



Red Hat OpenStack Platform 13

Partner Integration

Integrating and certifying third party software and hardware in a Red Hat OpenStack Platform environment

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Abstract

This guide provides guidelines on integrating and certifying third-party components into a Red Hat OpenStack Platform environment. This includes adding these components to your overcloud images, creating configuration for deployment by using director, and certifying these components with the Red Hat Connect Build Service.

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CHAPTER 1. REASONS TO INTEGRATE YOUR THIRD-PARTY COMPONENTS

You can use Red Hat OpenStack Platform (RHOSP) to integrate solutions with RHOSP director. Use RHOSP director to install and manage the deployment lifecycle of a RHOSP environment. You can optimize resources, reduce deployment times, and reduce lifecycle management costs.

RHOSP director integration provides integration with existing enterprise management systems and processes. Red Hat products, such as CloudForms, are expected to have visibility into integrations with director and provide broader exposure for management of service deployment.

1.1. PARTNER INTEGRATION PREREQUISITES

You must meet several prerequisites before you can perform operations with director. The goal of partner integration is to create a shared understanding of the entire integration as a basis for Red Hat engineering, partner managers, and support resources to facilitate technology working together.

To include a third-party component with Red Hat OpenStack Platform director, you must certify the partner solution with Red Hat OpenStack Platform.

OpenStack Plug-in Certification Guides

- [Red Hat OpenStack Certification Policy Guide](#)
- [Red Hat OpenStack Certification Workflow Guide](#)

OpenStack Application Certification Guides

- [Red Hat OpenStack Application Policy Guide](#)
- [Red Hat OpenStack Application Workflow Guide](#)

OpenStack Bare Metal Certification Guides

- [Red Hat OpenStack Platform Hardware Bare Metal Certification Policy Guide](#)
- [Red Hat OpenStack Platform Hardware Bare Metal Certification Workflow Guide](#)

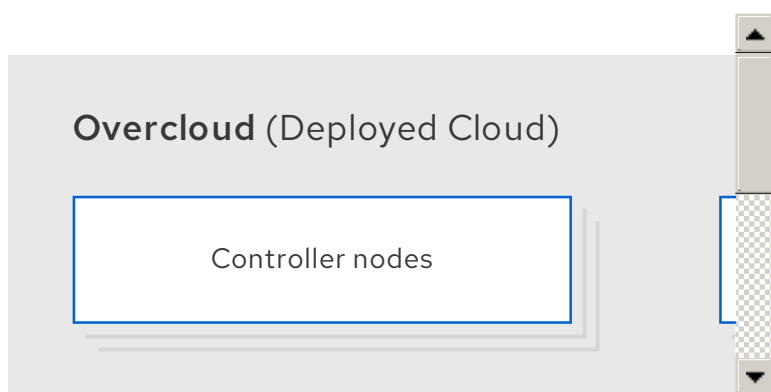
CHAPTER 2. DIRECTOR ARCHITECTURE

Red Hat OpenStack Platform director uses OpenStack APIs to configure, deploy, and manage Red Hat OpenStack Platform (RHOSP) environments. This means that integration with director requires you to integrate with these OpenStack APIs and supporting components. The benefits of these APIs are that they are well documented, undergo extensive integration testing upstream, are mature, and make understanding how director works easier for those that have a foundational knowledge of RHOSP. Director automatically inherits core OpenStack feature enhancements, security patches, and bug fixes.

Director is a toolset that you use to install and manage a complete RHOSP environment. It is based primarily on the OpenStack project TripleO, which is an abbreviation for "OpenStack-On-OpenStack". This project uses RHOSP components to install a fully operational RHOSP environment. This includes new OpenStack components that provision and control bare metal systems to use as OpenStack nodes. This provides a simple method for installing a complete RHOSP environment that is both lean and robust.

Director uses two main concepts: an undercloud and an overcloud. Director is a subset of OpenStack components that form a single-system OpenStack environment, also known as the undercloud. The undercloud acts as a management system that can create a production-level cloud for workloads to run. This production-level cloud is the overcloud. For more information about the overcloud and the undercloud, see the [Director Installation and Usage](#) guide.

Figure 2.1. Architecture of the undercloud and the overcloud



Director includes tools, utilities, and example templates that you can use to create an overcloud configuration. Director captures configuration data, parameters, and network topology information and uses this information in conjunction with components such as ironic, heat, and Puppet to orchestrate an overcloud installation.

2.1. CORE COMPONENTS AND OVERCLOUD

The following components are core to Red Hat OpenStack Platform director and contribute to overcloud creation:

- OpenStack Bare Metal Provisioning service (ironic)
- OpenStack Orchestration service (heat)
- Puppet
- TripleO and TripleO heat templates
- Composable services

- Containerized services and Kolla
- Ansible

2.1.1. OpenStack Bare Metal Provisioning service (ironic)

The Bare Metal Provisioning service provides dedicated bare metal hosts to end users through self-service provisioning. Director uses Bare Metal Provisioning to manage the life-cycle of the bare metal hardware in the overcloud. Bare Metal Provisioning uses its own API to define bare metal nodes.

To provision OpenStack environments with director, you must register your nodes with Bare Metal Provisioning by using a specific driver. The main supported driver is the Intelligent Platform Management Interface (IPMI) as most hardware contains some support for IPMI power management functions. However, Bare Metal Provisioning also contains vendor specific equivalents, such as HP iLO, Cisco UCS, or Dell DRAC.

Bare Metal Provisioning controls the power management of the nodes and gathers hardware information or facts using an introspection mechanism. Director uses the information from the introspection process to match nodes to various OpenStack environment roles, such as Controller nodes, Compute nodes, and Storage nodes. For example, a discovered node with 10 disks is usually provisioned as a Storage node.

Figure 2.2. Use the Bare Metal Provisioning service controls the power management of the nodes

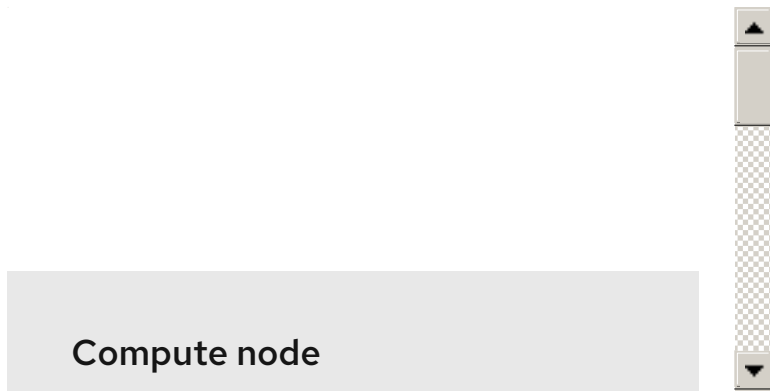


If you want to have director support for your hardware, you must have driver coverage in the Bare Metal Provisioning service.

2.1.2. Heat

Heat is an application stack orchestration engine. You can use heat to define elements for an application before you deploy it to a cloud. Create a stack template that includes a number of infrastructure resources, for example, instances, networks, storage volumes, and elastic IPs, with a set of parameters for configuration. Use heat to create these resources based on a given dependency chain, monitor the resources for availability, and scale if necessary. You can use these templates to make application stacks portable and to achieve repeatable results.

Figure 2.3. Use the heat service to define elements for an application before you deploy it to a cloud



Director uses the native OpenStack heat APIs to provision and manage the resources associated with overcloud deployment. This includes precise details such as defining the number of nodes to provision per node role, the software components to configure for each node, and the order in which director configures these components and node types. Director also uses heat to troubleshoot a deployment and make changes post-deployment.

The following example is a snippet from a heat template that defines parameters of a Controller node:

```
NeutronExternalNetworkBridge:
  description: Name of bridge used for external network traffic.
  type: string
  default: 'br-ex'
NeutronBridgeMappings:
  description: >
    The OVS logical->physical bridge mappings to use. See the Neutron
    documentation for details. Defaults to mapping br-ex - the external
    bridge on hosts - to a physical name 'datacentre' which can be used
    to create provider networks (and we use this for the default floating
    network) - if changing this either use different post-install network
    scripts or be sure to keep 'datacentre' as a mapping network name.
  type: string
  default: "datacentre:br-ex"
```

Heat consumes templates included with the director to facilitate the creation of an overcloud, which includes calling ironic to power the nodes. You can use the standard heat tools to view the resources and statuses of an in-progress overcloud. For example, you can use the heat tools to display the overcloud as a nested application stack. Use the syntax of heat templates to declare and create production OpenStack clouds. Because every partner integration use case requires heat templates, you must have some prior understanding and proficiency for partner integration.

2.1.3. Puppet

Puppet is a configuration management and enforcement tool you can use to describe and maintain the end state of a machine. You define this end state in a Puppet manifest. Puppet supports two models:

- A standalone mode in which you run instructions in the form of manifests locally
- A server mode in which Puppet retrieves its manifests from a central server, called a Puppet Master

You can make changes in two ways:

- Upload new manifests to a node and execute them locally.
- Make modifications in the client/server model on the Puppet Master.

Director uses Puppet in the following areas:

- On the undercloud host locally to install and configure packages according to the configuration in the **undercloud.conf** file.
- By injecting the **openstack-puppet-modules** package into the base overcloud image, the Puppet modules are ready for post-deployment configuration. By default, you create an image that contains all OpenStack services for each node.
- Providing additional Puppet manifests and heat parameters to the nodes and applying the configuration after overcloud deployment. This includes the services to enable and start the configuration depending on the node type.
- Providing Puppet hieradata to the nodes. The Puppet modules and manifests are free from site or node-specific parameters to keep the manifests consistent. The hieradata acts as a form of parameterized values that you can push to a Puppet module and reference in other areas. For example, to reference the MySQL password inside of a manifest, save this information as hieradata and reference it within the manifest.

To view the hieradata, enter the following command:

```
[root@localhost ~]# grep mysql_root_password hieradata.yaml # View the data in the
hieradata file
openstack::controller::mysql_root_password: 'redhat123'
```

To reference the hieradata in the Puppet manifest, enter the following command:

```
[root@localhost ~]# grep mysql_root_password example.pp # Now referenced in the Puppet
manifest
mysql_root_password => hiera('openstack::controller::mysql_root_password')
```

Partner-integrated services that need package installation and service enablement can create Puppet modules to meet their requirements. For more information about obtaining current OpenStack Puppet modules and examples, see [Section 4.2, "Obtaining OpenStack Puppet modules"](#).

2.1.4. TripleO and TripleO heat templates

Director is based on the upstream TripleO project. This project combines a set of OpenStack services with the following goals:

- Store overcloud images by using the Image service (glance)
- Orchestrate the overcloud by using the Orchestration service (heat)
- Provision bare metal machines by using the Bare Metal Provisioning (ironic) and Compute (nova) services

TripleO also includes a heat template collection that defines a Red Hat-supported overcloud environment. Director, using heat, reads this template collection and orchestrates the overcloud stack.

2.1.5. Composable services

Each aspect of Red Hat OpenStack Platform is broken into a composable service. This means that you can define different roles that use different combinations of services. For example, you can move the networking agents from the default Controller node to a standalone Networker node.

For more information about the composable service architecture, see [Chapter 6, Composable services](#).

2.1.6. Containerized services and Kolla

Each of the main Red Hat OpenStack Platform (RHOSP) services run in containers. This provides a method to keep each service within its own isolated namespace separated from the host. This has the following effects:

- During deployment, RHOSP pulls and runs container images from the Red Hat Customer Portal.
- The **podman** command operates management functions, like starting and stopping services.
- To upgrade containers, you must pull new container images and replace the existing containers with newer versions.

Red Hat OpenStack Platform uses a set of containers built and managed with the **Kolla** toolset.

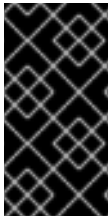
2.1.7. Ansible

Red Hat OpenStack Platform uses Ansible to drive certain functions in relation to composable service upgrades. This includes functions such as starting and stopping services and performing database upgrades. These upgrade tasks are defined within composable service templates.

CHAPTER 3. WORKING WITH OVERCLOUD IMAGES

Red Hat OpenStack Platform (RHOSP) director provides images for the overcloud. The QCOW image in this collection contains a base set of software components that integrate to form various overcloud roles, such as Compute, Controller, and storage nodes. In some situations, you might aim to modify certain aspects of the overcloud image to suit your needs, such as installing additional components to nodes.

