNKNOWN in Operations Console

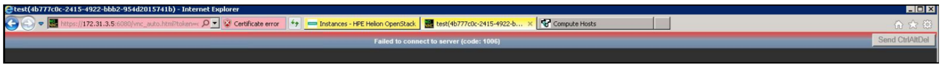
In the Operations Console Alarms dashboard, if all the alarms for ESX cluster are showing UNKNOWN then restart the `openstack-monasca-agent` running in ESX compute proxy.

1. SSH to the respective compute proxy. You can find the hostname of the proxy from the dimensions list shown against the respective alarm.
2. Restart the `openstack-monasca-agent` service.

   ```
   sudo systemctl restart openstack-monasca-agent
   ```

24.3 Issue: Unable to view the VM console in Horizon UI

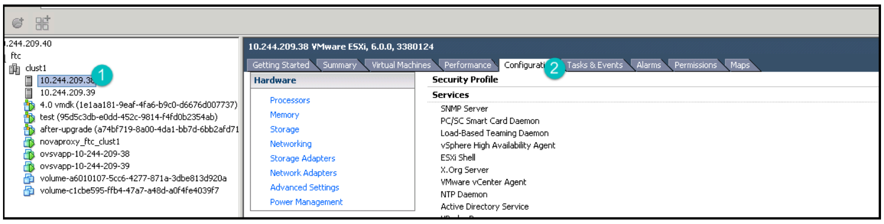
By default the gdbserver firewall is disabled in ESXi host which results in a Handshake error when accessing the VM instance console in the Horizon UI.



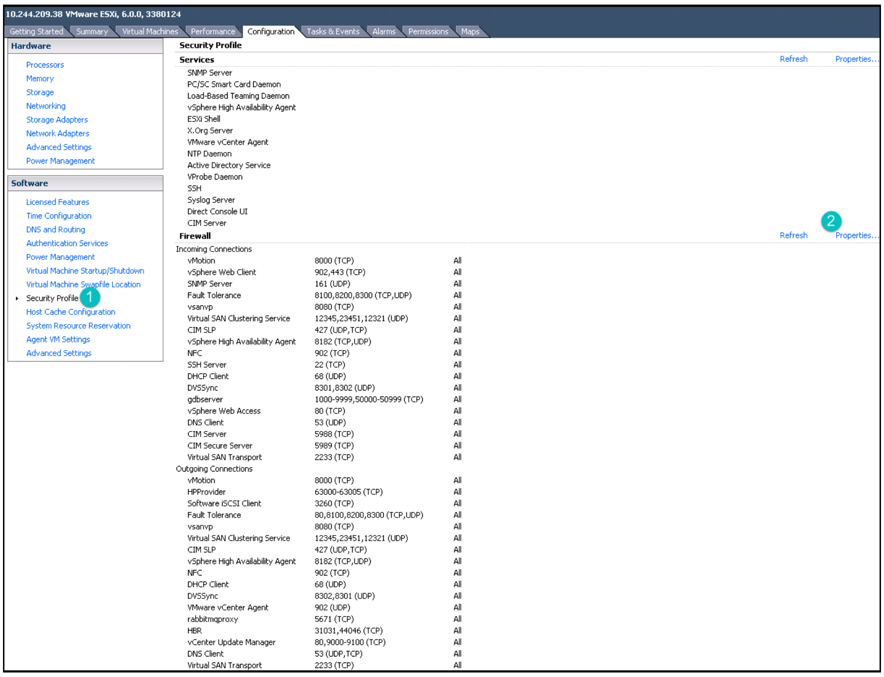
Procedure to enable gdbserver

1. Login to vSphere Client.

2. Select the ESXi Host and click *Configuration* tab in the menu bar. You must perform the following actions on all the ESXi hosts in the compute clusters.

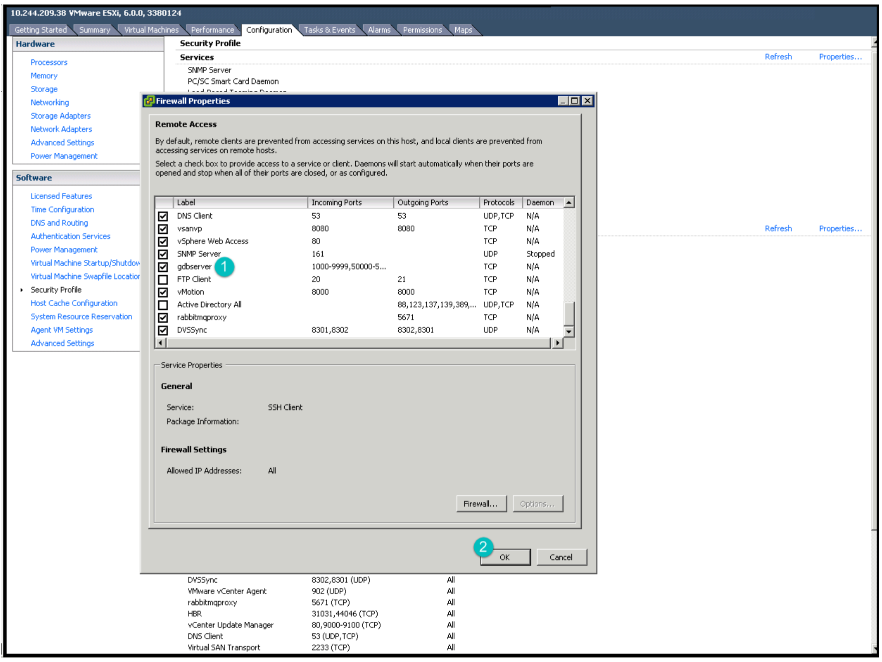


3. On the left hand side select **Security Profile** from the list of **Software**. Click **Properties** on the right hand side.



Firewall Properties box displays.

4. Select **gdbserver** checkbox and click **OK**.



III Post-Installation

25 Overview

Once you have completed your cloud deployment, these are some of the common post-installation tasks you may need to perform. Take a look at the descriptions below to determine which of these you need to do.

26 Cloud Verification

Once you have completed your cloud deployment, these are some of the common post-installation tasks you may need to perform to verify your cloud installation.

26.1 API Verification

SUSE OpenStack Cloud 8 provides a tool, Tempest, that you can use to verify that your cloud deployment completed successfully:

- *Section 26.1.1, "Prerequisites"*
- *Section 26.1.2, "Tempest Integration Tests"*
  - *Section 26.1.3, "Running the Tests"*
  - *Section 26.1.4, "Viewing Test Results"*
  - *Section 26.1.5, "Customizing the Test Run"*
- *Section 27.1, "Verifying Your Block Storage Backend"*
- *Section 27.2, "Verify the Object Storage (Swift) Operations"*

26.1.1 Prerequisites

The verification tests rely on you having an external network setup and a cloud image in your image (Glance) repository. Run the following playbook to configure your cloud:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts ardana-cloud-configure.yml
```

> **Note**
>
> In SUSE OpenStack Cloud 8, the EXT_NET_CIDR setting for the external network is now specified in the input model - see *Book* "Planning an Installation with Cloud Lifecycle Manager", *Chapter 6 "Configuration Objects", Section 6.16 "Configuration Data", Section 6.16.2 "Neutron Configuration Data", Section 6.16.2.2 "neutron-external-networks"*.

26.1.2 Tempest Integration Tests

Tempest is a set of integration tests for OpenStack API validation, scenarios, and other specific tests to be run against a live OpenStack cluster. In SUSE OpenStack Cloud 8, Tempest has been modeled as a service and this gives you the ability to locate Tempest anywhere in the cloud. It is recommended that you install Tempest on your Cloud Lifecycle Manager node - that is where it resides by default in a new installation.

A version of the upstream Tempest (http://docs.openstack.org/developer/tempest/) integration tests is pre-deployed on the Cloud Lifecycle Manager node. For details on what Tempest is testing, you can check the contents of this file on your Cloud Lifecycle Manager:

```
/opt/stack/tempest/run_filters/ci.txt
```

You can use these embedded tests to verify if the deployed cloud is functional.

For more information on running Tempest tests, see Tempest - The OpenStack Integration Test Suite (https://git.openstack.org/cgit/openstack/tempest/tree/README.rst).

> **Important**
>
> Running these tests requires access to the deployed cloud's identity admin credentials

Tempest creates and deletes test accounts and test resources for test purposes.

In certain cases Tempest might fail to clean-up some of test resources after a test is complete, for example in case of failed tests.

26.1.3 Running the Tests

To run the default set of Tempest tests:

1. Log in to the Cloud Lifecycle Manager.

2. Ensure you can access your cloud:

   ```
   cd ~/scratch/ansible/next/ardana/ansible
   ansible-playbook -i hosts/verb_hosts cloud-client-setup.yml
   source /etc/environment
   ```

3. Run the tests:

   ```
   cd ~/scratch/ansible/next/ardana/ansible
   ```

```
ansible-playbook -i hosts/verb_hosts tempest-run.yml
```

Optionally, you can *Section 26.1.5, "Customizing the Test Run"*.

26.1.4 Viewing Test Results

Tempest is deployed under `/opt/stack/tempest`. Test results are written in a log file in the following directory:

```
/opt/stack/tempest/logs
```

A detailed log file is written to:

```
/opt/stack/tempest/tempest.log
```

The results are also stored in the `testrepository` database.

To access the results after the run:

1. Log in to the Cloud Lifecycle Manager.
2. Change to the `tempest` directory and list the test results:

   ```
   cd /opt/stack/tempest
   ./venv/bin/testr last
   ```

> **Important**
>
> If you encounter an error saying "local variable 'run_subunit_content' referenced before assignment", you may need to log in as the `tempest` user to run this command. This is due to a known issue reported at https://bugs.launchpad.net/testrepository/+bug/1348970.

See Test Repository Users Manual (https://testrepository.readthedocs.org/en/latest/) for more details on how to manage the test result repository.

26.1.5 Customizing the Test Run

There are several ways available to customize which tests will be executed.

- *Section 26.1.6, “Run Tests for Specific Services and Exclude Specific Features”*
- *Section 26.1.7, “Run Tests Matching a Series of White and Blacklists”*

26.1.6 Run Tests for Specific Services and Exclude Specific Features

Tempest allows you to test specific services and features using the `tempest.conf` configuration file.

A working configuration file with inline documentation is deployed under `/opt/stack/tempest/etc/`.

To use this, follow these steps:

1. Log in to the Cloud Lifecycle Manager.
2. Edit the `/opt/stack/tempest/configs/tempest_region0.conf` file.
3. To test specific service, edit the `[service_available]` section and clear the comment character `#` and set a line to `true` to test that service or `false` to not test that service.

   ```
   cinder = true
   neutron = false
   ```

4. To test specific features, edit any of the `*_feature_enabled` sections to enable or disable tests on specific features of a service.

   ```
   [volume-feature-enabled]
   [compute-feature-enabled]
   [identity-feature-enabled]
   [image-feature-enabled]
   [network-feature-enabled]
   [object-storage-feature-enabled]
   ```

   ```
   #Is the v2 identity API enabled (boolean value)
   api_v2 = true
   #Is the v3 identity API enabled (boolean value)
   api_v3 = false
   ```

5. Then run tests normally

26.1.7 Run Tests Matching a Series of White and Blacklists

You can run tests against specific scenarios by editing or creating a run filter file.

Run filter files are deployed under `/opt/stack/tempest/run_filters`.

Use run filters to whitelist or blacklist specific tests or groups of tests:

- lines starting with # or empty are ignored
- lines starting with `+` are whitelisted
- lines starting with `-` are blacklisted
- lines not matching any of the above conditions are blacklisted

If whitelist is empty, all available tests are fed to blacklist. If blacklist is empty, all tests from whitelist are returned.

Whitelist is applied first. The blacklist is executed against the set of tests returned by the whitelist.

To run whitelist and blacklist tests:

1. Log in to the Cloud Lifecycle Manager.
2. Make sure you can access the cloud:

   ```
   cd ~/scratch/ansible/next/ardana/ansible
   ansible-playbook -i hosts/verb_hosts cloud-client-setup.yml
   source /etc/environment
   ```

3. Run the tests:

   ```
   cd ~/scratch/ansible/next/ardana/ansible
   ansible-playbook -i hosts/verb_hosts tempest-run.yml  -e run_filter <run_filter_name>
   ```

Note that the run_filter_name is the name of the run_filter file except for the extension. For instance, to run using the filter from the file /opt/stack/tempest/run_filters/ci.txt, use the following:

```
ansible-playbook -i hosts/verb_hosts tempest-run.yml -e run_filter=ci
```

Documentation on the format of white and black-lists is available at:

```
/opt/stack/tempest/tests2skip.py
```

Example:

The following entries run API tests, exclude tests that are less relevant for deployment validation, such as negative, admin, cli and third-party (EC2) tests:

```
+tempest\.api\.*
*[Aa]dmin.*
*[Nn]egative.*
- tempest\.cli.*
- tempest\.thirdparty\.*
```

27 UI Verification

Once you have completed your cloud deployment, these are some of the common post-installation tasks you may need to perform to verify your cloud installation.

27.1 Verifying Your Block Storage Backend

The sections below will show you the steps to verify that your Block Storage backend was setup properly.

27.1.1 Create a Volume

Perform the following steps to create a volume using Horizon dashboard.

1. Log into the Horizon dashboard. For more information, see *Book “User Guide”, Chapter 3 “Cloud Admin Actions with the Dashboard”*.
2. Choose *Project* › *Compute* › *Volumes*.
3. On the *Volumes* tabs, click the *Create Volume* button to create a volume.
4. In the *Create Volume* options, enter the required details into the fields and then click the *Create Volume* button:
   a. Volume Name - This is the name you specify for your volume.
   b. Description (optional) - This is an optional description for the volume.
   c. Type - Select the volume type you have created for your volumes from the drop down.
   d. Size (GB) - Enter the size, in GB, you would like the volume to be.
   e. Availability Zone - You can either leave this at the default option of *Any Availability Zone* or select a specific zone from the drop-down box.

The dashboard will then show the volume you have just created.

27.1.2 Attach Volume to an Instance

Perform the following steps to attach a volume to an instance:

1. Log into the Horizon dashboard. For more information, see *Book "User Guide", Chapter 3 "Cloud Admin Actions with the Dashboard"*.
2. Choose *Project* › *Compute* › *Instances*.
3. In the *Action* column, choose the *Edit Attachments* in the drop-down box next to the instance you want to attach the volume to.
4. In the *Attach To Instance* drop-down, select the volume that you want to attach.
5. Edit the *Device Name* if necessary.
6. Click *Attach Volume* to complete the action.
7. On the *Volumes* screen, verify that the volume you attached is displayed in the *Attached To* columns.

27.1.3 Detach Volume from Instance

Perform the following steps to detach the volume from instance:

1. Log into the Horizon dashboard. For more information, see *Book "User Guide", Chapter 3 "Cloud Admin Actions with the Dashboard"*.
2. Choose *Project* › *Compute* › *Instances*.
3. Click the check box next to the name of the volume you want to detach.
4. In the *Action* column, choose the *Edit Attachments* in the drop-down box next to the instance you want to attach the volume to.
5. Click *Detach Attachment*. A confirmation dialog box appears.
6. Click *Detach Attachment* to confirm the detachment of the volume from the associated instance.

27.1.4 Delete Volume

Perform the following steps to delete a volume using Horizon dashboard:

1. Log into the Horizon dashboard. For more information, see *Book "User Guide", Chapter 3 "Cloud Admin Actions with the Dashboard"*.
2. Choose *Project* › *Compute* › *Volumes*.
3. In the *Actions* column, click *Delete Volume* next to the volume you would like to delete.
4. To confirm and delete the volume, click *Delete Volume* again.
5. Verify that the volume was removed from the *Volumes* screen.

27.1.5 Verifying Your Object Storage (Swift)

The following procedure shows how to validate that all servers have been added to the Swift rings:

1. Run the swift-compare-model-rings.yml playbook as follows:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts swift-compare-model-rings.yml
```

2. Search for output similar to the following. Specifically, look at the number of drives that are proposed to be added.

```
TASK: [swiftlm-ring-supervisor | validate-input-model | Print report] *********
ok: [ardana-cp1-c1-m1-mgmt] => {
    "var": {
        "report.stdout_lines": [
            "Rings:",
            "  ACCOUNT:",
            "    ring exists",
            "    no device changes",
            "    ring will be rebalanced",
            "  CONTAINER:",
            "    ring exists",
            "    no device changes",
            "    ring will be rebalanced",
            "  OBJECT-0:",
            "    ring exists",
```

```
            "    no device changes",
            "    ring will be rebalanced"
        ]
    }
}
```

3. If the text contains "no device changes" then the deploy was successful and no further action is needed.

4. If more drives need to be added, it indicates that the deploy failed on some nodes and that you restarted the deploy to include those nodes. However, the nodes are not in the Swift rings because enough time has not elapsed to allow the rings to be rebuilt. You have two options to continue:

   a. Repeat the deploy. There are two steps:

      i. Delete the ring builder files as described in *Book "Operations Guide", Chapter 15 "Troubleshooting Issues", Section 15.6 "Storage Troubleshooting", Section 15.6.2 "Swift Storage Troubleshooting", Section 15.6.2.8 "Restarting the Object Storage Deployment"*.

      ii. Repeat the installation process starting by running the `site.yml` playbook as described in *Section 12.7, "Deploying the Cloud"*.

   b. Rebalance the rings several times until all drives are incorporated in the rings. This process may take several hours to complete (because you need to wait one hour between each rebalance). The steps are as follows:

      i. Change the min-part-hours to 1 hour. See *Book "Operations Guide", Chapter 8 "Managing Object Storage", Section 8.5 "Managing Swift Rings", Section 8.5.7 "Changing min-part-hours in Swift"*.

      ii. Use the "First phase of ring rebalance" and "Final rebalance phase" as described in *Book "Operations Guide", Chapter 8 "Managing Object Storage", Section 8.5 "Managing Swift Rings", Section 8.5.5 "Applying Input Model Changes to Existing Rings"*. The "Weight change phase of ring rebalance" does not apply because you have not set the weight-step attribute at this stage.

      iii. Set the min-part-hours to the recommended 16 hours as described in *Book "Operations Guide", Chapter 8 "Managing Object Storage", Section 8.5 "Managing Swift Rings", Section 8.5.7 "Changing min-part-hours in Swift"*.

If you receive errors during the validation, see *Book "Operations Guide", Chapter 15 "Troubleshooting Issues", Section 15.6 "Storage Troubleshooting", Section 15.6.2 "Swift Storage Troubleshooting", Section 15.6.2.3 "Interpreting Swift Input Model Validation Errors"*.

27.2 Verify the Object Storage (Swift) Operations

For information about verifying the operations, see *Book "Operations Guide", Chapter 8 "Managing Object Storage", Section 8.1 "Running the Swift Dispersion Report"*.

27.3 Uploading an Image for Use

To create a Compute instance, you need to obtain an image that you can use. The Cloud Lifecycle Manager provides an Ansible playbook that will download a CirrOS Linux image, and then upload it as a public image to your image repository for use across your projects.

27.3.1 Running the Playbook

Use the following command to run this playbook:

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts glance-cloud-configure.yml -e proxy=<PROXY>
```

The table below shows the optional switch that you can use as part of this playbook to specify environment-specific information:

Switch	Description
`-e proxy="<proxy_address:port>"`	Optional. If your environment requires a proxy for the internet, use this switch to specify the proxy information.

27.3.2 How to Curate Your Own Images

OpenStack has created a guide to show you how to obtain, create, and modify images that will be compatible with your cloud:

OpenStack Virtual Machine Image Guide (http://docs.openstack.org/image-guide/content/)

27.3.3 Using the GlanceClient CLI to Create Images

You can use the GlanceClient on a machine accessible to your cloud or on your Cloud Lifecycle Manager where it is automatically installed.

The GlanceClient allows you to create, update, list, and delete images as well as manage your image member lists, which allows you to share access to images across multiple tenants. As with most of the OpenStack CLI tools, you can use the `glance help` command to get a full list of commands as well as their syntax.

If you would like to use the `--copy-from` option when creating an image, you will need to have your Administrator enable the http store in your environment using the instructions outlined at *Book "Operations Guide", Chapter 5 "Managing Compute", Section 5.6 "Configuring the Image Service", Section 5.6.2 "Allowing the Glance copy-from option in your environment"*.

27.4 Creating an External Network

You must have an external network set up to allow your Compute instances to reach the internet. There are multiple methods you can use to create this external network and we provide two of them here. The SUSE OpenStack Cloud installer provides an Ansible playbook that will create this network for use across your projects. We also show you how to create this network via the command line tool from your Cloud Lifecycle Manager.

27.4.1 Using the Ansible Playbook

This playbook will query the Networking service for an existing external network, and then create a new one if you do not already have one. The resulting external network will have the name `ext-net` with a subnet matching the CIDR you specify in the command below.

If you need to specify more granularity, for example specifying an allocation pool for the subnet then you should utilize the *Section 27.4.2, "Using the NeutronClient CLI"*.

```
cd ~/scratch/ansible/next/ardana/ansible
ansible-playbook -i hosts/verb_hosts neutron-cloud-configure.yml -e EXT_NET_CIDR=<CIDR>
```

The table below shows the optional switch that you can use as part of this playbook to specify environment-specific information:

Switch	Description
`-e EXT_NET_CIDR=<CIDR>`	Optional. You can use this switch to specify the external network CIDR. If you choose not to use this switch, or use a wrong value, the VMs will not be accessible over the network. This CIDR will be from the `EXTERNAL VM` network. **Note** If this option is not defined the default value is "172.31.0.0/16"

27.4.2 Using the NeutronClient CLI

For more granularity you can utilize the Neutron command line tool to create your external network.

1. Log in to the Cloud Lifecycle Manager.
2. Source the Admin credentials:

   ```
   source ~/service.osrc
   ```

3. Create the external network and then the subnet using these commands below.
   Creating the network:

   ```
   neutron net-create --router:external <external-network-name>
   ```

   Creating the subnet:

   ```
   neutron subnet-create <external-network-name> <CIDR> --gateway <gateway> \
   --allocation-pool start=<IP_start>,end=<IP_end> [--disable-dhcp]
   ```

Where:

Value	Description
external-network-name	This is the name given to your external network. This is a unique value that you will choose. The value `ext-net` is usually used.
CIDR	You can use this switch to specify the external network CIDR. If you choose not to use this switch, or use a wrong value, the VMs will not be accessible over the network. This CIDR will be from the EXTERNAL VM network.
--gateway	Optional switch to specify the gateway IP for your subnet. If this is not included then it will choose the first available IP.
--allocation-pool start end	Optional switch to specify a start and end IP address to use as the allocation pool for this subnet.
--disable-dhcp	Optional switch if you want to disable DHCP on this subnet. If this is not specified then DHCP will be enabled.

27.4.3 Next Steps

Once the external network is created, users can create a Private Network to complete their networking setup. For instructions, see *Book "User Guide", Chapter 8 "Creating a Private Network"*.

28 Installing OpenStack Clients

If you have a standalone deployer, the OpenStack CLI and other clients will not be installed automatically on that node. If you require access to these clients, you will need to follow the procedure below to add the appropriate software.

1. [OPTIONAL] Connect to your standalone deployer and try to use the OpenStack CLI:

```
source ~/keystone.osrc
openstack project list

-bash: openstack: command not found
```

2. Edit the configuration file containing details of your Control Plane, typically `~/openstack/my_cloud/definition/data/control_plane`.

3. Locate the stanza for the cluster where you want to install the client(s). For a standalone deployer, this will look like the following extract:

```
      clusters:
        - name: cluster0
          cluster-prefix: c0
          server-role: LIFECYCLE-MANAGER-ROLE
          member-count: 1
          allocation-policy: strict
          service-components:
            - ntp-server
            - lifecycle-manager
```

4. Choose the client(s) you wish to install from the following list of available clients:

```
 - barbican-client
 - ceilometer-client
 - cinder-client
 - designate-client
 - glance-client
 - heat-client
 - ironic-client
 - keystone-client
 - magnum-client
 - manila-client
 - monasca-client
 - neutron-client
 - nova-client
 - ntp-client
```

```
- octavia-client
- openstack-client
- swift-client
```

5. Add the client(s) to the list of `service-components` - in this example, we add the `openstack-client` to the standalone deployer:

```
    clusters:
      - name: cluster0
        cluster-prefix: c0
        server-role: LIFECYCLE-MANAGER-ROLE
        member-count: 1
        allocation-policy: strict
        service-components:
          - ntp-server
          - lifecycle-manager
          - openstack-client
          - ceilometer-client
          - cinder-client
          - designate-client
          - glance-client
          - heat-client
          - ironic-client
          - keystone-client
          - neutron-client
          - nova-client
          - swift-client
          - monasca-client
          - barbican-client
```

6. Commit the configuration changes:

```
cd ~/openstack/ardana/ansible
git add -A
git commit -m "Add explicit client service deployment"
```

7. Run the configuration processor, followed by the `ready-deployment` playbook:

```
cd ~/openstack/ardana/ansible
ansible-playbook -i hosts/localhost config-processor-run.yml -e encrypt="" \
  -e rekey=""
ansible-playbook -i hosts/localhost ready-deployment.yml
```

8. Add the software for the clients using the following command:

```
cd ~/scratch/ansible/next/ardana/ansible
```

```
ansible-playbook -i hosts/verb_hosts clients-upgrade.yml
```

9. Check that the software has been installed correctly. In this instance, connect to your standalone deployer and try to use the OpenStack CLI:

```
source ~/keystone.osrc
openstack project list
```

You should now see a list of projects returned:

```
stack@ardana-cp1-c0-m1-mgmt:~$ openstack project list

+----------------------------------+------------------+
| ID                               | Name             |
+----------------------------------+------------------+
| 076b6e879f324183bbd28b46a7ee7826 | kronos           |
| 0b81c3a9e59c47cab0e208ea1bb7f827 | backup           |
| 143891c2a6094e2988358afc99043643 | octavia          |
| 1d3972a674434f3c95a1d5ed19e0008f | glance-swift     |
| 2e372dc57cac4915bf06bbee059fc547 | glance-check     |
| 383abda56aa2482b95fb9da0b9dd91f4 | monitor          |
| 606dd3b1fa6146668d468713413fb9a6 | swift-monitor    |
| 87db9d1b30044ea199f0293f63d84652 | admin            |
| 9fbb7494956a483ca731748126f50919 | demo             |
| a59d0c682474434a9ddc240ddfe71871 | services         |
| a69398f0f66a41b2872bcf45d55311a7 | swift-dispersion |
| f5ec48d0328d400992c1c5fb44ec238f | cinderinternal   |
+----------------------------------+------------------+
```

29 Configuring Transport Layer Security (TLS)

TLS is enabled by default during the installation of SUSE OpenStack Cloud 8 and additional configuration options are available to secure your environment, as described below.

In SUSE OpenStack Cloud 8, you can provide your own certificate authority and certificates for internal and public virtual IP addresses (VIPs), and you should do so for any production cloud. The certificates automatically generated by SUSE OpenStack Cloud are useful for testing and setup, but you should always install your own for production use. Certificate installation is discussed below.

Read the following if you are using the default `cert-name: my-public-cert` in your model.

The bundled test certificate for public endpoints, located at `~/openstack/my_cloud/config/tls/certs/my-public-cert`, is now expired but was left in the product in case you changed the content with your valid certificate. Please verify if the certificate is expired and generate your own, as described in *Section 29.4, "Generate a self-signed CA"*.

You can verify the expiry date by running this command:

```
ardana > openssl x509 -in ~/openstack/my_cloud/config/tls/certs/my-public-cert \
-noout -enddate
notAfter=Oct  8 09:01:58 2016 GMT
```

Before you begin, the following list of terms will be helpful when generating and installing certificates.

SUSE OpenStack Cloud-generated public CA

A SUSE OpenStack Cloud-generated public CA (`openstack_frontend_cacert.crt`) is available for you to use in `/etc/pki/trust/anchors/ca-certificates`.

Fully qualified domain name (FQDN) of the public VIP

The registered domain name. A FQDN is not mandatory. It is perfectly valid to have no FQDN and use IP addresses instead. Note that you can use FQDNs on public endpoints, and you may change them whenever the need arises.

Certificate authority (CA) certificate

Your certificates must be signed by a CA, such as your internal IT department or a public certificate authority. For this example we will use a self-signed certificate.

Server certificate

It is easy to confuse server certificates and CA certificates. Server certificates reside on the server and CA certificates reside on the client. A server certificate affirms that the server that sent it serves a set of IP addresses, domain names, and set of services. A CA certificate is used by the client to authenticate this claim.

SAN (subject-alt-name)

The set of IP addresses and domain names in a server certificate request: A template for a server certificate.

Certificate signing request (CSR)

A blob of data generated from a certificate request and sent to a CA, which would then sign it, produce a server certificate, and send it back.

External VIP

External virtual IP address

Internal VIP

Internal virtual IP address

The major difference between an external VIP certificate and an internal VIP certificate is that the internal VIP has approximately 40 domain names in the SAN. This is because each service has a different domain name in SUSE OpenStack Cloud 8. So it is unlikely that you can create an internal server certificate before running the configuration processor. But after a configuration processor run, a certificate request would be created for each of your cert-names.

29.1 Configuring TLS in the input model

For this example certificate configuration, let us assume there is no FQDN for the external VIP and that you are going to use the default IP address provided by SUSE OpenStack Cloud 8. Let's also assume that for the internal VIP you will use the defaults as well. If you were to call your certificate authority "example-CA," the CA certificate would then be called "example-CA.crt" and the key would be called "example-CA.key." In the following examples, the external VIP certificate will be named "example-public-cert" and the internal VIP certificate will be named "example-internal-cert."

Note

Cautions:

Any time you make a cert change when using your own CA:

- You should use a distinct name from those already existing in `config/tls/cacerts`. This also means that you should not *reuse* your CA names (and use unique and distinguishable names such as MyCompanyXYZ_PrivateRootCA.crt). A new name is what indicates that a file is new or changed, so reusing a name means that the file is not considered changed even its contents have changed.
- You should not remove any existing CA files from `config/tls/cacerts`.
- If you want to remove an existing CA you must
  1. First remove the file.
  2. Then run:

```
ardana > ansible -i hosts/verb_hosts FND-STN -a 'sudo keytool -delete -alias \
debian:<filename to remove> \
-keystore /usr/lib/jvm/java-7-openjdk-amd64/jre/lib/security/cacerts \
-storepass changeit'
```

Important

Be sure to install your own certificate for all production clouds after installing and testing your cloud. If you ever want to test or troubleshoot later, you will be able to revert to the sample certificate to get back to a stable state for testing.

Note

Unless this is a new deployment, do not update both the certificate and the CA together. Add the CA first and then run a site deploy. Then update the certificate and run tls-reconfigure, FND-CLU-stop, FND-CLU-start and then ardana-reconfigure. If a playbook has failed, rerun it with -vv to get detailed error information. The configure, HAproxy restart, and reconfigure steps are included below. If this is a new deployment and you are adding your own certs/CA before running site.yml this caveat does not apply.

You can add your own certificate by following the instructions below. All changes must go into the file `~/openstack/my_cloud/definition/data/network_groups.yml`.

Below are the entries for TLS for the internal and admin load balancers:

```
- provider: ip-cluster
        name: lb
        tls-components:
        - default
        components:
        # These services do not currently support TLS so they are not listed
        # under tls-components
        - nova-metadata
        roles:
        - internal
        - admin
        cert-file: openstack-internal-cert
        # The openstack-internal-cert is a reserved name and
        # this certificate will be autogenerated. You
        # can bring in your own certificate with a different name

        # cert-file: customer-provided-internal-cert
        # replace this with name of file in "config/tls/certs/"
```

The configuration processor will also create a request template for each named certificate under `info/cert_reqs/` This will be of the form:

```
info/cert_reqs/customer-provided-internal-cert
```

These request templates contain the subject `Alt-names` that the certificates need. You can add to this template before generating your certificate signing request .

You would then send the CSR to your CA to be signed, and once you receive the certificate, place it in `config/tls/certs`.

When you bring in your own certificate, you may want to bring in the trust chains (or CA certificate) for this certificate. This is usually not required if the CA is a public signer that is typically bundled with the operating system. However, we suggest you include it anyway by copying the file into the directory `config/cacerts/`.

29.2 User-provided certificates and trust chains

SUSE OpenStack Cloud generates its own internal certificates but is designed to allow you to bring in your own certificates for the VIPs. Here is the general process.

1. You must have a server certificate and a CA certificate to go with it (unless the signer is a public CA and it is already bundled with most distributions).

2. You must decide the names of the server certificates and configure the `network_groups.yml` file in the input model such that each load balancer provider has at least one cert-name associated with it.

3. Run the configuration processor. Note that you may or may not have the certificate file at this point. The configuration processor would create certificate request file artifacts under `info/cert_reqs/` for each of the cert-name(s) in the `network_groups.yml` file. While there is no special reason to use the request file created for an external endpoint VIP certificate, it is important to use the request files created for internal certificates since the canonical names for the internal VIP can be many and service specific and each of these need to be in the Subject Alt Names attribute of the certificate.

4. Create a certificate signing request for this request file and send it to your internal CA or a public CA to get it certified and issued with a certificate. You will now have a server certificate and possibly a trust chain or CA certificate.

5. Next, upload it to the Cloud Lifecycle Manager. Server certificates should be added to `config/tls/certs` and CA certificates should be added to `config/tls/cacerts`. The file extension should be CRT file for the CA certificate to be processed by SUSE OpenStack Cloud. Detailed steps are next.

29.3 Edit the input model to include your certificate files

Edit the load balancer configuration in `~/openstack/my_cloud/definition/data/network_groups.yml`:

```
load-balancers:
 - provider: ip-cluster
 name: lb
 tls-components:
 - default
 components:
 - nova-metadata
 roles:
 - internal
 - admin
 cert-file: example-internal-cert #<<<---- Certificate name for the internal VIP

- provider: ip-cluster
 name: extlb
```

```
external-name: myardana.test #<<<--- Use just IP for the external VIP in this example
tls-components:
- default
roles:
- public
cert-file: example-public-cert #<<<---- Certificate name for the external VIP
```

Commit your changes to the local git repository and run the configuration processor:

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "changed VIP certificates"
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

Verify that certificate requests have been generated by the configuration processor for every certificate file configured in the `networks_groups.yml` file. In this example, there are two files, as shown from the list command:

```
ardana > ls ~/openstack/my_cloud/info/cert_reqs
example-internal-cert
example-public-cert
```

29.4 Generate a self-signed CA

Note

In a production setting you will not perform this step. You will use your company's CA or a valid public CA.

This section demonstrates to how you can create your own self-signed CA and then use this CA to sign server certificates. This CA can be your organization's IT internal CA that is self-signed and whose CA certificates are deployed on your organization's machines. This way the server certificate becomes legitimate.

Note

Please use a unique CN for your example Certificate Authority and do not install multiple CA certificates with the same CN into your cloud.

Copy the commands below to the command line and execute. This will cause the two files, `example-CA.key` and `example-CA.crt` to be created:

```
ardana > export EXAMPLE_CA_KEY_FILE='example-CA.key'
ardana > export EXAMPLE_CA_CERT_FILE='example-CA.crt'
ardana > openssl req -x509 -batch -newkey rsa:2048 -nodes -out "${EXAMPLE_CA_CERT_FILE}" \
-keyout "${EXAMPLE_CA_KEY_FILE}" \
-subj "/C=UK/O=hp/CN=YourOwnUniqueCertAuthorityName" \
-days 365
```

You can tweak the subj and days settings above to meet your needs, or to test. For instance, if you want to test what happens when a CA expires, you can set 'days' to a very low value. Grab the configuration processor-generated request file from `info/cert_reqs/`:

```
ardana > cat ~/openstack/my_cloud/info/cert_reqs/example-internal-cert
```

Now, copy this file to your working directory and append a `.req` extension to it.

```
ardana > cp ~/openstack/my_cloud/info/cert_reqs/example-internal-cert \
example-internal-cert.req
```

EXAMPLE 29.1: CERTIFICATE REQUEST FILE

```
[req]
distinguished_name = req_distinguished_name
req_extensions = v3_req
prompt = no

[ req_distinguished_name ]
CN = "openstack-vip"

[ v3_req ]
basicConstraints = CA:FALSE
keyUsage = nonRepudiation, digitalSignature, keyEncipherment
subjectAltName = @alt_names

[ alt_names ]
DNS.1 = "deployerincloud-ccp-c0-m1-mgmt"
DNS.2 = "deployerincloud-ccp-vip-CEI-API-mgmt"
DNS.3 = "deployerincloud-ccp-vip-CND-API-mgmt"
DNS.4 = "deployerincloud-ccp-vip-DES-API-mgmt"
DNS.5 = "deployerincloud-ccp-vip-FND-MDB-mgmt"
DNS.6 = "deployerincloud-ccp-vip-FND-RMQ-mgmt"
DNS.7 = "deployerincloud-ccp-vip-FND-VDB-mgmt"
DNS.8 = "deployerincloud-ccp-vip-FRE-API-mgmt"
DNS.9 = "deployerincloud-ccp-vip-GLA-API-mgmt"
DNS.10 = "deployerincloud-ccp-vip-GLA-REG-mgmt"
```