You can use the **virt-customize** tool to modify an existing overcloud image to augment an existing Controller node. For example, use the following procedures to install additional **ml2** plugins, Cinder backends, or monitoring agents that do not ship with the initial image.



IMPORTANT

If you modify the overcloud image to include third-party software and report an issue, Red Hat might request that you reproduce the issue with an unmodified image in accordance with our general third-party support policy: <https://access.redhat.com/articles/1067>.

3.1. OBTAINING THE OVERCLOUD IMAGES

Director requires several disk images to provision overcloud nodes:

- **An introspection kernel and ramdisk** - For bare metal system introspection over PXE boot.
- **A deployment kernel and ramdisk** - For system provisioning and deployment.
- **An overcloud kernel, ramdisk, and full image** - A base overcloud system that director writes to the hard disk of the node.

Procedure

1. To obtain these images, install the **rhosp-director-images** and **rhosp-director-images-ipa** packages:

```
$ sudo yum install rhosp-director-images rhosp-director-images-ipa
```

2. Extract the archives to the **images** directory on the **stack** user home, **/home/stack/images**:

```
$ cd ~/images
$ for i in /usr/share/rhosp-director-images/overcloud-full-latest-13.0.tar /usr/share/rhosp-director-images/ironic-python-agent-latest-13.0.tar; do tar -xvf $i; done
```

3.2. INITRD: MODIFYING THE INITIAL RAMDISKS

Some situations might require that you modify the initial ramdisk. For example, you might require that a certain driver is available when you boot the nodes during the introspection or provisioning processes. In the context of the overcloud, this includes one of the following ramdisks:

- The introspection ramdisk - **ironic-python-agent.initramfs**
- The provisioning ramdisk - **overcloud-full.initrd**

This procedure adds an additional RPM package to the **ironic-python-agent.initramfs** ramdisk as an example.

Procedure

1. Log in as the **root** user and create a temporary directory for the ramdisk:

```
# mkdir ~/ipa-tmp
# cd ~/ipa-tmp
```

2. Use the **skipcpio** and **cpio** commands to extract the ramdisk to the temporary directory:

```
# /usr/lib/dracut/skipcpio ~/images/ironic-python-agent.initramfs | zcat | cpio -ivd | pax -r
```

3. Install an RPM package to the extracted contents:

```
# rpm2cpio ~/RPMs/python-proliantutils-2.1.7-1.el7ost.noarch.rpm | pax -r
```

4. Recreate the new ramdisk:

```
# find . 2>/dev/null | cpio --quiet -c -o | gzip -8 > /home/stack/images/ironic-python-agent.initramfs
# chown stack: /home/stack/images/ironic-python-agent.initramfs
```

5. Verify that the new package now exists in the ramdisk:

```
# lsinitrd /home/stack/images/ironic-python-agent.initramfs | grep proliant
```

3.3. QCOW: INSTALLING VIRT-CUSTOMIZE TO DIRECTOR

The **libguestfs-tools** package contains the **virt-customize** tool.

Procedure

- Install the **libguestfs-tools** from the **rhel-8-for-x86_64-appstream-eus-rpms** repository:

```
$ sudo yum install libguestfs-tools
```



IMPORTANT

If you install the **libguestfs-tools** package on the undercloud, disable **iscsid.socket** to avoid port conflicts with the **tripleo_iscsid** service on the undercloud:

```
$ sudo systemctl disable --now iscsid.socket
```

3.4. QCOW: INSPECTING THE OVERCLOUD IMAGE

Before you can review the contents of the **overcloud-full.qcow2** image, you must create a virtual machine that uses this image.

Procedure

1. To create a virtual machine instance that uses the **overcloud-full.qcow2** image, use the **guestmount** command:

```
$ mkdir ~/overcloud-full
$ guestmount -a overcloud-full.qcow2 -i --ro ~/overcloud-full
```

You can review the contents of the QCOW2 image in **~/overcloud-full**.

2. Alternatively, you can use virt-manager to create a virtual machine with the following boot options:
 - **Kernel path:** /overcloud-full.vmlinuz
 - **initrd path:** /overcloud-full.initrd
 - **Kernel arguments:** root=/dev/sda

3.5. QCOW: SETTING THE ROOT PASSWORD

Set the root password to provide administrator-level access for your nodes through the console.

Procedure

- Set the password for the **root** user on image:

```
$ virt-customize --selinux-relabel -a overcloud-full.qcow2 --root-password password:test
[ 0.0] Examining the guest ...
[ 18.0] Setting a random seed
[ 18.0] Setting passwords
[ 19.0] Finishing off
```

3.6. QCOW: REGISTERING THE IMAGE

Register your overcloud image to the Red Hat Content Delivery Network.

Procedure

1. Register your image temporarily to enable Red Hat repositories relevant to your customizations:

```
$ virt-customize --selinux-relabel -a overcloud-full.qcow2 --run-command 'subscription-
manager register --username=[username] --password=[password]'
[ 0.0] Examining the guest ...
[ 10.0] Setting a random seed
[ 10.0] Running: subscription-manager register --username=[username] --password=
[password]
[ 24.0] Finishing off
```

2. Replace the **[username]** and **[password]** with your Red Hat customer account details. This runs the following command on the image:

```
subscription-manager register --username=[username] --password=[password]
```


3.7. QCOW: ATTACHING A SUBSCRIPTION AND ENABLING RED HAT REPOSITORIES

Procedure

1. Find a list of pool ID from your account subscriptions:

```
$ sudo subscription-manager list
```

2. Choose a subscription pool ID and attach it to the image:

```
$ virt-customize --selinux-relabel -a overcloud-full.qcow2 --run-command 'subscription-
manager attach --pool [subscription-pool]'
[ 0.0] Examining the guest ...
[ 12.0] Setting a random seed
[ 12.0] Running: subscription-manager attach --pool [subscription-pool]
[ 52.0] Finishing off
```

3. Replace the **[subscription-pool]** with your chosen subscription pool ID:

```
subscription-manager attach --pool [subscription-pool]
```

This adds the pool to the image so that you can enable the repositories.

4. Enable the Red Hat repositories:

```
$ subscription-manager repos --enable=[repo-id]
```

3.8. QCOW: COPYING A CUSTOM REPOSITORY FILE

Adding third-party software to the image requires additional repositories. The following is an example repo file that contains configuration to use the OpenDaylight repository content.

Procedure

1. List the contents of the **opendaylight.repo** file:

```
$ cat opendaylight.repo

[opendaylight]
name=OpenDaylight Repository
baseurl=https://nexus.opendaylight.org/content/repositories/opendaylight-yum-epel-6-
x86_64/
gpgcheck=0
```

2. Copy the repository file on to the image:

```
$ virt-customize --selinux-relabel -a overcloud-full.qcow2 --upload
opendaylight.repo:/etc/yum.repos.d/
[ 0.0] Examining the guest ...
```

```
[ 12.0] Setting a random seed
[ 12.0] Copying: opendaylight.repo to /etc/yum.repos.d/
[ 13.0] Finishing off
```

The **--upload** option copies the repository file to **/etc/yum.repos.d/** on the overcloud image.

Important: Red Hat does not offer support for software from non-certified vendors. Check with your Red Hat support representative that the software you want to install is supported.

3.9. QCOW: INSTALLING RPMS

Procedure

- Use the **virt-customize** command to install packages to the image:

```
$ virt-customize --selinux-relabel -a overcloud-full.qcow2 --install opendaylight
[ 0.0] Examining the guest ...
[ 11.0] Setting a random seed
[ 11.0] Installing packages: opendaylight
[ 91.0] Finishing off
```

Use the **--install** option to specify a package to install.

3.10. QCOW: CLEANING THE SUBSCRIPTION POOL

Procedure

- After you install the necessary packages to customize the image, remove the subscription pools and unregister the image:

```
$ virt-customize --selinux-relabel -a overcloud-full.qcow2 --run-command 'subscription-
manager remove --all'
[ 0.0] Examining the guest ...
[ 12.0] Setting a random seed
[ 12.0] Running: subscription-manager remove --all
[ 18.0] Finishing off
```

3.11. QCOW: UNREGISTERING THE IMAGE

Procedure

- Unregister the image so that the overcloud deployment process can deploy the image to your nodes and register each of them individually:

```
$ virt-customize --selinux-relabel -a overcloud-full.qcow2 --run-command 'subscription-
manager unregister'
[ 0.0] Examining the guest ...
[ 11.0] Setting a random seed
[ 11.0] Running: subscription-manager unregister
[ 17.0] Finishing off
```

3.12. QCOW: RESET THE MACHINE ID

Procedure

- Reset the machine ID for the image so that machines that use this image do not use duplicate machine IDs:

```
$ virt-sysprep --operation machine-id -a overcloud-full.qcow2
```

3.13. UPLOADING THE IMAGES TO DIRECTOR

After you modify the image, you need to upload it to director.

Procedure

1. Source the **stackrc** file so that you can access director from the command line:

```
$ source stackrc
```

2. Upload the default director images to use for deploying the overcloud:

```
$ openstack overcloud image upload --image-path /home/stack/images/
```

This uploads the following images into the director:

- bm-deploy-kernel
- bm-deploy-ramdisk
- overcloud-full
- overcloud-full-initrd
- overcloud-full-vmlinuz

The script also installs the introspection images on the directors PXE server.

3. View a list of the images in the CLI:

```
$ openstack image list
+-----+-----+
| ID                | Name                |
+-----+-----+
| 765a46af-4417-4592-91e5-a300ead3faf6 | bm-deploy-ramdisk   |
| 09b40e3d-0382-4925-a356-3a4b4f36b514 | bm-deploy-kernel   |
| ef793cd0-e65c-456a-a675-63cd57610bd5 | overcloud-full     |
| 9a51a6cb-4670-40de-b64b-b70f4dd44152 | overcloud-full-initrd |
| 4f7e33f4-d617-47c1-b36f-cbe90f132e5d | overcloud-full-vmlinuz |
+-----+-----+
```

This list does not show the introspection PXE images (agent.*). Director copies these files to **/httpboot**.

```
[stack@host1 ~]$ ls /httpboot -l
```

total 151636

```
-rw-r--r--. 1 ironic ironic    269 Sep 19 02:43 boot.ipxe
-rw-r--r--. 1 root  root      252 Sep 10 15:35 inspector.ipxe
-rwxr-xr-x. 1 root  root    5027584 Sep 10 16:32 agent.kernel
-rw-r--r--. 1 root  root   150230861 Sep 10 16:32 agent.ramdisk
drwxr-xr-x. 2 ironic ironic    4096 Sep 19 02:45 pxelinux.cfg
```

CHAPTER 4. CONFIGURING ADDITIONS TO THE OPENSTACK PUPPET MODULES

This chapter explores how to provide additions to the OpenStack Puppet modules. This includes some basic guidelines on developing Puppet modules.

4.1. PUPPET SYNTAX AND MODULE STRUCTURE

The following section provides a few basics to help you understand Puppet syntax and the structure of a Puppet module.

4.1.1. Anatomy of a Puppet module

Before you contribute to the OpenStack modules, you must understand the components that create a Puppet module.

Manifests

Manifests are files that contain code to define a set of resources and their attributes. A resource is any configurable part of a system. Examples of resources include packages, services, files, users, and groups, SELinux configuration, SSH key authentication, cron jobs, and more. A manifest defines each required resource by using a set of key-value pairs for their attributes.

```
package { 'httpd':  
  ensure => installed,  
}
```

For example, this declaration checks if the **httpd** package is installed. If not, the manifest executes **dnf** and installs it. Manifests are located in the manifest directory of a module. Puppet modules also use a test directory for test manifests. These manifests are used to test certain classes that are in your official manifests.

Classes

Classes unify multiple resources in a manifest. For example, if you install and configure a HTTP server, you might create a class with three resources: one to install the HTTP server packages, one to configure the HTTP server, and one to start or enable the server. You can also refer to classes from other modules, which applies their configuration. For example, if you want to configure an application that also required a webserver, you can refer to the previously mentioned class for the HTTP server.

Static Files

Modules can contain static files that Puppet can copy to certain locations on your system. Define locations, and other attributes such as permissions, by using file resource declarations in manifests. Static files are located in the files directory of a module.

Templates

Sometimes configuration files require custom content. In this situation, users create a template instead of a static file. Like static files, templates are defined in manifests and copied to locations on a system. The difference is that templates allow Ruby expressions to define customized content and variable input. For example, if you want to configure httpd with a customizable port then the template for the configuration file includes:

```
Listen <%= @httpd_port %>
```

The `httpd_port` variable in this case is defined in the manifest that references this template.

Templates are located in the `templates` directory of a module.

Plugins

Use plugins for aspects that extend beyond the core functionality of Puppet. For example, you can use plugins to define custom facts, custom resources, or new functions. For example, a database administrator might need a resource type for PostgreSQL databases. This can help the database administrator populate PostgreSQL with a set of new databases after they install PostgreSQL. As a result, the database administrator must create only a Puppet manifest that ensures PostgreSQL installs and the databases are created afterwards.

Plugins are located in the `lib` directory of a module. This includes a set of subdirectories depending on the plugin type:

- `/lib/facter` - Location for custom facts.
- `/lib/puppet/type` - Location for custom resource type definitions, which outline the key-value pairs for attributes.
- `/lib/puppet/provider` - Location for custom resource providers, which are used in conjunction with resource type definitions to control resources.
- `/lib/puppet/parser/functions` - Location for custom functions.

4.1.2. Installing a service

Some software requires package installations. This is one function that a Puppet module can perform. This requires a resource definition that defines configurations for a certain package.

For example, to install the `httpd` package through the `mymodule` module, add the following content to a Puppet manifest in the `mymodule` module:

```
class mymodule::httpd {
  package { 'httpd':
    ensure => installed,
  }
}
```

This code defines a subclass of `mymodule` called `httpd`, then defines a package resource declaration for the `httpd` package. The `ensure => installed` attribute tells Puppet to check if the package is installed. If it is not installed, Puppet executes `yum` to install it.

4.1.3. Starting and enabling a service

After you install a package, you might want to start the service. Use another resource declaration called `service`. Edit the manifest with the following content:

```
class mymodule::httpd {
  package { 'httpd':
    ensure => installed,
  }
  service { 'httpd':
    ensure => running,
  }
}
```

```

enable => true,
require => Package["httpd"],
}
}

```

Result:

- The **ensure => running** attribute checks if the service is running. If not, Puppet enables it.
- The **enable => true** attribute sets the service to run when the system boots.
- The **require => Package["httpd"]** attribute defines an ordering relationship between one resource declaration and another. In this case, it ensures that the **httpd** service starts after the **httpd** package installs. This creates a dependency between the service and its respective package.

4.1.4. Configuring a service

The HTTP server provides some default configuration in `/etc/httpd/conf/httpd.conf`, which provides a web host on port 80. However, you can add extra configuration to provide an additional web host on a user-specified port.

Procedure

1. You must use a template file to store the HTTP configuration file because the user-defined port requires variable input. In the module templates directory, add a file called **myserver.conf.erb** with the following contents:

```

Listen <%= @httpd_port %>
NameVirtualHost *:<%= @httpd_port %>
<VirtualHost *:<%= @httpd_port %>>
  DocumentRoot /var/www/myserver/
  ServerName *:<%= @fqdn %>>
  <Directory "/var/www/myserver/">
    Options All Indexes FollowSymLinks
    Order allow,deny
    Allow from all
  </Directory>
</VirtualHost>

```

This template follows the standard syntax for Apache web server configuration. The only difference is the inclusion of Ruby escape characters to inject variables from the module. For example, **httpd_port**, which you use to specify the web server port.

The inclusion of **fqdn** is a variable that stores the fully qualified domain name of the system. This is known as a **system fact**. System facts are collected from each system before generating each Puppet catalog of a system. Puppet uses the **facter** command to gather these system facts and you can also run **facter** to view a list of these facts.

2. Save **myserver.conf.erb**.
3. Add the resource to the Puppet manifest of the module:

```

class mymodule::httpd {
  package { ['httpd']:

```

```

    ensure => installed,
  }
  service { 'httpd':
    ensure => running,
    enable => true,
    require => Package["httpd"],
  }
  file { '/etc/httpd/conf.d/myserver.conf':
    notify => Service["httpd"],
    ensure => file,
    require => Package["httpd"],
    content => template("mymodule/myserver.conf.erb"),
  }
  file { "/var/www/myserver":
    ensure => "directory",
  }
}

```

Result:

- You add a file resource declaration for the server configuration file, **(/etc/httpd/conf.d/myserver.conf)**. The content for this file is the **myserver.conf.erb** template that you created.
- You check the **httpd** package is installed before you add this file.
- You add a second file resource declaration that creates a directory, **/var/www/myserver**, for your web server.
- You add a relationship between the configuration file and the **httpd** service using the **notify => Service["httpd"]** attribute. This checks your configuration file for any changes. If the file has changed, Puppet restarts the service.

4.2. OBTAINING OPENSTACK PUPPET MODULES

The Red Hat OpenStack Platform uses the official OpenStack Puppet modules. To obtain OpenStack Puppet modules, see the **openstack** group on **Github**.

Procedure

1. In your browser, go to <https://github.com/openstack>.
2. In the filters section, search for **Puppet**. All Puppet modules use the prefix **puppet-**.
3. Clone the Puppet module that you want. For example, the official OpenStack Block Storage (cinder) module:

```
$ git clone https://github.com/openstack/puppet-cinder.git
```

4.3. EXAMPLE CONFIGURATION OF A PUPPET MODULE

The OpenStack modules primarily aim to configure the core service. Most modules also contain additional manifests to configure additional services, sometimes known as **backends**, **agents**, or **plugins**. For example, the **cinder** module contains a directory called **backends**, which contains configuration

options for different storage devices including NFS, iSCSI, Red Hat Ceph Storage, and others.

For example, the **manifests/backends/nfs.pp** file contains the following configuration:

```

define cinder::backend::nfs (
  $volume_backend_name = $name,
  $nfs_servers          = [],
  $nfs_mount_options   = undef,
  $nfs_disk_util       = undef,
  $nfs_sparsed_volumes = undef,
  $nfs_mount_point_base = undef,
  $nfs_shares_config   = '/etc/cinder/shares.conf',
  $nfs_used_ratio      = '0.95',
  $nfs_oversub_ratio   = '1.0',
  $extra_options       = {},
) {

  file {$nfs_shares_config:
    content => join($nfs_servers, "\n"),
    require => Package['cinder'],
    notify  => Service['cinder-volume']
  }

  cinder_config {
    "${name}/volume_backend_name": value => $volume_backend_name;
    "${name}/volume_driver":      value =>
      'cinder.volume.drivers.nfs.NfsDriver';
    "${name}/nfs_shares_config":  value => $nfs_shares_config;
    "${name}/nfs_mount_options":  value => $nfs_mount_options;
    "${name}/nfs_disk_util":      value => $nfs_disk_util;
    "${name}/nfs_sparsed_volumes": value => $nfs_sparsed_volumes;
    "${name}/nfs_mount_point_base": value => $nfs_mount_point_base;
    "${name}/nfs_used_ratio":     value => $nfs_used_ratio;
    "${name}/nfs_oversub_ratio":  value => $nfs_oversub_ratio;
  }

  create_resources('cinder_config', $extra_options)
}

```

Result:

- The **define** statement creates a defined type called **cinder::backend::nfs**. A defined type is similar to a class; the main difference is Puppet evaluates a defined type multiple times. For example, you might require multiple NFS back ends and as such the configuration requires multiple evaluations for each NFS share.
- The next few lines define the parameters in this configuration and their default values. The default values are overwritten if the user passes new values to the **cinder::backend::nfs** defined type.
- The **file** function is a resource declaration that calls for the creation of a file. This file contains a list of the NFS shares and the name for this file is defined in the parameters **\$nfs_shares_config = '/etc/cinder/shares.conf'**. Note the additional attributes:
 - The **content** attribute creates a list by using the **\$nfs_servers** parameter.

- The **require** attribute ensures that the **cinder** package is installed.
- The **notify** attribute tells the **cinder-volume** service to reset.
- The **cinder_config** function is a resource declaration that uses a plugin from the **lib/puppet/** directory in the module. This plugin adds configuration to the **/etc/cinder/cinder.conf** file. Each line in this resource adds a configuration options to the relevant section in the **cinder.conf** file. For example, if the **\$name** parameter is **my nfs**, then the following attributes:

```
"${name}/volume_backend_name": value => $volume_backend_name;
"${name}/volume_driver":      value =>
  'cinder.volume.drivers.nfs.NfsDriver';
"${name}/nfs_shares_config":  value => $nfs_shares_config;
```

Save the following snippet to the **cinder.conf** file:

```
[my nfs]
volume_backend_name=my nfs
volume_driver=cinder.volume.drivers.nfs.NfsDriver
nfs_shares_config=/etc/cinder/shares.conf
```

- The **create_resources** function converts a hash into a set of resources. In this case, the manifest converts the **\$extra_options** hash to a set of additional configuration options for the backend. This provides a flexible method to add further configuration options that are not included in the core parameters of the manifest.

This shows the importance of including a manifest to configure the OpenStack driver of your hardware. The manifest provides a method for director to include configuration options that are relevant to your hardware. This acts as a main integration point for director to configure your overcloud to use your hardware.

4.4. EXAMPLE OF ADDING HIERA DATA TO A PUPPET CONFIGURATION

Puppet contains a tool called **hieradata**, which acts as a key value system that provides node-specific configuration. These keys and their values are usually stored in files located in **/etc/puppet/hieradata**. The **/etc/puppet/hiera.yaml** file defines the order that Puppet reads the files in the **hieradata** directory.

During overcloud configuration, Puppet uses hieradata to overwrite the default values for certain Puppet classes. For example, the default NFS mount options for **cinder::backend::nfs** in **puppet-cinder** are undefined:

```
$nfs_mount_options = undef,
```

However, you can create your own manifest that calls the **cinder::backend::nfs** defined type and replace this option with hieradata:

```
cinder::backend::nfs { $cinder_nfs_backend:
  nfs_mount_options => hieradata('cinder_nfs_mount_options'),
}
```

This means the **nfs_mount_options** parameter takes uses hieradata value from the **cinder_nfs_mount_options** key:

■

```
cinder_nfs_mount_options: rsize=8192,wsiz=8192
```

Alternatively, you can use the hiera data to overwrite **cinder::backend::nfs::nfs_mount_options** parameter directly so that it applies to all evaluations of the NFS configuration:

```
cinder::backend::nfs::nfs_mount_options: rsize=8192,wsiz=8192
```

The above hiera data overwrites this parameter on each evaluation of **cinder::backend::nfs**.

CHAPTER 5. ORCHESTRATION

Red Hat OpenStack Platform (RHOSP) director uses Heat Orchestration Templates (HOT) as a template format for its overcloud deployment plan. Templates in HOT format are usually expressed in YAML format. The purpose of a template is to define and create a *stack*, which is a collection of resources that heat creates, and the configuration of the resources. Resources are objects in RHOSP and can include compute resources, network configuration, security groups, scaling rules, and custom resources.



NOTE

For RHOSP to use the heat template file as a custom template resource, the file extension must be either **.yaml** or **.template**.

This chapter provides some basics for understanding the HOT syntax so that you can create your own template files.

5.1. LEARNING HEAT TEMPLATE BASICS

5.1.1. Understanding heat templates

Heat templates have three main sections:

Parameters

These are settings passed to heat to customize a stack. You can also use heat parameters to customize default values. These settings are defined in the **parameters** section of a template.

Resources

These are the specific objects to create and configure as part of a stack. Red Hat OpenStack Platform (RHOSP) contains a set of core resources that span across all components. These are defined in the **resources** section of a template.

Output

These are values passed from heat after the creation of the stack. You can access these values either through the heat API or client tools. These are defined in the **output** section of a template.

Here is an example of a basic heat template:

```
heat_template_version: 2013-05-23

description: > A very basic Heat template.

parameters:
  key_name:
    type: string
    default: lars
    description: Name of an existing key pair to use for the instance
  flavor:
    type: string
    description: Instance type for the instance to be created
    default: m1.small
  image:
    type: string
    default: cirros
```

```

description: ID or name of the image to use for the instance

resources:
  my_instance:
    type: OS::Nova::Server
    properties:
      name: My Cirros Instance
      image: { get_param: image }
      flavor: { get_param: flavor }
      key_name: { get_param: key_name }

output:
  instance_name:
    description: Get the instance's name
    value: { get_attr: [ my_instance, name ] }

```

This template uses the resource type **type: OS::Nova::Server** to create an instance called **my_instance** with a particular flavor, image, and key. The stack can return the value of **instance_name**, which is called **My Cirros Instance**.