```
DNS.11 = "deployerincloud-ccp-vip-HEA-ACF-mgmt"
DNS.12 = "deployerincloud-ccp-vip-HEA-ACW-mgmt"
DNS.13 = "deployerincloud-ccp-vip-HEA-API-mgmt"
DNS.14 = "deployerincloud-ccp-vip-HUX-SVC-mgmt"
DNS.15 = "deployerincloud-ccp-vip-HZN-WEB-mgmt"
DNS.16 = "deployerincloud-ccp-vip-KEY-API-mgmt"
DNS.17 = "deployerincloud-ccp-vip-KEYMGR-API-mgmt"
DNS.18 = "deployerincloud-ccp-vip-LOG-API-mgmt"
DNS.19 = "deployerincloud-ccp-vip-LOG-SVR-mgmt"
DNS.20 = "deployerincloud-ccp-vip-MON-API-mgmt"
DNS.21 = "deployerincloud-ccp-vip-NEU-SVR-mgmt"
DNS.22 = "deployerincloud-ccp-vip-NOV-API-mgmt"
DNS.23 = "deployerincloud-ccp-vip-NOV-MTD-mgmt"
DNS.24 = "deployerincloud-ccp-vip-OCT-API-mgmt"
DNS.25 = "deployerincloud-ccp-vip-OPS-WEB-mgmt"
DNS.26 = "deployerincloud-ccp-vip-SHP-API-mgmt"
DNS.27 = "deployerincloud-ccp-vip-SWF-PRX-mgmt"
DNS.28 = "deployerincloud-ccp-vip-admin-CEI-API-mgmt"
DNS.29 = "deployerincloud-ccp-vip-admin-CND-API-mgmt"
DNS.30 = "deployerincloud-ccp-vip-admin-DES-API-mgmt"
DNS.31 = "deployerincloud-ccp-vip-admin-FND-MDB-mgmt"
DNS.32 = "deployerincloud-ccp-vip-admin-FRE-API-mgmt"
DNS.33 = "deployerincloud-ccp-vip-admin-GLA-API-mgmt"
DNS.34 = "deployerincloud-ccp-vip-admin-HEA-ACF-mgmt"
DNS.35 = "deployerincloud-ccp-vip-admin-HEA-ACW-mgmt"
DNS.36 = "deployerincloud-ccp-vip-admin-HEA-API-mgmt"
DNS.37 = "deployerincloud-ccp-vip-admin-HUX-SVC-mgmt"
DNS.38 = "deployerincloud-ccp-vip-admin-HZN-WEB-mgmt"
DNS.39 = "deployerincloud-ccp-vip-admin-KEY-API-mgmt"
DNS.40 = "deployerincloud-ccp-vip-admin-KEYMGR-API-mgmt"
DNS.41 = "deployerincloud-ccp-vip-admin-MON-API-mgmt"
DNS.42 = "deployerincloud-ccp-vip-admin-NEU-SVR-mgmt"
DNS.43 = "deployerincloud-ccp-vip-admin-NOV-API-mgmt"
DNS.44 = "deployerincloud-ccp-vip-admin-OPS-WEB-mgmt"
DNS.45 = "deployerincloud-ccp-vip-admin-SHP-API-mgmt"
DNS.46 = "deployerincloud-ccp-vip-admin-SWF-PRX-mgmt"
DNS.47 = "192.168.245.5"
IP.1 = "192.168.245.5"

=============end of certificate request file.
```

Note

In the case of a public VIP certificate, please add all the FQDNs you want it to support Currently SUSE OpenStack Cloud does not add the hostname for the external-name specified in `network_groups.yml` to the certificate request file . However, you can add it to the certificate request file manually. Here we assume that `myardana.test` is your external-name. In that case you would add this line (to the certificate request file that is shown above in *Example 29.1, "Certificate request file"*):

```
DNS.48 = "myardana.test"
```

Note

Any attempt to use IP addresses rather than FQDNs in certificates must use subject alternate name entries that list both the IP address (needed for Google) and DNS with an IP (needed for a Python bug workaround). Failure to create the certificates in this manner will cause future installations of Go-based tools (such as Cloud Foundry, Stackato and other PaaS components) to fail.

29.5 Generate a certificate signing request

Now that you have a CA and a certificate request file, it is time to generate a CSR.

```
ardana > export EXAMPLE_SERVER_KEY_FILE='example-internal-cert.key'
ardana > export EXAMPLE_SERVER_CSR_FILE='example-internal-cert.csr'
ardana > export EXAMPLE_SERVER_REQ_FILE=example-internal-cert.req
ardana > openssl req -newkey rsa:2048 -nodes -keyout "$EXAMPLE_SERVER_KEY_FILE" \
-out "$EXAMPLE_SERVER_CSR_FILE" -extensions v3_req -config "$EXAMPLE_SERVER_REQ_FILE"
```

Note that in production you would usually send the generated `example-internal-cert.csr` file to your IT department. But in this example you are your own CA, so sign and generate a server certificate.

29.6 Generate a server certificate

Note

In a production setting you will not perform this step. You will send the CSR created in the previous section to your company CA or a to a valid public CA and have them sign and send you back the certificate.

This section demonstrates how you would use your own self-signed CA that your created earlier to sign and generate a server certificate. A server certificate is essentially a signed public key, the signer being a CA and trusted by a client. When you install this the signing CA's certificate (called CA certificate or trust chain) on the client machine, you are telling the client to trust this CA, and thereby implicitly trusting any server certificates that are signed by this CA, thus creating a trust anchor.

CA configuration file

When the CA signs the certificate, it uses a configuration file that tells it to verify the CSR. Note that in a production scenario the CA takes care of this for you.

Create a file called `openssl.cnf` and add the following contents to it.

```
# Copyright 2010 United States Government as represented by the
# Administrator of the National Aeronautics and Space Administration.
# All Rights Reserved.
#...

# OpenSSL configuration file.
#

# Establish working directory.

dir = .

[ ca ]
default_ca = CA_default

[ CA_default ]
serial = $dir/serial
database = $dir/index.txt
new_certs_dir = $dir/
certificate = $dir/cacert.pem
private_key = $dir/cakey.pem
unique_subject = no
default_crl_days = 365
default_days = 365
default_md = md5
preserve = no
email_in_dn = no
nameopt = default_ca
certopt = default_ca
policy = policy_match
copy_extensions = copy
```

```
[ policy_match ]
countryName = optional
stateOrProvinceName = optional
organizationName = optional
organizationalUnitName = optional
commonName = supplied
emailAddress = optional

[ req ]
default_bits = 1024 # Size of keys
default_keyfile = key.pem # name of generated keys
default_md = md5 # message digest algorithm
string_mask = nombstr # permitted characters
distinguished_name = req_distinguished_name
req_extensions = v3_req
x509_extensions = v3_ca

[ req_distinguished_name ]
# Variable name Prompt string
#---------------------- ----------------------------------
0.organizationName = Organization Name (company)
organizationalUnitName = Organizational Unit Name (department, division)
emailAddress = Email Address
emailAddress_max = 40
localityName = Locality Name (city, district)
stateOrProvinceName = State or Province Name (full name)
countryName = Country Name (2 letter code)
countryName_min = 2
countryName_max = 2
commonName = Common Name (hostname, IP, or your name)
commonName_max = 64

# Default values for the above, for consistency and less typing.
# Variable name Value
#------------------------------ ------------------------------
0.organizationName_default = Exampleco PLC
localityName_default = Anytown
stateOrProvinceName_default = Anycounty
countryName_default = UK
commonName_default = my-CA

[ v3_ca ]
basicConstraints = CA:TRUE
subjectKeyIdentifier = hash
authorityKeyIdentifier = keyid:always,issuer:always
subjectAltName = @alt_names
```

```
[ v3_req ]
basicConstraints = CA:FALSE
subjectKeyIdentifier = hash

[ alt_names ]

######### end of openssl.cnf #########
```

Sign and create a server certificate

Now you can sign the server certificate with your CA. Copy the commands below to the command line and execute. This will cause the one file, example-internal-cert.crt, to be created:

```
ardana > export EXAMPLE_SERVER_CERT_FILE='example-internal-cert.crt'
ardana > export EXAMPLE_SERVER_CSR_FILE='example-internal-cert.csr'
ardana > export EXAMPLE_CA_KEY_FILE='example-CA.key'
ardana > export EXAMPLE_CA_CERT_FILE='example-CA.crt'
ardana > touch index.txt
ardana > openssl rand -hex -out serial 6
ardana > openssl ca -batch -notext -md sha256 -in "$EXAMPLE_SERVER_CSR_FILE" \
-cert "$EXAMPLE_CA_CERT_FILE" \
-keyfile "$EXAMPLE_CA_KEY_FILE" \
-out "$EXAMPLE_SERVER_CERT_FILE" \
-config openssl.cnf -extensions v3_req
```

Finally, concatenate both the server key and certificate in preparation for uploading to the Cloud Lifecycle Manager.

```
ardana > cat example-internal-cert.key example-internal-cert.crt > example-internal-cert
```

Note that you have only created the internal-cert in this example. Repeat the above sequence for example-public-cert. Make sure you use the appropriate certificate request generated by the configuration processor.

29.7 Upload to the Cloud Lifecycle Manager

The following two files created from the example run above will need to be uploaded to the Cloud Lifecycle Manager and copied into `config/tls`.

- example-internal-cert
- example-CA.crt

Once on the Cloud Lifecycle Manager, execute the following two copy commands to copy to their respective directories. Note if you had created an external cert, you can copy that in a similar manner, specifying its name using the copy command as well.

```
ardana > cp example-internal-cert ~/openstack/my_cloud/config/tls/certs/
ardana > cp example-CA.crt ~/openstack/my_cloud/config/tls/cacerts/
```

Continue with the deployment

Next, log into the Cloud Lifecycle Manager node, and save and commit the changes to the local git repository:

```
ardana > cd ~/openstack/ardana/ansible
ardana > git add -A
ardana > git commit -m "updated certificate and CA"
```

Next, rerun the `config-processor-run` playbook, and run `ready-deployment.yml`:

```
ardana > cd ~/openstack/ardana/ansible
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

If you receive any prompts, enter the required information.

Note

For automated installation (for example CI) you can specify the required passwords on the Ansible command line. For example, the command below will disable encryption by the configuration processor:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml -e encrypt="" -e
 rekey=""
```

Run this series of runbooks to complete the deployment:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts tls-reconfigure.yml
ardana > ansible-playbook -i hosts/verb_hosts FND-CLU-stop.yml
ardana > ansible-playbook -i hosts/verb_hosts FND-CLU-start.yml
ardana > ansible-playbook -i hosts/verb_hosts monasca-stop.yml
ardana > ansible-playbook -i hosts/verb_hosts monasca-start.yml
ardana > ansible-playbook -i hosts/verb_hosts ardana-reconfigure.yml
```

29.8 Configuring the cipher suite

By default, the cipher suite is set to: `HIGH:!aNULL:!eNULL:!DES:!3DES`. This setting is recommended in the OpenStack documentation site (http://docs.openstack.org/security-guide/secure-communication/introduction-to-ssl-and-tls.html). You may override this. To do so, open `config/haproxy/defaults.yml` and edit it. The parameters can be found under the `haproxy_globals` list.

```
- "ssl-default-bind-ciphers HIGH:!aNULL:!eNULL:!DES:!3DES"
- "ssl-default-server-ciphers HIGH:!aNULL:!eNULL:!DES:!3DES"
```

Make the changes as needed. It is best to keep the two options identical.

29.9 Testing

You can easily determine if an endpoint is behind TLS. To do so, run the following command, which probes a Keystone identity service endpoint that is behind TLS:

```
ardana > echo | openssl s_client -connect 192.168.245.5:5000 | openssl x509 -fingerprint -noout
depth=0 CN = openstack-vip
verify error:num=20:unable to get local issuer certificate
verify return:1
depth=0 CN = openstack-vip
verify error:num=27:certificate not trusted
verify return:1
depth=0 CN = openstack-vip
verify error:num=21:unable to verify the first certificate
verify return:1
DONE
SHA1 Fingerprint=C6:46:1E:59:C6:11:BF:72:5E:DD:FC:FF:B0:66:A7:A2:CC:32:1C:B8
```

The next command probes a MariaDB endpoint that is not behind TLS:

```
ardana > echo | openssl s_client -connect 192.168.245.5:3306 | openssl x509 -fingerprint -noout
140448358213264:error:140770FC:SSL routines:SSL23_GET_SERVER_HELLO:unknown protocol:s23_clnt.c:795:
unable to load certificate
140454148159120:error:0906D06C:PEM routines:PEM_read_bio:no start line:pem_lib.c:703
:Expecting: TRUSTED CERTIFICATE
```

29.10 Verifying that the trust chain is correctly deployed

You can determine if the trust chain is correctly deployed by running the following commands:

```
ardana > echo | openssl s_client -connect 192.168.245.9:5000 2>/dev/null | grep code
Verify return code: 21 (unable to verify the first certificate)
echo | openssl s_client -connect 192.168.245.9:5000 \
-CAfile /etc/pki/trust/anchors/ca-certificates/openstack_frontend_cacert.crt 2>/dev/null | grep
 code
Verify return code: 0 (ok)
```

Here, the first command produces error 21, which is then fixed by providing the CA certificate file. This verifies that the CA certificate matches the server certificate.

29.11 Turning TLS on or off

You should leave TLS enabled in production. However, if you need to disable it for any reason, you must change "tls-components" to "components" in `network_groups.yml` (as shown earlier) and comment out the cert-file. Additionally, if you have a `network_groups.yml` file from a previous installation, you will not have TLS enabled unless you change "components" to "tls-components" in that file. By default, Horizon is configured with TLS in the input model. Note that you should not disable TLS in the input model for Horizon as that is a public endpoint and is required. Additionally, you should keep all services behind TLS, but using the input model file `network_groups.yml` you may turn TLS off for a service for troubleshooting or debugging. TLS should always be enabled for production environments.