IMPORTANT

A heat template also requires the **heat_template_version** parameter, which defines the syntax version to use and the functions available. For more information, see the [Official Heat Documentation](#).

5.1.2. Understanding environment files

An environment file is a special type of template that provides customization for your heat templates. This includes three key parts:

Resource Registry

This section defines custom resource names that are linked to other heat templates. This provides a method to create custom resources that do not exist within the core resource collection. These are defined in the **resource_registry** section of an environment file.

Parameters

These are common settings that you apply to the parameters of the top-level template. For example, if you have a template that deploys nested stacks, such as resource registry mappings, the parameters apply only to the top-level template and not templates for the nested resources. Parameters are defined in the **parameters** section of an environment file.

Parameter Defaults

These parameters modify the default values for parameters in all templates. For example, if you have a heat template that deploys nested stacks, such as resource registry mappings, the parameter defaults apply to all templates. The parameter defaults are defined in the **parameter_defaults** section of an environment file.



IMPORTANT

Use **parameter_defaults** instead of **parameters** when you create custom environment files for your overcloud. This is so that the parameters apply to all stack templates for the overcloud.

Example of a basic environment file:

```

resource_registry:
  OS::Nova::Server::MyServer: myserver.yaml

parameter_defaults:
  NetworkName: my_network

parameters:
  MyIP: 192.168.0.1

```

The environment file, **my_env.yaml**, might be included when creating a stack from a heat template, **my_template.yaml**. The **my_env.yaml** file creates a new resource type called **OS::Nova::Server::MyServer**. The **myserver.yaml** file is a heat template file that provides an implementation for this resource type that overrides any built-in ones. You can include the **OS::Nova::Server::MyServer** resource in your **my_template.yaml** file.

The **MyIP** applies a parameter only to the main heat template that deploys with this environment file. In this example, it only applies to the parameters in **my_template.yaml**.

The **NetworkName** applies to both the main heat template, **my_template.yaml**, and the templates that are associated with the resources that are included the main template, such as the **OS::Nova::Server::MyServer** resource and its **myserver.yaml** template in this example.



NOTE

For RHOSP to use the heat template file as a custom template resource, the file extension must be either **.yaml** or **.template**.

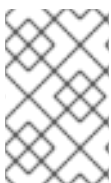
5.2. OBTAINING THE DEFAULT DIRECTOR TEMPLATES

Director uses an advanced heat template collection to create an overcloud. This collection is available from the **openstack** group on **GitHub** in the [openstack-tripleo-heat-templates](https://github.com/openstack/tripleo-heat-templates) repository.

Procedure

- To obtain a clone of this template collection, enter the following command:

```
$ git clone https://github.com/openstack/tripleo-heat-templates.git
```



NOTE

The Red Hat-specific version of this template collection is available from the **openstack-tripleo-heat-template** package, which installs the collection to **/usr/share/openstack-tripleo-heat-templates**.

The main files and directories in this template collection are:

overcloud.j2.yaml

This is the main template file that creates the overcloud environment. This file uses Jinja2 syntax to iterate over certain sections in the template to create custom roles. The Jinja2 formatting is rendered into YAML during the overcloud deployment process.

overcloud-resource-registry-puppet.j2.yaml

This is the main environment file that creates the overcloud environment. It provides a set of

configurations for Puppet modules that are stored on the overcloud image. After director writes the overcloud image to each node, heat starts the Puppet configuration for each node by using the resources registered in this environment file. This file uses Jinja2 syntax to iterate over certain sections in the template to create custom roles. The Jinja2 formatting is rendered into YAML during the overcloud deployment process.

roles_data.yaml

This is a file that defines the roles in an overcloud and maps services to each role.

network_data.yaml

This is a file that defines the networks in an overcloud and their properties such as subnets, allocation pools, and VIP status. The default **network_data** file contains the default networks: External, Internal Api, Storage, Storage Management, Tenant, and Management. You can create a custom **network_data** file and add it to your **openstack overcloud deploy** command with the **-n** option.

plan-environment.yaml

This is a file that defines the metadata for your overcloud plan. This includes the plan name, main template to use, and environment files to apply to the overcloud.

capabilities-map.yaml

This is a mapping of environment files for an overcloud plan. Use this file to describe and enable environment files on the director web UI. Custom environment files that are detected in the **environments** directory in an overcloud plan but are not defined in the **capabilities-map.yaml** are listed in the **Other** subtab of **2 Specify Deployment Configuration > Overall Settings** on the web UI.

environments

Contains additional heat environment files that you can use with your overcloud creation. These environment files enable extra functions for your resulting Red Hat OpenStack Platform (RHOSP) environment. For example, the directory contains an environment file to enable Cinder NetApp backend storage (**cinder-netapp-config.yaml**). Any environment files that are detected in this directory that are not defined in the **capabilities-map.yaml** file are listed in the **Other** subtab of **2 Specify Deployment Configuration > Overall Settings** in the director's web UI.

network

This is a set of heat templates to help create isolated networks and ports.

puppet

These are templates that are mostly driven by configuration with Puppet. The **overcloud-resource-registry-puppet.j2.yaml** environment file uses the files in this directory to drive the application of the Puppet configuration on each node.

puppet/services

This is a directory that contains heat templates for all services in the composable service architecture.

extraconfig

These are templates that enable extra functionality.

firstboot

Provides example **first_boot** scripts that director uses when it initially creates the nodes.

This provides a general overview of the templates the director uses for orchestrating the Overcloud creation. The next few sections show how to create your own custom templates and environment files that you can add to an Overcloud deployment.

5.3. FIRST BOOT: CUSTOMIZING FIRST BOOT CONFIGURATION

The director provides a mechanism to perform configuration on all nodes upon the initial creation of the Overcloud. The director achieves this through **cloud-init**, which you can call using the **OS::TripleO::NodeUserData** resource type.

In this example, you will update the nameserver with a custom IP address on all nodes. You must first create a basic heat template (**/home/stack/templates/nameserver.yaml**) that runs a script to append each node's **resolv.conf** with a specific nameserver. You can use the **OS::TripleO::MultipartMime** resource type to send the configuration script.

```
heat_template_version: 2014-10-16

description: >
  Extra hostname configuration

resources:
  userdata:
    type: OS::Heat::MultipartMime
    properties:
      parts:
        - config: {get_resource: nameserver_config}

  nameserver_config:
    type: OS::Heat::SoftwareConfig
    properties:
      config: |
        #!/bin/bash
        echo "nameserver 192.168.1.1" >> /etc/resolv.conf

outputs:
  OS::stack_id:
    value: {get_resource: userdata}
```

Next, create an environment file (**/home/stack/templates/firstboot.yaml**) that registers your heat template as the **OS::TripleO::NodeUserData** resource type.

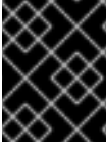
```
resource_registry:
  OS::TripleO::NodeUserData: /home/stack/templates/nameserver.yaml
```

To add the first boot configuration, add the environment file to the stack along with your other environment files when first creating the Overcloud. For example:

```
$ openstack overcloud deploy --templates \
...
-e /home/stack/templates/firstboot.yaml \
...
```

The **-e** applies the environment file to the Overcloud stack.

This adds the configuration to all nodes when they are first created and boot for the first time. Subsequent inclusions of these templates, such as updating the Overcloud stack, does not run these scripts.



IMPORTANT

You can only register the **OS::TripleO::NodeUserData** to one heat template. Subsequent usage overrides the heat template to use.

This achieves the following:

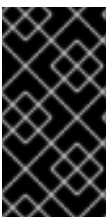
1. **OS::TripleO::NodeUserData** is a director-based Heat resource used in other templates in the collection and applies first boot configuration to all nodes. This resource passes data for use in **cloud-init**. The default **NodeUserData** refers to a Heat template that produces a blank value (**firstboot/userdata_default.yaml**). In our case, our **firstboot.yaml** environment file replaces this default with a reference to our own **nameserver.yaml** file.
2. **nameserver_config** defines our Bash script to run on first boot. The **OS::Heat::SoftwareConfig** resource defines it as a piece of configuration to apply.
3. **userdata** converts the configuration from **nameserver_config** into a multi-part MIME message using the **OS::Heat::MultipartMime** resource.
4. The **outputs** provides an output parameter **OS::stack_id** which takes the MIME message from **userdata** and provides it to the the Heat template/resource calling it.

As a result, each node runs the following Bash script on its first boot:

```
#!/bin/bash
echo "nameserver 192.168.1.1" >> /etc/resolve.conf
```

This example shows how Heat template pass and modify configuration from one resource to another. It also shows how to use environment files to register new Heat resources or modify existing ones.

5.4. PRE-CONFIGURATION: CUSTOMIZING SPECIFIC OVERCLOUD ROLES



IMPORTANT

Previous versions of this document used the **OS::TripleO::Tasks::*PreConfig** resources to provide pre-configuration hooks on a per role basis. The director's Heat template collection requires dedicated use of these hooks, which means you should not use them for custom use. Instead, use the **OS::TripleO::*ExtraConfigPre** hooks outlined below.

The Overcloud uses Puppet for the core configuration of OpenStack components. The director provides a set of hooks to provide custom configuration for specific node roles after the first boot completes and before the core configuration begins. These hooks include:

OS::TripleO::ControllerExtraConfigPre

Additional configuration applied to Controller nodes before the core Puppet configuration.

OS::TripleO::ComputeExtraConfigPre

Additional configuration applied to Compute nodes before the core Puppet configuration.

OS::TripleO::CephStorageExtraConfigPre

Additional configuration applied to Ceph Storage nodes before the core Puppet configuration.

OS::TripleO::ObjectStorageExtraConfigPre

Additional configuration applied to Object Storage nodes before the core Puppet configuration.

OS::TripleO::BlockStorageExtraConfigPre

Additional configuration applied to Block Storage nodes before the core Puppet configuration.

OS::TripleO::[ROLE]ExtraConfigPre

Additional configuration applied to custom nodes before the core Puppet configuration. Replace **[ROLE]** with the composable role name.

In this example, you first create a basic heat template (**/home/stack/templates/nameserver.yaml**) that runs a script to write to a node's **resolv.conf** with a variable nameserver.

```
heat_template_version: 2014-10-16

description: >
  Extra hostname configuration

parameters:
  server:
    type: string
  nameserver_ip:
    type: string
  DeployIdentifier:
    type: string

resources:
  CustomExtraConfigPre:
    type: OS::Heat::SoftwareConfig
    properties:
      group: script
      config:
        str_replace:
          template: |
            #!/bin/sh
            echo "nameserver _NAMESERVER_IP_" > /etc/resolv.conf
        params:
          _NAMESERVER_IP_: {get_param: nameserver_ip}

  CustomExtraDeploymentPre:
    type: OS::Heat::SoftwareDeployment
    properties:
      server: {get_param: server}
      config: {get_resource: CustomExtraConfigPre}
      actions: ['CREATE','UPDATE']
      input_values:
        deploy_identifier: {get_param: DeployIdentifier}

outputs:
  deploy_stdout:
    description: Deployment reference, used to trigger pre-deploy on changes
    value: {get_attr: [CustomExtraDeploymentPre, deploy_stdout]}
```

In this example, the **resources** section contains the following:

CustomExtraConfigPre

This defines a software configuration. In this example, we define a Bash **script** and Heat replaces **_NAMESERVER_IP_** with the value stored in the **nameserver_ip** parameter.

CustomExtraDeploymentPre

This executes a software configuration, which is the software configuration from the **CustomExtraConfigPre** resource. Note the following:

- The **config** parameter makes a reference to the **CustomExtraConfigPre** resource so Heat knows what configuration to apply.
- The **server** parameter retrieves a map of the Overcloud nodes. This parameter is provided by the parent template and is mandatory in templates for this hook.
- The **actions** parameter defines when to apply the configuration. In this case, we only apply the configuration when the Overcloud is created or updated. Possible actions include **CREATE, UPDATE, DELETE, SUSPEND, and RESUME**.
- **input_values** contains a parameter called **deploy_identifier**, which stores the **DeployIdentifier** from the parent template. This parameter provides a timestamp to the resource for each deployment update. This ensures the resource reapplies on subsequent overcloud updates.