If you are using an example input model on a clean install, all supported TLS services will be enabled before deployment of your cloud. If you want to change this setting later, for example, when upgrading, you can change the input model and reconfigure the system. The process is as follows:

Edit the input model `network_groups.yml` file appropriately, as described above. Then, commit the changes to the git repository:

```
ardana > cd ~/openstack/ardana/ansible/
ardana > git add -A
ardana > git commit -m "TLS change"
```

Change directories again and run the configuration processor and ready deployment playbooks:

```
ardana > ansible-playbook -i hosts/localhost config-processor-run.yml
```

```
ardana > ansible-playbook -i hosts/localhost ready-deployment.yml
```

Change directories again and run the reconfigure playbook:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts ardana-reconfigure.yml
```

30 Configuring Availability Zones

The Cloud Lifecycle Manager only creates a default availability zone during installation. If your system has multiple failure/availability zones defined in your input model, these zones will not get created automatically.

Once the installation has finished, you can run the `nova-cloud-configure.yml` playbook to configure availability zones and assign compute nodes to those zones based on the configuration specified in the model.

You can run the playbook `nova-cloud-configure.yml` any time you make changes to the configuration of availability zones in your input model. Alternatively, you can use Horizon or the command line to perform the configuration.

For more details, see the OpenStack Availability Zone documentation at https://docs.openstack.org/nova/pike/user/aggregates.html.

31 Configuring Load Balancer as a Service

The SUSE OpenStack Cloud Neutron LBaaS service supports several load balancing providers. By default, both Octavia and the namespace HAProxy driver are configured to be used. We describe this in more detail here.

The SUSE OpenStack Cloud Neutron LBaaS service supports several load balancing providers. By default, both Octavia and the namespace HAProxy driver are configured to be used. A user can specify which provider to use with the `--provider` flag upon load balancer creation.

Example:

```
tux > neutron lbaas-loadbalancer-create --name NAME --provider \
  [octavia|haproxy] SUBNET
```

If you do not specify the `--provider` option it will default to Octavia. The Octavia driver provides more functionality than the HAProxy namespace driver which is deprecated. The HAProxy namespace driver will be retired in a future version of SUSE OpenStack Cloud.

There are additional drivers for third-party hardware load balancers. Please refer to the vendor directly. The `neutron service-provider-list` command displays not only the currently installed load balancer drivers but also other installed services such as VPN. You can see a list of available services as follows:

```
tux > neutron service-provider-list
+----------------+----------+---------+
| service_type   | name     | default |
+----------------+----------+---------+
| LOADBALANCERV2 | octavia  | True    |
| VPN            | openswan | True    |
| LOADBALANCERV2 | haproxy  | False   |
| LOADBALANCERV2 | octavia  | True    |
| VPN            | openswan | True    |
| LOADBALANCERV2 | haproxy  | False   |
+----------------+----------+---------+
```

Note

The Octavia load balancer provider is listed as the default.

31.1 Prerequisites

You will need to create an external network and create an image to test LBaaS functionality. If you have already created an external network and registered an image, this step can be skipped.

Creating an external network: *Section 27.4, "Creating an External Network"*.

Creating and uploading a Glance image: *Book "User Guide", Chapter 10 "Creating and Uploading a Glance Image"*.

31.2 Octavia Load Balancing Provider

The Octavia Load balancing provider bundled with SUSE OpenStack Cloud 8 is an operator grade load balancer for OpenStack. It is based on the OpenStack Pike version of Octavia. It differs from the namespace driver by starting a new Nova virtual machine to house the HAProxy load balancer software, called an *amphora*, that provides the load balancer function. A virtual machine for each load balancer requested provides a better separation of load balancers between tenants and makes it easier to grow load balancing capacity alongside compute node growth. Additionally, if the virtual machine fails for any reason Octavia will replace it with a replacement VM from a pool of spare VMs, assuming that the feature is configured.

Note

The Health Monitor will not create or replace failed amphorae. If the pool of spare VMs is exhausted there will be no additional virtual machines to handle load balancing requests.

Octavia uses two-way SSL encryption to communicate with the amphora. There are demo Certificate Authority (CA) certificates included with SUSE OpenStack Cloud 8 in `~/scratch/ansible/next/ardana/ansible/roles/octavia-common/files` on the Cloud Lifecycle Manager. For additional security in production deployments, all certificate authorities should be replaced with ones you generated yourself by running the following commands:

```
ardana > openssl genrsa -passout pass:foobar -des3 -out cakey.pem 2048
ardana > openssl req -x509 -passin pass:foobar -new -nodes -key cakey.pem -out ca_01.pem
ardana > openssl genrsa -passout pass:foobar -des3 -out servercakey.pem 2048
ardana > openssl req -x509 -passin pass:foobar -new -nodes -key cakey.pem -out serverca_01.pem
```

For more details refer to the openssl man page (https://www.openssl.org/docs/manmaster/) ↗.

Note

If you change the certificate authority and have amphora running with an old CA you will not be able to control the amphora. The amphoras will need to be failed over so they can utilize the new certificate. If you change the CA password for the server certificate you need to change that in the Octavia configuration files as well. For more information, see *Book "Operations Guide", Chapter 9 "Managing Networking", Section 9.3 "Networking Service Overview", Section 9.3.9 "Load Balancer: Octavia Driver Administration", Section 9.3.9.2 "Tuning Octavia Installation"*.

31.3 Setup of prerequisites

Octavia Network and Management Network Ports

The Octavia management network and Management network must have access to each other. If you have a configured firewall between the Octavia management network and Management network, you must open up the following ports to allow network traffic between the networks.

- From Management network to Octavia network
  - TCP 9443 (amphora API)
- From Octavia network to Management network
  - TCP 9876 (Octavia API)
  - UDP 5555 (Octavia Health Manager)

Installing the Amphora Image

Octavia uses Nova VMs for its load balancing function and SUSE provides images used to boot those VMs called `octavia-amphora`.

Warning

Without these images the Octavia load balancer will not work.

Register the image. The OpenStack load balancing service (Octavia) does not automatically register the Amphora guest image.

1. The full path and name for the Amphora image is `/srv/www/suse-12.3/x86_64/repos/Cloud/suse/noarch/openstack-octavia-amphora-image-x86_64-0.1.0-1.21.noarch.rpm`
   Switch to the ansible directory and register the image by giving the full path and name for the Amphora image as an argument to service_package:

   ```
   ardana > cd ~/scratch/ansible/next/ardana/ansible/
   ardana > ansible-playbook -i hosts/verb_hosts service-guest-image.yml \
   -e service_package=\
   /srv/www/suse-12.3/x86_64/repos/Cloud/suse/noarch/openstack-octavia-amphora-image-
   x86_64-0.1.0-1.21.noarch.rpm
   ```

2. Source the service user (this can be done on a different computer)

   ```
   tux > source service.osrc
   ```

3. Verify that the image was registered (this can be done on a computer with access to the Glance CLI client)

   ```
   tux > openstack image list
   +--------------------------------------+------------------------+---------
   | ID                                   | Name                   | Status |
   +--------------------------------------+------------------------+--------+
   ...
   | 1d4dd309-8670-46b6-801d-3d6af849b6a9 | octavia-amphora-x86_64 | active |
   ...
   ```

   ### Important

   In the example above, the status of the `octavia-amphora-x86_64` image is *active* which means the image was successfully registered. If a status of the images is *queued*, you need to run the image registration again.

   If you run the registration by accident, the system will only upload a new image if the underlying image has been changed.

Please be aware that if you have already created load balancers they will not receive the new image. Only load balancers created after the image has been successfully installed will use the new image. If existing load balancers need to be switched to the new image please follow the instructions in *Book “Operations Guide”, Chapter 9 “Managing Networking”, Section 9.3 “Networking Service Overview”, Section 9.3.9 “Load Balancer: Octavia Driver Administration”, Section 9.3.9.2 “Tuning Octavia Installation”*.

Setup network, subnet, router, security and IP's

If you have already created a network, subnet, router, security settings and IPs you can skip the following steps and go directly to creating the load balancers.

1. Create a network.

```
tux > neutron network create lb_net1
+---------------------------+--------------------------------------+
| Field                     | Value                                |
+---------------------------+--------------------------------------+
| admin_state_up            | True                                 |
| id                        | 71a1ac88-30a3-48a3-a18b-d98509fbef5c |
| mtu                       | 0                                    |
| name                      | lb_net1                              |
| provider:network_type     | vxlan                                |
| provider:physical_network |                                      |
| provider:segmentation_id  | 1061                                 |
| router:external           | False                                |
| shared                    | False                                |
| status                    | ACTIVE                               |
| subnets                   |                                      |
| tenant_id                 | 4b31d0508f83437e83d8f4d520cda22f     |
+---------------------------+--------------------------------------+
```

2. Create a subnet.

```
tux > neutron subnet create --name lb_subnet1 lb_net1 10.247.94.128/26 \
  --gateway 10.247.94.129
+-------------------+--------------------------------------------------+
| Field             | Value                                            |
+-------------------+--------------------------------------------------+
| allocation_pools  | {"start": "10.247.94.130", "end": "10.247.94.190"} |
| cidr              | 10.247.94.128/26                                 |
| dns_nameservers   |                                                  |
| enable_dhcp       | True                                             |
| gateway_ip        | 10.247.94.129                                    |
| host_routes       |                                                  |
| id                | 6fc2572c-53b3-41d0-ab63-342d9515f514             |
| ip_version        | 4                                                |
| ipv6_address_mode |                                                  |
| ipv6_ra_mode      |                                                  |
| name              | lb_subnet1                                       |
| network_id        | 71a1ac88-30a3-48a3-a18b-d98509fbef5c             |
```

```
| subnetpool_id     |                                                    |
| tenant_id         | 4b31d0508f83437e83d8f4d520cda22f                   |
+-------------------+----------------------------------------------------+
```

3. Create a router.

```
tux > neutron router create --distributed False lb_router1
+-----------------------+--------------------------------------+
| Field                 | Value                                |
+-----------------------+--------------------------------------+
| admin_state_up        | True                                 |
| distributed           | False                                |
| external_gateway_info |                                      |
| ha                    | False                                |
| id                    | 6aafc9a9-93f6-4d7e-94f2-3068b034b823 |
| name                  | lb_router1                           |
| routes                |                                      |
| status                | ACTIVE                               |
| tenant_id             | 4b31d0508f83437e83d8f4d520cda22f     |
+-----------------------+--------------------------------------+
```

4. Add interface to router. In the following example, the interface `426c5898-f851-4f49-b01f-7a6fe490410c` will be added to the router `lb_router1`.

```
tux > neutron router add subnet lb_router1 lb_subnet1
```

5. Set gateway for router.

```
tux > neutron router set lb_router1 ext-net
```

6. Check networks.

```
tux > neutron network list
+----------------------------+-----------------+----------------------------+
| id                         | name            | subnets                    |
+----------------------------+-----------------+----------------------------+
| d3cb12a6-a000-4e3e-        | ext-net         | f4152001-2500-4ebe-ba9d-   |
| 82c4-ee04aa169291          |                 | a8d6149a50df 10.247.96.0/23 |
| 8306282a-3627-445a-a588-c18 | OCTAVIA-MGMT-NET | f00299f8-3403-45ae-ac4b-   |
| 8b6a13163                  |                 | 58af41d57bdc               |
|                            |                 | 10.247.94.128/26           |
| 71a1ac88-30a3-48a3-a18b-   | lb_net1         | 6fc2572c-                  |
| d98509fbef5c               |                 | 53b3-41d0-ab63-342d9515f514 |
|                            |                 | 10.247.94.128/26           |
+----------------------------+-----------------+----------------------------+
```

7. Create security group.

```
tux > neutron security group create lb_secgroup1
+----------------+---------------------------------------------------------------------------+
| Field          | Value                                                                     |
+----------------+---------------------------------------------------------------------------+
| description    |                                                                           |
| id             | 75343a54-83c3-464c-8773-802598afaee9                                      |
| name           | lb_secgroup1                                                              |
| security group | {"remote_group_id": null, "direction": "egress", "remote_ip_prefix": null,|
|    rules       | "protocol": null, "tenant_id": "4b31d...da22f", "port_range_max": null,   |
|                | "security_group_id": "75343a54-83c3-464c-8773-802598afaee9",              |
|                | "port_range_min": null, "ethertype": "IPv4", "id": "20ae3...97a7a"}       |
|                | {"remote_group_id": null, "direction": "egress",                          |
|                | "remote_ip_prefix": null, "protocol": null, "tenant_id": "4b31...a22f",   |
|                | "port_range_max": null, "security_group_id": "7534...98afaee9",           |
|                | "port_range_min": null, "ethertype": "IPv6", "id": "563c5c...aaef9"}      |
| tenant_id      | 4b31d0508f83437e83d8f4d520cda22f                                          |
+----------------+---------------------------------------------------------------------------+
```

8. Create icmp security group rule.

```
tux > neutron security group rule create lb_secgroup1 --protocol icmp
+-------------------+--------------------------------------+
| Field             | Value                                |
+-------------------+--------------------------------------+
| direction         | ingress                              |
| ethertype         | IPv4                                 |
| id                | 16d74150-a5b2-4cf6-82eb-a6c49a972d93 |
| port_range_max    |                                      |
| port_range_min    |                                      |
| protocol          | icmp                                 |
| remote_group_id   |                                      |
| remote_ip_prefix  |                                      |
| security_group_id | 75343a54-83c3-464c-8773-802598afaee9 |
| tenant_id         | 4b31d0508f83437e83d8f4d520cda22f     |
+-------------------+--------------------------------------+
```

9. Create TCP port 22 rule.