Next, create an environment file (**/home/stack/templates/pre_config.yaml**) that registers your heat template to the role-based resource type. For example, to apply only to Controller nodes, use the **ControllerExtraConfigPre** hook:

```
resource_registry:
  OS::TripleO::ControllerExtraConfigPre: /home/stack/templates/nameserver.yaml

parameter_defaults:
  nameserver_ip: 192.168.1.1
```

To apply the configuration, add the environment file to the stack along with your other environment files when creating or updating the Overcloud. For example:

```
$ openstack overcloud deploy --templates \
...
-e /home/stack/templates/pre_config.yaml \
...
```

This applies the configuration to all Controller nodes before the core configuration begins on either the initial Overcloud creation or subsequent updates.



IMPORTANT

You can only register each resource to only one Heat template per hook. Subsequent usage overrides the Heat template to use.

This achieves the following:

1. **OS::TripleO::ControllerExtraConfigPre** is a director-based Heat resource used in the configuration templates in the Heat template collection. This resource passes configuration to each Controller node. The default **ControllerExtraConfigPre** refers to a Heat template that

produces a blank value (**puppet/extraconfig/pre_deploy/default.yaml**). In our case, our **pre_config.yaml** environment file replaces this default with a reference to our own **nameserver.yaml** file.

2. The environment file also passes the **nameserver_ip** as a **parameter_default** value for our environment. This is a parameter that stores the IP address of our nameserver. The **nameserver.yaml** Heat template then accepts this parameter as defined in the **parameters** section.
3. The template defines **CustomExtraConfigPre** as a configuration resource through **OS::Heat::SoftwareConfig**. Note the **group: script** property. The **group** defines the software configuration tool to use, which are available through a set of hooks for Heat. In this case, the **script** hook runs an executable script that you define in the **SoftwareConfig** resource as the **config** property.
4. The script itself appends **/etc/resolve.conf** with the nameserver IP address. Note the **str_replace** attribute, which allows you to replace variables in the **template** section with parameters in the **params** section. In this case, we set the **NAMESERVER_IP** to the nameserver IP address, which substitutes the same variable in the script. This results in the following script:

```
#!/bin/sh
echo "nameserver 192.168.1.1" >> /etc/resolve.conf
```

This example shows how to create a Heat template that defines a configuration and deploys it using the **OS::Heat::SoftwareConfig** and **OS::Heat::SoftwareDeployments** before the core configuration. It also shows how to define parameters in your environment file and pass them to templates in the configuration.

5.5. PRE-CONFIGURATION: CUSTOMIZING ALL OVERCLOUD ROLES

The Overcloud uses Puppet for the core configuration of OpenStack components. The director provides a hook to configure all node types after the first boot completes and before the core configuration begins:

OS::TripleO::NodeExtraConfig

Additional configuration applied to all nodes roles before the core Puppet configuration.

In this example, you first create a basic heat template (**/home/stack/templates/nameserver.yaml**) that runs a script to append each node's **resolv.conf** with a variable nameserver.

```
heat_template_version: 2014-10-16

description: >
  Extra hostname configuration

parameters:
  server:
    type: string
  nameserver_ip:
    type: string
  DeployIdentifier:
    type: string

resources:
  CustomExtraConfigPre:
```

```

type: OS::Heat::SoftwareConfig
properties:
  group: script
  config:
    str_replace:
      template: |
        #!/bin/sh
        echo "nameserver _NAMESERVER_IP_" >> /etc/resolv.conf
  params:
    _NAMESERVER_IP_: {get_param: nameserver_ip}

```

CustomExtraDeploymentPre:

```

type: OS::Heat::SoftwareDeployment
properties:
  server: {get_param: server}
  config: {get_resource: CustomExtraConfigPre}
  actions: ['CREATE','UPDATE']
  input_values:
    deploy_identifier: {get_param: DeployIdentifier}

```

outputs:

```

deploy_stdout:
  description: Deployment reference, used to trigger pre-deploy on changes
  value: {get_attr: [CustomExtraDeploymentPre, deploy_stdout]}

```

In this example, the **resources** section contains the following:

CustomExtraConfigPre

This defines a software configuration. In this example, we define a Bash **script** and Heat replaces **_NAMESERVER_IP_** with the value stored in the **nameserver_ip** parameter.

CustomExtraDeploymentPre

This executes a software configuration, which is the software configuration from the **CustomExtraConfigPre** resource. Note the following:

- The **config** parameter makes a reference to the **CustomExtraConfigPre** resource so Heat knows what configuration to apply.
- The **server** parameter retrieves a map of the OpenStack nodes. This parameter is provided by the parent template and is mandatory in templates for this hook.
- The **actions** parameter defines when to apply the configuration. In this case, we only apply the configuration when the OpenStack is created or updated. Possible actions include **CREATE, UPDATE, DELETE, SUSPEND, and RESUME**.
- The **input_values** parameter contains a sub-parameter called **deploy_identifier**, which stores the **DeployIdentifier** from the parent template. This parameter provides a timestamp to the resource for each deployment update. This ensures the resource reapplies on subsequent openstack updates.

Next, create an environment file (**/home/stack/templates/pre_config.yaml**) that registers your heat template as the **OS::TripleO::NodeExtraConfig** resource type.

```

resource_registry:
  OS::TripleO::NodeExtraConfig: /home/stack/templates/nameserver.yaml

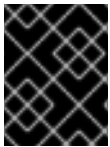
```

```
parameter_defaults:
  nameserver_ip: 192.168.1.1
```

To apply the configuration, add the environment file to the stack along with your other environment files when creating or updating the Overcloud. For example:

```
$ openstack overcloud deploy --templates \
...
-e /home/stack/templates/pre_config.yaml \
...
```

This applies the configuration to all nodes before the core configuration begins on either the initial Overcloud creation or subsequent updates.



IMPORTANT

You can only register the **OS::TripleO::NodeExtraConfig** to only one Heat template. Subsequent usage overrides the Heat template to use.

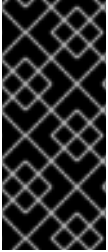
This achieves the following:

1. **OS::TripleO::NodeExtraConfig** is a director-based Heat resource used in the configuration templates in the Heat template collection. This resource passes configuration to each node. The default **NodeExtraConfig** refers to a Heat template that produces a blank value (**puppet/extraconfig/pre_deploy/default.yaml**). In our case, our **pre_config.yaml** environment file replaces this default with a reference to our own **nameserver.yaml** file.
2. The environment file also passes the **nameserver_ip** as a **parameter_default** value for our environment. This is a parameter that stores the IP address of our nameserver. The **nameserver.yaml** Heat template then accepts this parameter as defined in the **parameters** section.
3. The template defines **CustomExtraConfigPre** as a configuration resource through **OS::Heat::SoftwareConfig**. Note the **group: script** property. The **group** defines the software configuration tool to use, which are available through a set of hooks for Heat. In this case, the **script** hook runs an executable script that you define in the **SoftwareConfig** resource as the **config** property.
4. The script itself appends **/etc/resolve.conf** with the nameserver IP address. Note the **str_replace** attribute, which allows you to replace variables in the **template** section with parameters in the **params** section. In this case, we set the **NAMESERVER_IP** to the nameserver IP address, which substitutes the same variable in the script. This results in the following script:

```
#!/bin/sh
echo "nameserver 192.168.1.1" >> /etc/resolve.conf
```

This example shows how to create a Heat template that defines a configuration and deploys it using the **OS::Heat::SoftwareConfig** and **OS::Heat::SoftwareDeployments** before the core configuration. It also shows how to define parameters in your environment file and pass them to templates in the configuration.

5.6. POST-CONFIGURATION: CUSTOMIZING ALL OVERCLOUD ROLES



IMPORTANT

Previous versions of this document used the **OS::TripleO::Tasks::*PostConfig** resources to provide post-configuration hooks on a per role basis. The director's Heat template collection requires dedicated use of these hooks, which means you should not use them for custom use. Instead, use the **OS::TripleO::NodeExtraConfigPost** hook outlined below.

A situation might occur where you have completed the creation of your Overcloud but want to add additional configuration to all roles, either on initial creation or on a subsequent update of the Overcloud. In this case, you use the following post-configuration hook:

OS::TripleO::NodeExtraConfigPost

Additional configuration applied to all nodes roles after the core Puppet configuration.

In this example, you first create a basic heat template (**/home/stack/templates/nameserver.yaml**) that runs a script to append each node's **resolv.conf** with a variable nameserver.

```
description: >
  Extra hostname configuration

parameters:
  servers:
    type: json
  nameserver_ip:
    type: string
  DeployIdentifier:
    type: string

resources:
  CustomExtraConfig:
    type: OS::Heat::SoftwareConfig
    properties:
      group: script
      config:
        str_replace:
          template: |
            #!/bin/sh
            echo "nameserver _NAMESERVER_IP_" >> /etc/resolv.conf
        params:
          _NAMESERVER_IP_: {get_param: nameserver_ip}

  CustomExtraDeployments:
    type: OS::Heat::SoftwareDeploymentGroup
    properties:
      servers: {get_param: servers}
      config: {get_resource: CustomExtraConfig}
      actions: ['CREATE','UPDATE']
      input_values:
        deploy_identifier: {get_param: DeployIdentifier}
```

In this example, the **resources** section contains the following:

CustomExtraConfig

This defines a software configuration. In this example, we define a Bash **script** and Heat replaces **_NAMESERVER_IP_** with the value stored in the **nameserver_ip** parameter.

CustomExtraDeployments

This executes a software configuration, which is the software configuration from the **CustomExtraConfig** resource. Note the following:

- The **config** parameter makes a reference to the **CustomExtraConfig** resource so Heat knows what configuration to apply.
- The **servers** parameter retrieves a map of the Openstack nodes. This parameter is provided by the parent template and is mandatory in templates for this hook.
- The **actions** parameter defines when to apply the configuration. In this case, we only apply the configuration when the Openstack is created. Possible actions include **CREATE**, **UPDATE**, **DELETE**, **SUSPEND**, and **RESUME**.
- **input_values** contains a parameter called **deploy_identifier**, which stores the **DeployIdentifier** from the parent template. This parameter provides a timestamp to the resource for each deployment update. This ensures the resource reapplies on subsequent openstack updates.

Next, create an environment file (**/home/stack/templates/post_config.yaml**) that registers your heat template as the **OS::TripleO::NodeExtraConfigPost** resource type.

```
resource_registry:
  OS::TripleO::NodeExtraConfigPost: /home/stack/templates/nameserver.yaml

parameter_defaults:
  nameserver_ip: 192.168.1.1
```

To apply the configuration, add the environment file to the stack along with your other environment files when creating or updating the Openstack. For example:

```
$ openstack overcloud deploy --templates \
...
-e /home/stack/templates/post_config.yaml \
...
```

This applies the configuration to all nodes after the core configuration completes on either initial Openstack creation or subsequent updates.



IMPORTANT

You can only register the **OS::TripleO::NodeExtraConfigPost** to only one Heat template. Subsequent usage overrides the Heat template to use.

This achieves the following:

1. **OS::TripleO::NodeExtraConfigPost** is a director-based Heat resource used in the post-configuration templates in the collection. This resource passes configuration to each node type through the ***-post.yaml** templates. The default **NodeExtraConfigPost** refers to a Heat template that produces a blank value (**extraconfig/post_deploy/default.yaml**). In our case, our **post_config.yaml** environment file replaces this default with a reference to our own **nameserver.yaml** file.

2. The environment file also passes the `nameserver_ip` as a `parameter_default` value for our environment. This is a parameter that stores the IP address of our nameserver. The `nameserver.yaml` Heat template then accepts this parameter as defined in the `parameters` section.
3. The template defines `CustomExtraConfig` as a configuration resource through `OS::Heat::SoftwareConfig`. Note the `group: script` property. The `group` defines the software configuration tool to use, which are available through a set of hooks for Heat. In this case, the `script` hook runs an executable script that you define in the `SoftwareConfig` resource as the `config` property.
4. The script itself appends `/etc/resolve.conf` with the nameserver IP address. Note the `str_replace` attribute, which allows you to replace variables in the `template` section with parameters in the `params` section. In this case, we set the `NAMESERVER_IP` to the nameserver IP address, which substitutes the same variable in the script. This results in the following script:

```
#!/bin/sh
echo "nameserver 192.168.1.1" >> /etc/resolve.conf
```

This example shows how to create a Heat template that defines a configuration and deploys it using the `OS::Heat::SoftwareConfig` and `OS::Heat::SoftwareDeployments`. It also shows how to define parameters in your environment file and pass them to templates in the configuration.