```
tux > neutron security group rule create lb_secgroup1 --protocol tcp \
  --port-range-min 22 --port-range-max 22
+-------------------+--------------------------------------+
| Field             | Value                                |
+-------------------+--------------------------------------+
| direction         | ingress                              |
| ethertype         | IPv4                                 |
| id                | 472d3c8f-c50f-4ad2-97a1-148778e73af5 |
| port_range_max    | 22                                   |
| port_range_min    | 22                                   |
| protocol          | tcp                                  |
| remote_group_id   |                                      |
```

```
| remote_ip_prefix  |                                      |
| security_group_id | 75343a54-83c3-464c-8773-802598afaee9 |
| tenant_id         | 4b31d0508f83437e83d8f4d520cda22f     |
+-------------------+--------------------------------------+
```

10. Create TCP port 80 rule.

```
tux > neutron security group rule create lb_secgroup1 --protocol tcp \
  --port-range-min 80 --port-range-max 80
+-------------------+--------------------------------------+
| Field             | Value                                |
+-------------------+--------------------------------------+
| direction         | ingress                              |
| ethertype         | IPv4                                 |
| id                | 10a76cad-8b1c-46f6-90e8-5dddd279e5f7 |
| port_range_max    | 80                                   |
| port_range_min    | 80                                   |
| protocol          | tcp                                  |
| remote_group_id   |                                      |
| remote_ip_prefix  |                                      |
| security_group_id | 75343a54-83c3-464c-8773-802598afaee9 |
| tenant_id         | 4b31d0508f83437e83d8f4d520cda22f     |
+-------------------+--------------------------------------+
```

11. If you have not already created a keypair, create one now with `nova keypair create`. You will use the keypair to boot images.

```
tux > nova keypair create lb_kp1 > lb_kp1.pem

chmod 400 lb_kp1.pem

cat lb_kp1.pem
-----BEGIN RSA PRIVATE KEY-----
MIIEqAIBAAKCAQEAkbW5W/XWGRGC0LAJI7lttR7EdDfiTDeFJ7A9b9Cff+OMXjhx
WL26eKIr+jp8DR64YjV2mNnQLsDyCxekFpkyjnGRId3KVAeV5sRQqXgtaCXI+Rvd
IyUtd8p1cp3DRgTd1dxO0oL6bBmwrZatNrrRn4HgKc2c7ErekeXrwLHyE0Pia/pz
C6qs0coRdfIeXxsmS3kXExP0YfsswRS/OyDl8QhRAF0ZW/zV+DQIi8+HpLZT+RW1
8sTTYZ6b0kXoH9wLER4IUBj1I1IyrYdxlAhe2VIn+tF0Ec4nDBn1py9iwEfGmn0+
N2jHCJAkrK/QhWdXO4O8zeXfL4mCZ9FybW4nzQIDAQABAoIBACe0PvgB+v8FuIGp
FjR32J8b7ShF+hIOpufzrCoFzRCKLruV4bzuphstBZK/0QG6Nz/7lX99Cq9SwCGp
pXrK7+3EoGl8CB/xmTUylVA4gRb6BNNsdkuXW9ZigrJirs0rkk8uIwRV0GsYbP5A
Kp7ZNTmjqDN75aC1ngRfhGgTlQUOdxBH+4xSb7GukekD13V8V5MF1Qft089asdWp
l/TpvhYeW9O92xEnZ3qXQYpXYQgEFQoM2PKa3VW7FGLgfw9gdS/MSqpHuHGyKmjl
uT6upUX+Lofbe7V+9kfxuV32sLL/S5YFvkBy2q8VpuEV1sXI7O7Sc411WX4cqmlb
YoFwhrkCggCBALkYE7OMTtdCAGcMotJhTiiS5l8d4U/fn1x0zus43XV5Y7wCnMuU
r5vCoK+a+TR9Ekzc/GjccAx7Wz/YYKp6G8FXW114dLcADXZjqjIlX7ifUud4sLCS
y+x3KAJa7LqyzH53I6FOts9RaB5xx4gZ2WjcJquCTbATZWj7j1yGeNgvAoIAgQDJ
```

```
h0r0Te5IliYbCRg+ES9YRZzH/PSLuIn00bbLvpOPNEoKe2Pxs+KI8Fqp6ZIDAB3c
4EPOK5QrJvAny9Z58ZArrNZi15t84KEVAkWUATl+c4SmHc8sW/atgmUoqIzgDQXe
AlwadHLY7JCdg7EYDuUxuTKLLOdqfpf6fKkhNxtEwwKCAIAMxi+d5aIPUxvKAOI/
2L1XKYRCrkI9i/ZooBsjusH1+JG8iQWfOzy/aDhExlJKoBMiQOIerpABHIZYqqtJ
OLIvrsK8ebK8aoGDWS+G1HN9v2kuVnMDTK5MPJEDUJkj7XEVjU1lNZSCTGD+MOYP
a5FInmEA1zZbX4tRKoNjZFh0uwKCAIEAiLs7drAdOLBu4C72fL4KIljwu5t7jATD
zRAwduIxmZq/lYcMU2RaEdEJonivsUt193NNbeeRWwnLLSUWupvT1l4pAt0ISNzb
TbbB4F5IVOwpls9ozc8DecubuM9K7YTIc02kkepqNZWjtMsx74HDrU3a5iSsSkvj
73Z/BeMupCMCggCAS48BsrcsDsHSHE3tO4D8pAIr1r+6WPaQn49pT3GIrdQNc7aO
d9PfXmPoe/PxUlqaXoNAvT99+nNEadp+GTId21VM0Y28pn3EkIGE1Cqoeyl3BE08
f9SUiRNruDnH4F4OclsDBlmqWXImuXRfeiDHxM8X03UDZoqyHmGD3RqA53I=
-----END RSA PRIVATE KEY-----
```

12. Check and boot images.

```
tux > nova image list
+--------------+------------------------+--------+--------+
| ID           | Name                   | Status | Server |
+--------------+------------------------+--------+--------+
| 0526d...7f39 | cirros-0.4.0-x86_64    | ACTIVE |        |
| 8aa51...8f2f | octavia-amphora-x86_64 | ACTIVE |        |
+--------------+------------------------+--------+--------+
```

Boot first VM.

```
tux > nova server create --flavor 1 --image 04b1528b-b1e2-45d4-96d1-fbe04c6b2efd --key-name
 lb_kp1 \
  --security-groups lb_secgroup1 --nic net-id=71a1ac88-30a3-48a3-a18b-d98509fbef5c \
  lb_vm1 --poll
+---------------------------------------+--------------------------------------+
| Property                              | Value                                |
+---------------------------------------+--------------------------------------+
| OS-DCF:diskConfig                     | MANUAL                               |
| OS-EXT-AZ:availability_zone           |                                      |
| OS-EXT-SRV-ATTR:host                  | -                                    |
| OS-EXT-SRV-ATTR:hypervisor_hostname   | -                                    |
| OS-EXT-SRV-ATTR:instance_name         | instance-00000031                    |
| OS-EXT-STS:power_state                | 0                                    |
| OS-EXT-STS:task_state                 | scheduling                           |
| OS-EXT-STS:vm_state                   | building                             |
| OS-SRV-USG:launched_at                | -                                    |
| OS-SRV-USG:terminated_at              | -                                    |
| accessIPv4                            |                                      |
| accessIPv6                            |                                      |
| adminPass                             | NeVvhP5E8iCy                         |
| config_drive                          |                                      |
| created                               | 2016-06-15T16:53:00Z                 |
| flavor                                | m1.tiny (1)                          |
| hostId                                |                                      |
| id                                    | dfdfe15b-ce8d-469c-a9d8-2cea0e7ca287 |
```

```
| image                                | cirros-0.4.0-x86_64 (0526d...7f39)   |
| key_name                             | lb_kp1                               |
| metadata                             | {}                                   |
| name                                 | lb_vm1                               |
| os-extended-volumes:volumes_attached | []                                   |
| progress                             | 0                                    |
| security_groups                      | lb_secgroup1                         |
| status                               | BUILD                                |
| tenant_id                            | 4b31d0508f83437e83d8f4d520cda22f     |
| updated                              | 2016-06-15T16:53:00Z                 |
| user_id                              | fd471475faa84680b97f18e55847ec0a     |
+--------------------------------------+--------------------------------------+

            Server building... 100% complete
            Finished
```

Boot second VM.

```
tux > nova server create --flavor 1 --image 04b1528b-b1e2-45d4-96d1-fbe04c6b2efd --key-name
 lb_kp1 \
  --security-groups lb_secgroup1 --nic net-id=71a1ac88-30a3-48a3-a18b-d98509fbef5c \
  lb_vm2 --poll
+--------------------------------------+---------------------------------------+
| Property                             | Value                                 |
+--------------------------------------+---------------------------------------+
| OS-DCF:diskConfig                    | MANUAL                                |
| OS-EXT-AZ:availability_zone          |                                       |
| OS-EXT-SRV-ATTR:host                 | -                                     |
| OS-EXT-SRV-ATTR:hypervisor_hostname  | -                                     |
| OS-EXT-SRV-ATTR:instance_name        | instance-00000034                     |
| OS-EXT-STS:power_state               | 0                                     |
| OS-EXT-STS:task_state                | scheduling                            |
| OS-EXT-STS:vm_state                  | building                              |
| OS-SRV-USG:launched_at               | -                                     |
| OS-SRV-USG:terminated_at             | -                                     |
| accessIPv4                           |                                       |
| accessIPv6                           |                                       |
| adminPass                            | 3nFXjNrTrmNm                          |
| config_drive                         |                                       |
| created                              | 2016-06-15T16:55:10Z                  |
| flavor                               | m1.tiny (1)                           |
| hostId                               |                                       |
| id                                   | 3844bb10-2c61-4327-a0d4-0c043c674344  |
| image                                | cirros-0.4.0-x86_64 (0526d...7f39)    |
| key_name                             | lb_kp1                                |
| metadata                             | {}                                    |
| name                                 | lb_vm2                                |
| os-extended-volumes:volumes_attached | []                                    |
| progress                             | 0                                     |
| security_groups                      | lb_secgroup1                          |
| status                               | BUILD                                 |
```

```
| tenant_id                            | 4b31d0508f83437e83d8f4d520cda22f      |
| updated                              | 2016-06-15T16:55:09Z                  |
| user_id                              | fd471475faa84680b97f18e55847ec0a      |
+--------------------------------------+--------------------------------------+

            Server building... 100% complete
            Finished
```

13. List the running VM with `nova list`

```
tux > nova server list
+----------------+--------+--------+------------+-------------+-----------------------+
| ID             | Name   | Status | Task State | Power State | Networks              |
+----------------+--------+--------+------------+-------------+-----------------------+
| dfdfe...7ca287 | lb_vm1 | ACTIVE | -          | Running     | lb_net1=10.247.94.132 |
| 3844b...674344 | lb_vm2 | ACTIVE | -          | Running     | lb_net1=10.247.94.133 |
+----------------+--------+--------+------------+-------------+-----------------------+
```

14. Check ports.

```
tux > neutron port list
+----------------+------+-------------------+--------------------------------+
| id             | name | mac_address       | fixed_ips                      |
+----------------+------+-------------------+--------------------------------+
...
| 7e5e0...36450e |      | fa:16:3e:66:fd:2e | {"subnet_id": "6fc25...5f514", |
|                |      |                   | "ip_address": "10.247.94.132"} |
| ca95c...b36854 |      | fa:16:3e:e0:37:c4 | {"subnet_id": "6fc25...5f514", |
|                |      |                   | "ip_address": "10.247.94.133"} |
+----------------+------+-------------------+--------------------------------+
```

15. Create the first floating IP.

```
tux > neutron floating ip create ext-net --port-id 7e5e0038-88cf-4f97-a366-b58cd836450e
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| fixed_ip_address    | 10.247.94.132                        |
| floating_ip_address | 10.247.96.26                         |
| floating_network_id | d3cb12a6-a000-4e3e-82c4-ee04aa169291 |
| id                  | 3ce608bf-8835-4638-871d-0efe8ebf55ef |
| port_id             | 7e5e0038-88cf-4f97-a366-b58cd836450e |
| router_id           | 6aafc9a9-93f6-4d7e-94f2-3068b034b823 |
| status              | DOWN                                 |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f     |
+---------------------+--------------------------------------+
```

16. Create the second floating IP.

```
tux > neutron floating ip create ext-net --port-id ca95cc24-4e8f-4415-9156-7b519eb36854
```

```
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| fixed_ip_address    | 10.247.94.133                        |
| floating_ip_address | 10.247.96.27                         |
| floating_network_id | d3cb12a6-a000-4e3e-82c4-ee04aa169291 |
| id                  | 680c0375-a179-47cb-a8c5-02b836247444 |
| port_id             | ca95cc24-4e8f-4415-9156-7b519eb36854 |
| router_id           | 6aafc9a9-93f6-4d7e-94f2-3068b034b823 |
| status              | DOWN                                 |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f     |
+---------------------+--------------------------------------+
```

17. List the floating IP's.

```
tux > neutron floating ip list
+----------------+------------------+---------------------+---------------+
| id             | fixed_ip_address | floating_ip_address | port_id       |
+----------------+------------------+---------------------+---------------+
| 3ce60...bf55ef | 10.247.94.132    | 10.247.96.26        | 7e5e0...6450e |
| 680c0...247444 | 10.247.94.133    | 10.247.96.27        | ca95c...36854 |
+----------------+------------------+---------------------+---------------+
```

18. Show first Floating IP.

```
tux > neutron floating ip show 3ce608bf-8835-4638-871d-0efe8ebf55ef
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| fixed_ip_address    | 10.247.94.132                        |
| floating_ip_address | 10.247.96.26                         |
| floating_network_id | d3cb12a6-a000-4e3e-82c4-ee04aa169291 |
| id                  | 3ce608bf-8835-4638-871d-0efe8ebf55ef |
| port_id             | 7e5e0038-88cf-4f97-a366-b58cd836450e |
| router_id           | 6aafc9a9-93f6-4d7e-94f2-3068b034b823 |
| status              | ACTIVE                               |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f     |
+---------------------+--------------------------------------+
```

19. Show second Floating IP.

```
tux > neutron floating ip show 680c0375-a179-47cb-a8c5-02b836247444
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| fixed_ip_address    | 10.247.94.133                        |
| floating_ip_address | 10.247.96.27                         |
| floating_network_id | d3cb12a6-a000-4e3e-82c4-ee04aa169291 |
| id                  | 680c0375-a179-47cb-a8c5-02b836247444 |
```

```
| port_id              | ca95cc24-4e8f-4415-9156-7b519eb36854 |
| router_id            | 6aafc9a9-93f6-4d7e-94f2-3068b034b823 |
| status               | ACTIVE                               |
| tenant_id            | 4b31d0508f83437e83d8f4d520cda22f     |
+----------------------+--------------------------------------+
```

20. Ping first Floating IP.

```
tux > ping -c 1 10.247.96.26
PING 10.247.96.26 (10.247.96.26) 56(84) bytes of data.
64 bytes from 10.247.96.26: icmp_seq=1 ttl=62 time=3.50 ms

--- 10.247.96.26 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 3.505/3.505/3.505/0.000 ms
```

21. Ping second Floating IP.

```
tux > ping -c 1 10.247.96.27
PING 10.247.96.27 (10.247.96.27) 56(84) bytes of data.
64 bytes from 10.247.96.27: icmp_seq=1 ttl=62 time=3.47 ms

--- 10.247.96.27 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 3.473/3.473/3.473/0.000 ms
```

22. Listing the VMs will give you both the fixed and floating IP's for each virtual machine.

```
tux > nova list
+---------------+--------+--------+-------+---------+-----------------------------------+
| ID            | Name   | Status | Task  | Power   | Networks                          |
|               |        |        | State | State   |                                   |
+---------------+--------+--------+-------+---------+-----------------------------------+
| dfdfe...ca287 | lb_vm1 | ACTIVE | -     | Running | lb_net1=10.247.94.132, 10.247.96.26 |
| 3844b...74344 | lb_vm2 | ACTIVE | -     | Running | lb_net1=10.247.94.133, 10.247.96.27 |
+---------------+--------+--------+-------+---------+-----------------------------------+
```

23. List Floating IP's.

```
tux > neutron floating ip list
+---------------+-----------------+--------------------+-----------------+
| id            | fixed_ip_address | floating_ip_address | port_id        |
+---------------+-----------------+--------------------+-----------------+
| 3ce60...f55ef | 10.247.94.132   | 10.247.96.26        | 7e5e00...36450e |
| 680c0...47444 | 10.247.94.133   | 10.247.96.27        | ca95cc...b36854 |
+---------------+-----------------+--------------------+-----------------+
```

31.4 Create Load Balancers

The following steps will setup new Octavia Load Balancers.

> **Note**
>
> The following examples assume names and values from the previous section.

1. Create load balancer for subnet

```
tux > neutron lbaas-loadbalancer-create --provider octavia \
  --name lb1 6fc2572c-53b3-41d0-ab63-342d9515f514
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| admin_state_up      | True                                 |
| description         |                                      |
| id                  | 3d9170a1-8605-43e6-9255-e14a8b4aae53 |
| listeners           |                                      |
| name                | lb1                                  |
| operating_status    | OFFLINE                              |
| provider            | octavia                              |
| provisioning_status | PENDING_CREATE                       |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f     |
| vip_address         | 10.247.94.134                        |
| vip_port_id         | da28aed3-0eb4-4139-afcf-2d8fd3fc3c51 |
| vip_subnet_id       | 6fc2572c-53b3-41d0-ab63-342d9515f514 |
+---------------------+--------------------------------------+
```

2. List load balancers. You will need to wait until the load balancer `provisioning_status` is `ACTIVE` before proceeding to the next step.

```
tux > neutron lbaas-loadbalancer-list
+---------------+------+---------------+---------------------+----------+
| id            | name | vip_address   | provisioning_status | provider |
+---------------+------+---------------+---------------------+----------+
| 3d917...aae53 | lb1  | 10.247.94.134 | ACTIVE              | octavia  |
+---------------+------+---------------+---------------------+----------+
```

3. Once the load balancer is created, create the listener. This may take some time.

```
tux > neutron lbaas-listener-create --loadbalancer lb1 \
  --protocol HTTP --protocol-port=80 --name lb1_listener
+---------------------------+------------------------------------------------+
| Field                     | Value                                          |
+---------------------------+------------------------------------------------+
```

```
| admin_state_up            | True                                            |
| connection_limit          | -1                                              |
| default_pool_id           |                                                 |
| default_tls_container_ref |                                                 |
| description               |                                                 |
| id                        | c723b5c8-e2df-48d5-a54c-fc240ac7b539            |
| loadbalancers             | {"id": "3d9170a1-8605-43e6-9255-e14a8b4aae53"} |
| name                      | lb1_listener                                    |
| protocol                  | HTTP                                            |
| protocol_port             | 80                                              |
| sni_container_refs        |                                                 |
| tenant_id                 | 4b31d0508f83437e83d8f4d520cda22f                |
+---------------------------+------------------------------------------------+
```

4. Create the load balancing pool. During the creation of the load balancing pool, the status for the load balancer goes to `PENDING_UPDATE`. Use `neutron lbaas-loadbalancer-list` to watch for the change to `ACTIVE`. Once the load balancer returns to `ACTIVE`, proceed with the next step.

```
tux > neutron lbaas-pool-create --lb-algorithm ROUND_ROBIN \
  --listener lb1_listener --protocol HTTP --name lb1_pool
+---------------------+------------------------------------------------+
| Field               | Value                                          |
+---------------------+------------------------------------------------+
| admin_state_up      | True                                           |
| description         |                                                |
| healthmonitor_id    |                                                |
| id                  | 0f5951ee-c2a0-4e62-ae44-e1491a8988e1           |
| lb_algorithm        | ROUND_ROBIN                                    |
| listeners           | {"id": "c723b5c8-e2df-48d5-a54c-fc240ac7b539"} |
| members             |                                                |
| name                | lb1_pool                                       |
| protocol            | HTTP                                           |
| session_persistence |                                                |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f               |
+---------------------+------------------------------------------------+
```

5. Create first member of the load balancing pool.

```
tux > neutron lbaas-member-create --subnet 6fc2572c-53b3-41d0-ab63-342d9515f514 \
  --address 10.247.94.132 --protocol-port 80 lb1_pool
+----------------+--------------------------------------+
| Field          | Value                                |
+----------------+--------------------------------------+
| address        | 10.247.94.132                        |
| admin_state_up | True                                 |
```

```
| id             | 61da1e21-e0ae-4158-935a-c909a81470e1 |
| protocol_port  | 80                                   |
| subnet_id      | 6fc2572c-53b3-41d0-ab63-342d9515f514 |
| tenant_id      | 4b31d0508f83437e83d8f4d520cda22f     |
| weight         | 1                                    |
+----------------+--------------------------------------+
```

6. Create the second member.

```
tux > neutron lbaas-member-create --subnet 6fc2572c-53b3-41d0-ab63-342d9515f514 \
  --address 10.247.94.133 --protocol-port 80 lb1_pool
+----------------+--------------------------------------+
| Field          | Value                                |
+----------------+--------------------------------------+
| address        | 10.247.94.133                        |
| admin_state_up | True                                 |
| id             | 459c7f21-46f7-49e8-9d10-dc7da09f8d5a |
| protocol_port  | 80                                   |
| subnet_id      | 6fc2572c-53b3-41d0-ab63-342d9515f514 |
| tenant_id      | 4b31d0508f83437e83d8f4d520cda22f     |
| weight         | 1                                    |
+----------------+--------------------------------------+
```

7. You should check to make sure the load balancer is active and check the pool members.

```
tux > neutron lbaas-loadbalancer-list
+----------------+------+---------------+---------------------+----------+
| id             | name | vip_address   | provisioning_status | provider |
+----------------+------+---------------+---------------------+----------+
| 3d9170...aae53 | lb1  | 10.247.94.134 | ACTIVE              | octavia  |
+----------------+------+---------------+---------------------+----------+

neutron lbaas-member-list lb1_pool
+---------------+---------------+---------------+--------+---------------+----------------+
| id            | address       | protocol_port | weight | subnet_id     | admin_state_up |
+---------------+---------------+---------------+--------+---------------+----------------+
| 61da1...470e1 | 10.247.94.132 |            80 |      1 | 6fc25...5f514 | True           |
| 459c7...f8d5a | 10.247.94.133 |            80 |      1 | 6fc25...5f514 | True           |
+---------------+---------------+---------------+--------+---------------+----------------+
```

8. You can view the details of the load balancer, listener and pool.

```
tux > neutron lbaas-loadbalancer-show 3d9170a1-8605-43e6-9255-e14a8b4aae53
+---------------------+------------------------------------------------+
| Field               | Value                                          |
+---------------------+------------------------------------------------+
| admin_state_up      | True                                           |
| description         |                                                |
| id                  | 3d9170a1-8605-43e6-9255-e14a8b4aae53           |
```

```
| listeners           | {"id": "c723b5c8-e2df-48d5-a54c-fc240ac7b539"} |
| name                | lb1                                            |
| operating_status    | ONLINE                                         |
| provider            | octavia                                        |
| provisioning_status | ACTIVE                                         |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f               |
| vip_address         | 10.247.94.134                                  |
| vip_port_id         | da28aed3-0eb4-4139-afcf-2d8fd3fc3c51           |
| vip_subnet_id       | 6fc2572c-53b3-41d0-ab63-342d9515f514           |
+---------------------+------------------------------------------------+

neutron lbaas-listener-list
+-------------+-----------------+-------------+----------+---------------+----------------
+
| id          | default_pool_id | name         | protocol | protocol_port | admin_state_up
 |
+-------------+-----------------+-------------+----------+---------------+----------------
+
| c723...b539 | 0f595...8988e1  | lb1_listener | HTTP     |            80 | True
 |
+-------------+-----------------+-------------+----------+---------------+----------------
+

neutron lbaas-pool-list
+--------------------------------------+----------+----------+----------------+
| id                                   | name     | protocol | admin_state_up |
+--------------------------------------+----------+----------+----------------+
| 0f5951ee-c2a0-4e62-ae44-e1491a8988e1 | lb1_pool | HTTP     | True           |
+--------------------------------------+----------+----------+----------------+
```

31.5 Create Floating IPs for Load Balancer

To create the floating IP's for the load balancer, you will need to list the current ports to get the load balancer id. Once you have the id, you can then create the floating IP.

1. List the current ports.

```
tux > neutron port list
+-------------+--------------+-------------------+----------------------------------------+
| id          | name         | mac_address       | fixed_ips                              |
+-------------+--------------+-------------------+----------------------------------------+
...
| 7e5e...6450e |             | fa:16:3e:66:fd:2e | {"subnet_id": "6fc2572c-               |
|              |             |                   | 53b3-41d0-ab63-342d9515f514",          |
|              |             |                   | "ip_address": "10.247.94.132"}         |
| a3d0...55efe |             | fa:16:3e:91:a2:5b | {"subnet_id": "f00299f8-3403-45ae-ac4b- |
|              |             |                   | 58af41d57bdc", "ip_address":           |
|              |             |                   | "10.247.94.142"}                       |
| ca95...36854 |             | fa:16:3e:e0:37:c4 | {"subnet_id": "6fc2572c-               |
```

```
|              |              |                  | 53b3-41d0-ab63-342d9515f514",          |
|              |              |                  | "ip_address": "10.247.94.133"}         |
| da28...c3c51 | loadbalancer- | fa:16:3e:1d:a2:1c | {"subnet_id": "6fc2572c-              |
|              | 3d917...aae53 |                  | 53b3-41d0-ab63-342d9515f514",          |
|              |              |                  | "ip_address": "10.247.94.134"}         |
+--------------+--------------+------------------+----------------------------------------+
```

2. Create the floating IP for the load balancer.