5.7. PUPPET: APPLYING CUSTOM CONFIGURATION TO AN OVERCLOUD

Previously, we discussed adding configuration for a new backend to OpenStack Puppet modules. This section shows how the director executes the application of new configuration.

Heat templates provide a hook allowing you to apply Puppet configuration with a `OS::Heat::SoftwareConfig` resource. The process is similar to how we include and execute Bash scripts. However, instead of the `group: script` hook, we use the `group: puppet` hook.

For example, you might have a Puppet manifest (`example-puppet-manifest.pp`) that enables an NFS Cinder backend using the official Cinder Puppet Module:

```
cinder::backend::nfs { 'myfssserver':
  nfs_servers    => ['192.168.1.200:/storage'],
}
```

This Puppet configuration creates a new resource using the `cinder::backend::nfs` defined type. To apply this resource through Heat, create a basic Heat template (`puppet-config.yaml`) that runs our Puppet manifest:

```
heat_template_version: 2014-10-16

parameters:
  servers:
    type: json

resources:
  ExtraPuppetConfig:
    type: OS::Heat::SoftwareConfig
    properties:
```

```

group: puppet
config:
  get_file: example-puppet-manifest.pp
options:
  enable_hiera: True
  enable_facter: False

```

```

ExtraPuppetDeployment:
  type: OS::Heat::SoftwareDeployments
  properties:
    config: {get_resource: ExtraPuppetConfig}
    servers: {get_param: servers}
    actions: ['CREATE','UPDATE']

```

Next, create an environment file (**puppet_config.yaml**) that registers our Heat template as the **OS::TripleO::NodeExtraConfigPost** resource type.

```

resource_registry:
  OS::TripleO::NodeExtraConfigPost: puppet_config.yaml

```

This example is similar to using **SoftwareConfig** and **SoftwareDeployments** from the **script** hook example in the previous section. However, there are some differences in this example:

1. We set **group: puppet** so that we execute the **puppet** hook.
2. The **config** attribute uses the **get_file** attribute to refer to a Puppet manifest that contains our additional configuration.
3. The **options** attribute contains some options specific to Puppet configurations:
 - The **enable_hiera** option enables the Puppet configuration to use Hiera data.
 - The **enable_facter** option enables the Puppet configuration to use system facts from the **facter** command.

This example shows how to include a Puppet manifest as part of the software configuration for the Overcloud. This provides a way to apply certain configuration classes from existing Puppet modules on the Overcloud images, which helps you customize your Overcloud to use certain software and hardware.

5.8. PUPPET: CUSTOMIZING HIERADATA FOR ROLES

The Heat template collection contains a set of parameters to pass extra configuration to certain node types. These parameters save the configuration as hieradata for the node's Puppet configuration. These parameters are:

ControllerExtraConfig

Configuration to add to all Controller nodes.

ComputeExtraConfig

Configuration to add to all Compute nodes.

BlockStorageExtraConfig

Configuration to add to all Block Storage nodes.

ObjectStorageExtraConfig

Configuration to add to all Object Storage nodes

CephStorageExtraConfig

Configuration to add to all Ceph Storage nodes

[ROLE]ExtraConfig

Configuration to add to a composable role. Replace **[ROLE]** with the composable role name.

ExtraConfig

Configuration to add to all nodes.

To add extra configuration to the post-deployment configuration process, create an environment file that contains these parameters in the **parameter_defaults** section. For example, to increase the reserved memory for Compute hosts to 1024 MB and set the VNC keymap to Japanese:

```
parameter_defaults:
  ComputeExtraConfig:
    nova::compute::reserved_host_memory: 1024
    nova::compute::vnc_keymap: ja
```

Include this environment file when running **openstack overcloud deploy**.



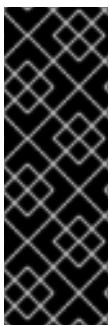
IMPORTANT

You can only define each parameter once. Subsequent usage overrides previous values.

5.9. ADDING ENVIRONMENT FILES TO AN OVERCLOUD DEPLOYMENT

After developing a set of environment files relevant to your custom configuration, include these files in your Overcloud deployment. This means running the **openstack overcloud deploy** command with the **-e** option, followed by the environment file. You can specify the **-e** option as many times as necessary for your customization. For example:

```
$ openstack overcloud deploy --templates -e network-configuration.yaml -e storage-configuration.yaml -e first-boot.yaml
```



IMPORTANT

Environment files are stacked in consecutive order. This means that each subsequent file stacks upon both the main Heat template collection and all previous environment files. This provides a way to override resource definitions. For example, if all environment files in an Overcloud deployment define the **NodeExtraConfigPost** resource, then Heat uses **NodeExtraConfigPost** defined in the last environment file. As a result, the order of the environment files is important. Make sure to order your environment files so they are processed and stacked correctly.



WARNING

Any environment files added to the Overcloud using the **-e** option become part of your Overcloud's stack definition. The director requires these environment files for any post-deployment or re-deployment functions. Failure to include these files can result in damage to your Overcloud.

CHAPTER 6. COMPOSABLE SERVICES

Red Hat OpenStack Platform (RHOSP) includes the ability to define custom roles and compose service combinations on roles. For more information, see {defaultURL}/advanced_overcloud_customization/chap-roles [Composable Services and Custom Roles] in the *Advanced Overcloud Customization* guide. As part of the integration, you can define your own custom services and include them on chosen roles.

6.1. EXAMINING COMPOSABLE SERVICE ARCHITECTURE

The core heat template collection contains two sets of composable service templates:

- **puppet/services** contains the base templates for configuring composable services.
- **docker/services** contains the containerized templates for key OpenStack Platform services. These templates act as augmentations for some of the base templates and reference back to the base templates.

Each template contains a description that identifies its purpose. For example, the **ntp.yaml** service template contains the following description:

```
description: >
  NTP service deployment using puppet, this YAML file
  creates the interface between the HOT template
  and the puppet manifest that actually installs
  and configure NTP.
```

These service templates are registered as resources specific to a RHOSP deployment. This means you can call each resource using a unique heat resource namespace defined in the **overcloud-resource-registry-puppet.j2.yaml** file. All services use the **OS::TripleO::Services** namespace for their resource type.

Some resources use the base composable service templates directly:

```
resource_registry:
  ...
  OS::TripleO::Services::Ntp: puppet/services/time/ntp.yaml
  ...
```

However, core services require containers and as such use the containerized service templates. For example, the **keystone** containerized service uses the following:

```
resource_registry:
  ...
  OS::TripleO::Services::Keystone: docker/services/keystone.yaml
  ...
```

These containerized templates usually reference back to the base templates in order to include Puppet configuration. For example, the **docker/services/keystone.yaml** template stores the output of the base template in the **KeystoneBase** parameter:

```
KeystoneBase:
  type: ../../puppet/services/keystone.yaml
```

The containerized template can then incorporate functions and data from the base template.

The **overcloud.j2.yaml** heat template includes a section of Jinja2-based code to define a service list for each custom role in the **roles_data.yaml** file:

```

{{role.name}}Services:
  description: A list of service resources (configured in the Heat
    resource_registry) which represent nested stacks
    for each service that should get installed on the {{role.name}} role.
  type: comma_delimited_list
  default: {{role.ServicesDefault|default([])}}

```

For the default roles, this creates the following service list parameters: **ControllerServices**, **ComputeServices**, **BlockStorageServices**, **ObjectStorageServices**, and **CephStorageServices**.

You define the default services for each custom role in the **roles_data.yaml** file. For example, the default Controller role contains the following content:

```

- name: Controller
  CountDefault: 1
  ServicesDefault:
    - OS::TripleO::Services::CACerts
    - OS::TripleO::Services::CephMon
    - OS::TripleO::Services::CephExternal
    - OS::TripleO::Services::CephRgw
    - OS::TripleO::Services::CinderApi
    - OS::TripleO::Services::CinderBackup
    - OS::TripleO::Services::CinderScheduler
    - OS::TripleO::Services::CinderVolume
    - OS::TripleO::Services::Core
    - OS::TripleO::Services::Kernel
    - OS::TripleO::Services::Keystone
    - OS::TripleO::Services::GlanceApi
    - OS::TripleO::Services::GlanceRegistry
  ...

```

These services are then defined as the default list for the **ControllerServices** parameter.

You can also use an environment file to override the default list for the service parameters. For example, you can define **ControllerServices** as a **parameter_default** in an environment file to override the services list from the **roles_data.yaml** file.

6.2. CREATING A USER-DEFINED COMPOSABLE SERVICE

This example examines how to create a user-defined composable service and focuses on implementing a message of the day (**motd**) service. In this example, the overcloud image contains a custom **motd** Puppet module loaded either through a configuration hook or through modifying the overcloud images. For more information, see [Chapter 3, Working with overcloud images](#).

When you create your own service, you must define the following items in the heat template of your service:

parameters

The following are compulsory parameters that you must include in your service template:

- **ServiceNetMap** - A map of services to networks. Use an empty hash (`{}`) as the **default** value as this parameter is overridden with values from the parent Heat template.
- **DefaultPasswords** - A list of default passwords. Use an empty hash (`{}`) as the **default** value as this parameter is overridden with values from the parent Heat template.
- **EndpointMap** - A list of OpenStack service endpoints to protocols. Use an empty hash (`{}`) as the **default** value as this parameter is overridden with values from the parent Heat template.

Define any additional parameters that your service requires.

outputs

The following output parameters define the service configuration on the host. For more information, see [Appendix A, Composable service parameters](#).

The following is an example heat template (**service.yaml**) for the **motd** service:

```
heat_template_version: 2016-04-08

description: >
  Message of the day service configured with Puppet

parameters:
  ServiceNetMap:
    default: {}
    type: json
  DefaultPasswords:
    default: {}
    type: json
  EndpointMap:
    default: {}
    type: json
  MotdMessage: ❶
    default: |
      Welcome to my Red Hat OpenStack Platform environment!

    type: string
    description: The message to include in the motd

outputs:
  role_data:
    description: Motd role using composable services.
    value:
      service_name: motd
      config_settings: ❷
        motd::content: {get_param: MotdMessage}
      step_config: | ❸
        if hiera('step') >= 2 {
          include ::motd
        }
```

- ❶ The template includes a **MotdMessage** parameter that defines the message of the day. The parameter includes a default message but you can override it by using the same parameter in a custom environment file.

- 2 The **outputs** section defines some service hieradata in **config_settings**. The **motd::content** hieradata stores the content from the **MotdMessage** parameter. The **motd** Puppet class
- 3 The **outputs** section includes a Puppet manifest snippet in **step_config**. The snippet checks if the configuration has reached step 2 and, if so, runs the **motd** Puppet class.

6.3. INCLUDING A USER-DEFINED COMPOSABLE SERVICES

You can configure the custom motd service only on the overcloud Controller nodes. This requires a custom environment file and custom roles data file included with your deployment. Replace example input in this procedure according to your requirements.

Procedure

1. Add the new service to an environment file, **env-motd.yaml**, as a registered heat resource within the **OS::TripleO::Services** namespace. In this example, the resource name for our **motd** service is **OS::TripleO::Services::Motd**:

```
resource_registry:
  OS::TripleO::Services::Motd: /home/stack/templates/motd.yaml

parameter_defaults:
  MotdMessage: |
    You have successfully accessed my Red Hat OpenStack Platform environment!
```

This custom environment file also includes a new message that overrides the default for **MotdMessage**.

The deployment now includes the **motd** service. However, each role that requires this new service must have an updated **ServicesDefault** listing in a custom **roles_data.yaml** file.