```
tux > neutron floating ip create ext-net --port-id da28aed3-0eb4-4139-afcf-2d8fd3fc3c51
Created a new floatingip:
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| fixed_ip_address    | 10.247.94.134                        |
| floating_ip_address | 10.247.96.28                         |
| floating_network_id | d3cb12a6-a000-4e3e-82c4-ee04aa169291 |
| id                  | 9a3629bd-b0a6-474c-abe9-89c6ecb2b22c |
| port_id             | da28aed3-0eb4-4139-afcf-2d8fd3fc3c51 |
| router_id           | 6aafc9a9-93f6-4d7e-94f2-3068b034b823 |
| status              | DOWN                                 |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f     |
+---------------------+--------------------------------------+
```

31.6 Testing the Octavia Load Balancer

To test the load balancers, create the following web server script so you can run it on each virtual machine. You will use `curl <ip address>` to test if the load balance services are responding properly.

1. Start running web servers on both of the virtual machines. Create the webserver.sh script with below contents. In this example, the port is 80.

```
tux > vi webserver.sh

#!/bin/bash

MYIP=$(/sbin/ifconfig eth0|grep 'inet addr'|awk -F: '{print $2}'| awk '{print $1}');
while true; do
    echo -e "HTTP/1.0 200 OK

Welcome to $MYIP" | sudo nc -l -p 80
done
```

2. Deploy the web server and run it on the first virtual machine.

```
ardana > ssh-keygen -R 10.247.96.26
```

```
/home/ardana/.ssh/known_hosts updated.
Original contents retained as /home/ardana/.ssh/known_hosts.old

scp -o StrictHostKeyChecking=no -i lb_kp1.pem webserver.sh cirros@10.247.96.26:
webserver.sh                                      100%  263     0.3KB/s   00:00

ssh -o StrictHostKeyChecking=no -i lb_kp1.pem cirros@10.247.96.26 'chmod +x ./webserver.sh'
ssh -o StrictHostKeyChecking=no -i lb_kp1.pem cirros@10.247.96.26 ./webserver.sh
```

3. Test the first web server.

```
tux > curl 10.247.96.26
 Welcome to 10.247.94.132
```

4. Deploy and start the web server on the second virtual machine like you did in the previous steps. Once the second web server is running, list the floating IPs.

```
tux > neutron floating ip list
+----------------+------------------+---------------------+---------------+
| id             | fixed_ip_address | floating_ip_address | port_id       |
+----------------+------------------+---------------------+---------------+
| 3ce60...bf55ef | 10.247.94.132    | 10.247.96.26        | 7e5e0...6450e |
| 680c0...247444 | 10.247.94.133    | 10.247.96.27        | ca95c...36854 |
| 9a362...b2b22c | 10.247.94.134    | 10.247.96.28        | da28a...c3c51 |
+----------------+------------------+---------------------+---------------+
```

5. Display the floating IP for the load balancer.

```
tux > neutron floating ip show 9a3629bd-b0a6-474c-abe9-89c6ecb2b22c
+---------------------+--------------------------------------+
| Field               | Value                                |
+---------------------+--------------------------------------+
| fixed_ip_address    | 10.247.94.134                        |
| floating_ip_address | 10.247.96.28                         |
| floating_network_id | d3cb12a6-a000-4e3e-82c4-ee04aa169291 |
| id                  | 9a3629bd-b0a6-474c-abe9-89c6ecb2b22c |
| port_id             | da28aed3-0eb4-4139-afcf-2d8fd3fc3c51 |
| router_id           | 6aafc9a9-93f6-4d7e-94f2-3068b034b823 |
| status              | ACTIVE                               |
| tenant_id           | 4b31d0508f83437e83d8f4d520cda22f     |
+---------------------+--------------------------------------+
```

6. Finally, test the load balancing.

```
tux > curl 10.247.96.28
Welcome to 10.247.94.132
```

```
tux > curl 10.247.96.28
Welcome to 10.247.94.133

tux > curl 10.247.96.28
Welcome to 10.247.94.132

tux > curl 10.247.96.28
Welcome to 10.247.94.133

tux > curl 10.247.96.28
Welcome to 10.247.94.132

tux > curl 10.247.96.28
Welcome to 10.247.94.133
```

32 Other Common Post-Installation Tasks

32.1 Determining Your User Credentials

On your Cloud Lifecycle Manager, in the `~/scratch/ansible/next/ardana/ansible/group_vars/` directory you will find several files. In the one labeled as first control plane node you can locate the user credentials for both the Administrator user (`admin`) and your Demo user (`demo`) which you will use to perform many other actions on your cloud.

For example, if you are using the Entry-scale KVM model and used the default naming scheme given in the example configuration files, you can use these commands on your Cloud Lifecycle Manager to **`grep`** for your user credentials:

Administrator

```
ardana > grep keystone_admin_pwd entry-scale-kvm-control-plane-1
```

Demo

```
ardana > grep keystone_demo_pwd entry-scale-kvm-control-plane-1
```

32.2 Configure your Cloud Lifecycle Manager to use the command-line tools

This playbook will do a series of steps to update your environment variables for your cloud so you can use command-line clients.

Run the following command, which will replace `/etc/hosts` on the Cloud Lifecycle Manager:

```
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts cloud-client-setup.yml
```

As the `/etc/hosts` file no longer has entries for Cloud Lifecycle Manager, sudo commands may become a bit slower. To fix this issue, once this step is complete, add "ardana" after "127.0.0.1 localhost". The result will look like this:

```
...
# Localhost Information
127.0.0.1 localhost ardana
```

32.3 Protect home directory

The home directory of the user that owns the SUSE OpenStack Cloud 8 scripts should not be world readable. Change the permissions so that they are only readable by the owner:

```
ardana > chmod 0700 ~
```

32.4 Back up Your SSH Keys

As part of the cloud deployment setup process, SSH keys to access the systems are generated and stored in `~/.ssh` on your Cloud Lifecycle Manager.

These SSH keys allow access to the subsequently deployed systems and should be included in the list of content to be archived in any backup strategy.

32.5 Retrieving Service Endpoints

1. Log in to your Cloud Lifecycle Manager.
2. Source the keystone admin credentials:

   ```
   ardana > unset OS_TENANT_NAME
   ardana > source ~/keystone.osrc
   ```

3. Using the OpenStack command-line tool you can then query the Keystone service for your endpoints:

   ```
   ardana > openstack endpoint list
   ```

   > **Tip**
   >
   > You can use `openstack -h` to access the client help file and a full list of commands.

To learn more about Keystone, see *Book "Operations Guide", Chapter 4 "Managing Identity", Section 4.1 "The Identity Service"*.

32.6 Other Common Post-Installation Tasks

Here are the links to other common post-installation tasks that either the Administrator or Demo users can perform:

- *Book "Operations Guide", Chapter 5 "Managing Compute", Section 5.4 "Enabling the Nova Resize and Migrate Features"*
- *Section 27.4, "Creating an External Network"*
- *Section 27.3, "Uploading an Image for Use"*
- *Book "User Guide", Chapter 8 "Creating a Private Network"*
- *Book "Operations Guide", Chapter 8 "Managing Object Storage", Section 8.1 "Running the Swift Dispersion Report"*
- *Book "Security Guide", Chapter 4 "SUSE® OpenStack Cloud: Service Admin Role Segregation in the Identity Service"*

33 Support

Find solutions for the most common pitfalls and technical details on how to create a support request for SUSE OpenStack Cloud here.

33.1 FAQ

1 Node Deployment

Q: *How to Disable the YaST Installer Self-Update when deploying nodes?*

A: Prior to starting an installation, the YaST installer can update itself if respective updates are available. By default this feature is enabled. In case of problems with this feature, disable it as follows:

1. Open `~/openstack/ardana/ansible/roles/cobbler/templates/sles.grub.j2` with an editor and add `self_update=0` to the line starting with `linuxefi`. The results needs to look like the following:

```
linuxefi images/{{ sles_profile_name }}-x86_64/linux ifcfg={{ item[0] }}=dhcp
 install=http://{{ cobbler_server_ip_addr }}:79/cblr/ks_mirror/
{{ sles_profile_name }} self_update=0 AutoYaST2=http://
{{ cobbler_server_ip_addr }}:79/cblr/svc/op/ks/system/{{ item[1] }}
```

2. Commit your changes:

```
ardana > git commit -m "Disable Yast Self Update feature" \
~/openstack/ardana/ansible/roles/cobbler/templates/sles.grub.j2
```

3. If you need to reenable the installer self-update, remove `self_update=0` and commit the changes.

33.2 Support

Before contacting support to help you with a problem on your cloud, it is strongly recommended that you gather as much information about your system and the problem as possible. For this purpose, SUSE OpenStack Cloud ships with a tool called **`supportconfig`**. It gathers system information such as the current kernel version being used, the hardware, RPM database, partitions, and other items. `supportconfig` also collects the most important log files, making it easier for the supporters to identify and solve your problem.

It is recommended to always run `supportconfig` on the CLM Server and on the Control Node(s). If a Compute Node or a Storage Node is part of the problem, run `supportconfig` on the affected node as well. For details on how to run `supportconfig`, see https://documentation.suse.com/sles/12-SP5/single-html/SLES-admin/#cha-adm-support.

33.2.1 Applying PTFs (Program Temporary Fixes) Provided by the SUSE L3 Support

Under certain circumstances, the SUSE support may provide temporary fixes, the so-called PTFs, to customers with an L3 support contract. These PTFs are provided as RPM packages. To make them available on all nodes in SUSE OpenStack Cloud, proceed as follows. If you prefer to test them first on a single node, see *Section 33.2.2, " Testing PTFs (Program Temporary Fixes) on a Single Node "*.

1. Download the packages from the location provided by the SUSE L3 Support to a temporary location on the CLM Server.

2. Move the packages from the temporary download location to the following directories on the CLM Server:

   "noarch" packages (`*.noarch.rpm`):
      `/srv/www/suse-12.2/x86_64/repos/PTF/rpm/noarch/`

   "x86_64" packages (`*.x86_64.rpm`)
      `/srv/www/suse-12.2/x86_64/repos/PTF/rpm/x86_64/`

3. Create or update the repository metadata:

```
ardana > createrepo-cloud-ptf
```

4. To deploy the updates, proceed as described in *Book "Operations Guide", Chapter 13 "System Maintenance", Section 13.3 "Cloud Lifecycle Manager Maintenance Update Procedure"* and refresh the PTF repository before installing package updates on a node:

```
ardana > zypper refresh -fr PTF
```

33.2.2 Testing PTFs (Program Temporary Fixes) on a Single Node

If you want to test a PTF (Program Temporary Fix) before deploying it on all nodes, if you want to verify that it fixes a certain issue, you can manually install the PTF on a single node.

In the following procedure, a PTF named `venv-openstack-nova-x86_64-ptf.rpm`, containing a fix for Nova, is installed on the Compute Node 01.

PROCEDURE 33.1: TESTING A FIX FOR NOVA

1. Check the version number of the package(s) that will be upgraded with the PTF. Run the following command on the deployer node:

   ```
   ardana > rpm -q venv-openstack-nova-x86_64
   ```

2. Install the PTF on the deployer node:

   ```
   tux > sudo zypper up ./venv-openstack-nova-x86_64-ptf.rpm
   ```

   This will install a new TAR archive in `/opt/ardana_packager/ardana-8/sles_venv/x86_64/`.

3. Register the TAR archive with the indexer:

   ```
   tux > sudo  create_index --dir \
         /opt/ardana_packager/ardana-8/sles_venv/x86_64
   ```

   This will update the indexer `/opt/ardana_packager/ardana-8/sles_venv/x86_64/packages`.

4. Deploy the fix on Compute Node 01:

   a. Check whether the fix can be deployed on a single Compute Node without updating the Control Nodes:

      ```
      ardana > cd ~/scratch/ansible/next/ardana/ansible
      ardana > ansible-playbook -i hosts/verb_hosts nova-upgrade.yml \
      --limit=inputmodel-ccp-compute0001-mgmt --list-hosts
      ```

   b. If the previous test passes, install the fix:

      ```
      ardana > ansible-playbook -i hosts/verb_hosts nova-upgrade.yml \
      --limit=inputmodel-ccp-compute0001-mgmt
      ```

5. Validate the fix, for example by logging in to the Compute Node to check the log files:

```
ardana > ssh ardana@inputmodel-ccp-compute0001-mgmt
```

6. In case your tests are positive, install the PTF on all nodes as described in *Section 33.2.1, " Applying PTFs (Program Temporary Fixes) Provided by the SUSE L3 Support "*.

   In case the test are negative uninstall the fix and restore the previous state of the Compute Node by running the following commands on the deployer node;

```
tux > sudo zypper install --force venv-openstack-nova-x86_64-OLD-VERSION
ardana > cd ~/scratch/ansible/next/ardana/ansible
ardana > ansible-playbook -i hosts/verb_hosts nova-upgrade.yml \
--limit=inputmodel-ccp-compute0001-mgmt
```

   Make sure to replace `OLD-VERSION` with the version number you checked in the first step.