2. Create a copy of the default **roles_data.yaml** file:

```
$ cp /usr/share/openstack-tripleo-heat-templates/roles_data.yaml ~/custom_roles_data.yaml
```

3. To edit this file, scroll to the **Controller** role and include the service in the **ServicesDefault** listing:

```
- name: Controller
  CountDefault: 1
  ServicesDefault:
    - OS::TripleO::Services::CACerts
    - OS::TripleO::Services::CephMon
    - OS::TripleO::Services::CephExternal
    ...
    - OS::TripleO::Services::FluentdClient
    - OS::TripleO::Services::VipHosts
    - OS::TripleO::Services::Motd      # Add the service to the end
```

4. When you create an overcloud, include the resulting environment file and the **custom_roles_data.yaml** file with your other environment files and deployment options:


```
$ openstack overcloud deploy --templates -e /home/stack/templates/env-motd.yaml -r  
~/custom_roles_data.yaml [OTHER OPTIONS]
```

This includes our custom **motd** service in our deployment and configures the service on Controller nodes only.

CHAPTER 7. BUILDING CERTIFIED CONTAINER IMAGES

You can use the partner **Build Service** to build your application containers for certification. The **Build Service** builds containers from Git repositories that are Internet-accessible publicly or privately with an SSH key.

This section describes the steps to use the automated **Build Service** as part of the **Red Hat OpenStack and NFV Zone** to automatically build containerized partner platform plugins to Red Hat OpenStack Platform 13 base containers.

Prerequisites

- Register with Red Hat Connect for Technology Partners.
- Apply for Zone access to the Red Hat OpenStack & NFV zone.
- Create a Product. The information you provide will be used when the certification is published in our catalog.
- Create a git repository for your plugin, with your Dockerfile and any components that you will include in the container.

If you have any problems when you register with or access the Red Hat Connect site, contact the [Red Hat Technology Partner Success Desk](#).

7.1. ADDING A CONTAINER PROJECT

One project represents one partner image. If you have multiple images, you must create multiple projects.

Procedure

1. Log in to [Red Hat Connect for Technology Partners](#) and click **Zones**.
2. Scroll down and select the **Red Hat OpenStack & NFV** zone. Click anywhere in the box.
3. Click **Certify** to access the existing products and projects of your company.
4. Click **Add Project** to create a new project.
5. Set the **Project Name**.
 - Project name is not visible outside the system.
 - The project name should include **[product][version]-[extended-base-container-image]-[your-plugin]**
 - For OpenStack purposes the format is **rhospXX-baseimage-myplugin**.
 - Example: **rhosp13-openstack-cinder-volume-myplugin**
6. Select the **Product**, **Product Version**, and **Release Category** based on your product or plugin, and its version.
 - Create the product and its version prior to creating projects.

- Set the label release category to **Tech Preview**. Generally Available is not an option until you have completed API testing with Red Hat Certification. Refer to the plugin certification requirements when you have certified your container image.
7. Select the **Red Hat Product** and **Red Hat Product Version** based on the base image you are modifying with your partner plugin. For this release, please select **Red Hat OpenStack Platform** and **13**.
 8. Click **Submit** to create the new project.

Result:

Red Hat assesses and confirms the certification of your project.

Send an email to connect@redhat.com stating whether the plugin is **in tree** or **out of tree** in regards to the upstream code.








- **In Tree** means the plugin is included in the OpenStack upstream code base and the plugin image is built by Red Hat and distributed with Red Hat OpenStack Platform {osp_curr_ver}.
- **Out of Tree** means the plugin image is not included in the OpenStack upstream code base and not distributed within RHOSP {osp_curr_ver}.

7.2. FOLLOWING THE CONTAINER CERTIFICATION CHECKLIST

Certified containers meet Red Hat standards for packaging, distribution, and maintenance. Containers that are certified by Red Hat have a high level of trust and supportability from container-capable platforms, including Red Hat OpenStack Platform (RHOSP). To maintain this, partners must keep their images up-to-date.

Procedure

1. Click **Certification Checklist**.
2. Complete all sections of the checklist. If you need more information about an item on the checklist, click the drop-down arrow on the left to view the item information and links to other resources.

Certified 		
> Update your company profile		EDIT
> Update your product profile		EDIT
> Accept the OpenStack Appendix		EDIT
> Update your project profile		EDIT
> Package and test your application as a con...	<input type="radio"/>	LEARN MORE
> Upload documentation and marketing mat...	<input type="radio"/>	START
> Provide a container registry namespace		EDIT
> Provide sales contact information		EDIT
> Obtain distribution approval from Red Hat	<input type="radio"/>	START
> Configure Automated Build Service	<input type="radio"/>	START

The checklist includes the following items:

Update your company profile

Ensures that your company profile is up to date.

Update your product profile

This page details to the product profile, including the product type, description, repository URL, version, and contact distribution list.

Accept the OpenStack Appendix

Site Agreement for the Container Terms.

Update project profile

Check that the image settings such as auto publish, registry namespace, release category, supported platforms are correct.



NOTE

In the **Supported Platforms** section, you must select an option so that you can save other required fields on this page.

Package and test your application as a container

Follow the instructions on this page to configure the build service. The build service is dependent on the completion of the previous steps.

Upload documentation and marketing materials

This redirects you to the product page. Scroll to the bottom and click **Add new Collateral** to upload your product information.



NOTE

You must provide a minimum of three materials. The first material must be a **document** type.

Provide a container registry namespace

This is the same as the project page profile page.

Provide sales contact information

This information is the same as the company profile.

Obtain distribution approval from Red Hat

Red Hat provides approval for this step.

Configure Automated Build Service

The configuration information to perform the build and scan of the container image.

The last item in the checklist is **Configure Automated Build Service**. Before you configure this service, you must ensure that your project contains a dockerfile that conforms to Red Hat certification standards.

7.3. DOCKERFILE REQUIREMENTS

As a part of the image build process, the build service scans your built image to ensure that it complies with Red Hat standards. Use the following guidelines as a basis for the dockerfile to include with your project:

- The base image must be a Red Hat image. Any images that use Ubuntu, Debian, and CentOS as a base do not pass the scanner.
- You must configure the required labels:
 - **name**
 - **maintainer**
 - **vendor**
 - **version**

- **release**
- **summary**
- You must include a software license as a text file within the image. Add the software license to the **licenses** directory at the root of your project.
- You must configure a user that is not the **root** user.

The following dockerfile example demonstrates the required information for the scan:

```
FROM registry.redhat.io/rhosp13/openstack-cinder-volume
MAINTAINER VenderX Systems Engineering <maintainer@vendorX.com>

###Required Labels
LABEL name="rhosp13/openstack-cinder-volume-vendorx-plugin" \
      maintainer="maintainer@vendorX.com" \
      vendor="VendorX" \
      version="3.7" \
      release="1" \
      summary="Red Hat OpenStack Platform 13.0 cinder-volume VendorX PluginY" \
      description="Red Hat OpenStack Platform 13.0 cinder-volume VendorX PluginY"

USER root

###Adding package
###repo exmple
COPY vendorX.repo /etc/yum.repos.d/vendorX.repo

###adding package with curl
RUN curl -L -o /vendorX-plugin.rpm http://vendorX.com/vendorX-plugin.rpm

###adding local package
COPY verdorX-plugin.rpm /

# Enable a repo to install a package
RUN yum clean all
RUN yum-config-manager --enable rhel-7-server-openstack-13-rpms
RUN yum install -y vendorX-plugin
RUN yum-config-manager --disable rhel-7-server-openstack-13-rpms

# Add required license as text file in Liceses directory (GPL, MIT, APACHE, Partner End User
Agreement, etc)
RUN mkdir /licenses
COPY licensing.txt /licenses

USER cinder
```

7.4. SETTING PROJECT DETAILS

You must set details for your project including the namespace and registry for your container image.

Procedure

1. Click **Project Settings**.
2. Ensure that your project name is in the correct format. Optionally, set **Auto-Publish** to **ON** if you want to automatically publish containers that pass certification. Certified containers are published in the Red Hat Container Catalog.

Project Name *

MyProject

Current project name: OS 13+ Test Project

Auto-Publish

Once a container is certified it is automatically published. Auto-publish must be enabled in order to set up automatic rebuilds.

ON

A container must be pushed to begin the auto-publish process.
Auto-publish is always enabled when **auto-rebuilding** is enabled.

3. To set the **Container Registry Namespace**, follow the online instructions.

Container Registry Namespace

mycompany

This should be your company name or abbreviation. For example, if your company is *Acme Corporation*, you can use names like *acme*, *acmecorp*, or *acme-corp*. This value is only editable when your company has no published containers in any project.

- Must be unique.
- Must be lowercase.
- Cannot contain special characters other than hyphens (-).
- Must start with a letter.
- Must be 64 characters or less.

- The container registry namespace is the name of your company.
 - The final registry URL is **registry.connect.redhat.com/namespace/repository:tag**.
 - Example: **registry.connect.redhat.com/mycompany/rhosp16-openstack-cinder-volume-myplugin:1.0**
4. To set the **Outbound Repository Name** and **Outbound Repository Descriptions**, follow the online instructions. The outbound repository name must be the same as the project name.

Outbound Repository Name

```
rhosp13-openstack-cinder-volume-myplugin
```

This should represent your product (or the component if your product consists of multiple containers) and a major version. For example, you could use names like *jboss-server7*, or *agent5*. This value is only editable when there are no published containers in this project.

- Must be unique.
- Must be lowercase.
- Cannot contain special characters other than hyphens (-).
- Must start with a letter.
- Must be 64 characters or less.

- **[product][version]-[extended_base_container_image]-[your_plugin]**
 - For OpenStack purposes the format is **rhospXX-baseimage-myplugin**
 - Final registry URL would be then **registry.connect.redhat.com/namespace/repository:tag**
 - Example: **registry.connect.redhat.com/mycompany/rhosp13-openstack-cinder-volume-myplugin:1.0**
5. Add additional information about your project in the relevant fields:
- **Repository Description**
 - **Supporting Documentation for Primed**
6. Click **Submit**.

7.5. BUILDING A CONTAINER IMAGE WITH THE BUILD SERVICE

Build the container image for your partner plugin.

Procedure

1. Click **Build Service**.
2. Click **Configure Build Service** to configure your build details.
 - a. Ensure that the **Red Hat Container Build** is set to **ON**.
 - b. Add your **Git Source URL** and optionally add your **Source Code SSH Key** if your git repository is protected. The URL can be HTML or SSH. SSH is required for protected git repositories.
 - c. Optional: Add **Dockerfile Name** or leave blank if your Dockerfile name is **Dockerfile**.
 - d. Optional: Add the **Context Directory** if the docker build context root is not the root of the git repository. Otherwise, leave this field blank.
 - e. Set the **Branch** in your git repository to base the container image on.

- f. Click **Submit** to finalize the **Build Service** settings.
3. Click **Start Build**.
 4. Add a **Tag Name** and click **Submit**. It can take up to six minutes for the build to complete.
 - The tag name should be a version of your plugin
 - Final reference URL would be **registry.connect.redhat.com/namespace/repository:tag**
 - Example: **registry.connect.redhat.com/mycompany/rhosp13-openstack-cinder-volume-myplugin:1.0**
 5. Click **Refresh** to check that your build is complete. Optional: Click the matching **Build ID** to view the build details and logs.
 6. The build service both builds and scans the image. This normally takes 10-15 minutes to complete. When the scan completes, click the **View** link to expand the scan results.

7.6. CORRECTING FAILED SCAN RESULTS

The **Scan Details** page displays the result of the scan, including any failed items. If your image scan reports a **FAILED** status, use the following procedure to investigate how to correct the failure.

Procedure

1. On the **Container Information** page, click the **View** link to expand the scan results.
2. Click the failed item. For example, in the following screenshot, the **has_licenses** check failed.

Scan Details

▾ Assessments

Name	Value ▲
has_licenses	X
not_running_privileged	✓
rpm_list_successful	✓
rpm_verify_successful	✓
is_rhel	✓
vendor_label_exists	✓
free_of_critical_vulnerabilities	✓
good_tags	✓
good_layer_count	✓
release_label_exists	✓
not_running_as_root	✓
version_label_exists	✓
name_label_exists	✓

3. Click the failed item to open the **Policy Guide** at the relevant section and view more information about how to correct the issue.



NOTE

If you receive an **Access Denied** warning when you access the **Policy Guide**, email connect@redhat.com

7.7. PUBLISHING A CONTAINER IMAGE

After the container image passes the scan, you can publish the container image.

Procedure

1. On the **Container Information** page, click the **Publish** link to publish the container image live.
2. The **Publish** link changes to **Unpublish**. To unpublish a container, click the **Unpublish** link.

When you publish the link, check the certification documentation for more information about certifying your plugin. For more links to certification documentation, see [Section 1.1, "Partner integration prerequisites"](#).

7.8. DEPLOYING A VENDOR PLUGIN

To use third-party hardware as a Block Storage back end, you must deploy a vendor plugin. The following example demonstrates how to deploy a vendor plugin to use Dell EMC hardware as a Block Storage back end.

1. Log in to the **registry.connect.redhat.com** catalog:

```
$ docker login registry.connect.redhat.com
```

2. Download the plugin:

```
$ docker pull registry.connect.redhat.com/dellemc/openstack-cinder-volume-dellemc-rhosp13
```

3. Tag and push the image to the local undercloud registry using the undercloud IP address relevant to your OpenStack deployment:

```
$ docker tag registry.connect.redhat.com/dellemc/openstack-cinder-volume-dellemc-rhosp13  
192.168.24.1:8787/dellemc/openstack-cinder-volume-dellemc-rhosp13
```

```
$ docker push 192.168.24.1:8787/dellemc/openstack-cinder-volume-dellemc-rhosp13
```

4. Deploy the overcloud with an additional environment file that contains the following parameter:

```
parameter_defaults:  
  DockerCinderVolumeImage: 192.168.24.1:8787/dellemc/openstack-cinder-volume-dellemc-  
rhosp13
```

CHAPTER 8. INTEGRATION OF OPENSTACK COMPONENTS AND THEIR RELATIONSHIP WITH DIRECTOR AND THE OVERCLOUD

Use the following concepts about specific integration points to begin integrating hardware and software with Red Hat OpenStack Platform (RHOSP).

8.1. BARE METAL PROVISIONING (IRONIC)

Use the OpenStack Bare Metal Provisioning (ironic) component within director to control the power state of the nodes. Director uses a set of back-end drivers to interface with specific bare metal power controllers. These drivers are the key to enabling hardware and vendor specific extensions and capabilities. The most common driver is the IPMI driver, **pxe_ipmitool**, which controls the power state for any server that supports the Intelligent Platform Management Interface (IPMI).

Integration with Bare Metal Provisioning starts with the upstream OpenStack community. Ironic drivers accepted upstream are automatically included in the core RHOSP product and director by default. However, they might not be supported according to certification requirements.

Hardware drivers must undergo continuous integration testing to ensure their continued functionality. For more information about third-party driver testing and suitability, see the OpenStack community page [Ironic Testing](#).

Upstream Repositories:

- OpenStack: <http://git.openstack.org/cgit/openstack/ironic/>
- GitHub: <https://github.com/openstack/ironic/>

Upstream Blueprints:

- Launchpad: <http://launchpad.net/ironic>

Puppet Module:

- GitHub: <https://github.com/openstack/puppet-ironic>

Bugzilla components:

- openstack-ironic
- python-ironicclient
- python-ironic-oscplugin
- openstack-ironic-discoverd
- openstack-puppet-modules
- openstack-tripleo-heat-templates

Integration Notes:

- The upstream project contains drivers in the **ironic/drivers** directory.

- Director performs a bulk registration of nodes defined in a JSON file. The **os-cloud-config** tool, <https://github.com/openstack/os-cloud-config/>, parses this file to determine the node registration details and perform the registration. This means the **os-cloud-config** tool, specifically the **nodes.py** file, requires support for your driver.
- Director is automatically configured to use Bare Metal Provisioning, which means the Puppet configuration requires little to no modification. However, if your driver is included with Bare Metal Provisioning, you must add your driver to the **/etc/ironic/ironic.conf** file. Edit this file and search for the **enabled_drivers** parameter:

```
enabled_drivers=pxe_ipmitool,pxe_ssh,pxe_drac
```

This allows Bare Metal Provisioning to use the specified driver from the **drivers** directory.

8.2. NETWORKING (NEUTRON)

OpenStack Networking (neutron) provides the ability to create a network architecture within your cloud environment. The project provides several integration points for Software Defined Networking (SDN) vendors. These integration points usually fall into the categories of plugins or agents:

A plugin allows extension and customization of pre-existing neutron functions. Vendors can write plugins to ensure interoperability between neutron and certified software and hardware. Develop a driver for neutron Modular Layer 2 (ml2) plugin, which provides a modular back end for integrating your own drivers.

An agent provides a specific network function. The main neutron server and its plugins communicate with neutron agents. Existing examples include agents for DHCP, Layer 3 support, and bridging support.

For both plugins and agents, you can choose one of the following options:

- Include them for distribution as part of the Red Hat OpenStack Platform (RHOSP) solution
- Add them to the overcloud images after RHOSP distribution

Analyze the functionality of existing plugins and agents to determine how to integrate your own certified hardware and software. In particular, it is recommended to first develop a driver as a part of the ml2 plugin.

Upstream Repositories:

- OpenStack: <http://git.openstack.org/cgit/openstack/neutron/>
- GitHub: <https://github.com/openstack/neutron/>

Upstream Blueprints:

- Launchpad: <http://launchpad.net/neutron>

Puppet Module:

- GitHub: <https://github.com/openstack/puppet-neutron>

Bugzilla components:

- openstack-neutron
- python-neutronclient

- openstack-puppet-modules
- openstack-tripleo-heat-templates

Integration Notes:

- The upstream **neutron** project contains several integration points:
 - The plugins are located in **neutron/plugins/**
 - The ml2 plugin drivers are located in **neutron/plugins/ml2/drivers/**
 - The agents are located in **neutron/agents/**
- Since the OpenStack Liberty release, many of the vendor-specific ml2 plugin have been moved into their own repositories beginning with **networking-*x***. For example, the Cisco-specific plugins are located in <https://github.com/openstack/networking-cisco>
- The **puppet-neutron** repository also contains separate directories to configure these integration points:
 - The plugin configuration is located in **manifests/plugins/**
 - The ml2 plugin driver configuration is located in **manifests/plugins/ml2/**
 - The agent configuration is located in **manifests/agents/**
- The **puppet-neutron** repository contains numerous additional libraries for configuration functions. For example, the **neutron_plugin_ml2** library adds a function to add attributes to the ml2 plugin configuration file.

8.3. BLOCK STORAGE (CINDER)

OpenStack Block Storage (cinder) provides an API that interacts with block storage devices, which Red Hat OpenStack Platform (RHOSP) uses to create volumes. For example, Block Storage provides virtual storage devices for instances. Block Storage provides a core set of drivers to support different storage hardware and protocols. For example, some of the core drivers include support for NFS, iSCSI, and Red Hat Ceph Storage. Vendors can include drivers to support additional certified hardware.

Vendors have the following two main options with the drivers and configuration they develop:

- Include them for distribution as part of the RHOSP solution
- Add them to the overcloud images after RHOSP distribution

Analyze the functionality of existing drivers to determine how to integrate your own certified hardware and software.

Upstream Repositories:

- OpenStack: <http://git.openstack.org/cgit/openstack/cinder/>
- GitHub: <https://github.com/openstack/cinder/>

Upstream Blueprints:

- Launchpad: <http://launchpad.net/cinder>

Puppet Module:

- GitHub: <https://github.com/openstack/puppet-cinder>

Bugzilla components:

- openstack-cinder
- python-cinderclient
- openstack-puppet-modules
- openstack-tripleo-heat-templates

Integration Notes:

- The upstream **cinder** repository contains the drivers in **cinder/volume/drivers/**
- The **puppet-cinder** repository contains two main directories for driver configuration:
 - The **manifests/backend** directory contains a set of defined types that configure the drivers.
 - The **manifests/volume** directory contains a set of classes to configure a default block storage device.
- The **puppet-cinder** repository contains a library called **cinder_config** to add attributes to the Cinder configuration files.

8.4. IMAGE STORAGE (GLANCE)

OpenStack Image service (glance) provides an API that interacts with storage types to provide storage for images. Image service provides a core set of drivers to support different storage hardware and protocols. For example, the core drivers include support for file, OpenStack Object Storage (swift), OpenStack Block Storage (cinder), and Red Hat Ceph Storage. Vendors can include drivers to support additional certified hardware.

Upstream Repositories:

- OpenStack:
 - <http://git.openstack.org/cgit/openstack/glance/>
 - http://git.openstack.org/cgit/openstack/glance_store/
- GitHub:
 - <https://github.com/openstack/glance/>
 - https://github.com/openstack/glance_store/

Upstream Blueprints:

- Launchpad: <http://launchpad.net/glance>

Puppet Module:

- GitHub: <https://github.com/openstack/puppet-glance>

Bugzilla components:

- openstack-glance
- python-glanceclient
- openstack-puppet-modules
- openstack-tripleo-heat-templates

Integration Notes:

- Adding a vendor-specific driver is not necessary because Image service can use Block Storage, which contains integration points, to manage image storage.
- The upstream **glance_store** repository contains the drivers in **glance_store/_drivers**.
- The **puppet-glance** repository contains the driver configuration in the **manifests/backend** directory.
- The **puppet-glance** repository contains a library called **glance_api_config** to add attributes to the Glance configuration files.

8.5. SHARED FILE SYSTEMS (MANILA)

OpenStack Shared File System Service (Manila) provides an API for shared and distributed file system services. Vendors can include drivers to support additional certified hardware.

Upstream Repositories:

- OpenStack: <http://git.openstack.org/cgit/openstack/manila/>
- GitHub: <https://github.com/openstack/manila/>

Upstream Blueprints:

- Launchpad: <http://launchpad.net/manila>

Puppet Module:

- GitHub: <https://github.com/openstack/puppet-manila>

Bugzilla components:

- openstack-manila
- python-manilaclient
- openstack-puppet-modules
- openstack-tripleo-heat-templates

Integration Notes:

- The upstream **manila** repository contains the drivers in **manila/share/drivers/**.

- The **puppet-manila** repository contains the driver configuration in the **manifests/backend** directory.
- The **puppet-manila** repository contains a library called **manila_config** to add attributes to the manila configuration files.

8.6. OPENSIFT-ON-OPENSTACK

Red Hat OpenStack Platform (RHOSP) aims to support OpenShift-on-OpenStack deployments. For more information about the partner integration for these deployments, see the [Red Hat OpenShift Partners](#) page.

APPENDIX A. COMPOSABLE SERVICE PARAMETERS

The following parameters are used for the outputs in all composable services:

- [service_name](#)
- [config_settings](#)
- [service_config_settings](#)
- [global_config_settings](#)
- [step_config](#)
- [upgrade_tasks](#)
- [upgrade_batch_tasks](#)

The following parameters are used for the outputs specifically for containerized composable services:

- [puppet_config](#)
- [kolla_config](#)
- [docker_config](#)
- [docker_puppet_tasks](#)
- [host_prep_tasks](#)
- [fast_forward_upgrade_tasks](#)

A.1. ALL COMPOSABLE SERVICES

The following parameters apply to all composable services.

service_name

The name of your service. You can use this to apply configuration from other composable services via [service_config_settings](#).

config_settings

Custom hieradata settings for your service.

service_config_settings

Custom hieradata settings for another service. For example, your service might require its endpoints registered in OpenStack Identity (**keystone**). This provides parameters from one service to another and provide a method of cross-service configuration, even if the services are on different roles.

global_config_settings

Custom hieradata settings distributed to all roles.

step_config

A Puppet snippet to configure the service. This snippet is added to a combined manifest created and run at each step of the service configuration process. These steps are:

- Step 1 - Load balancer configuration
- Step 2 - Core high availability and general services (Database, RabbitMQ, NTP)
- Step 3 - Early OpenStack Platform Service setup (Storage, Ring Building)
- Step 4 - General OpenStack Platform services
- Step 5 - Service activation (Pacemaker) and OpenStack Identity (keystone) role and user creation

In any referenced puppet manifest, you can use the **step** hieradata (using **hieradata('step')**) to define specific actions at specific steps during the deployment process.

upgrade_tasks

Ansible snippet to help with upgrading the service. The snippet is added to a combined playbook. Each operation uses a tag to define a **step**, which includes:

- **common** - Applies to all steps
- **step0** - Validation
- **step1** - Stop all OpenStack services.
- **step2** - Stop all Pacemaker-controlled services
- **step3** - Package update and new package installation
- **step4** - Start OpenStack service required for database upgrade
- **step5** - Upgrade database

upgrade_batch_tasks

Performs a similar function to **upgrade_tasks** but only executes batch set of Ansible tasks in order they are listed. The default is **1**, but you can change this per role using the **upgrade_batch_size** parameter in a **roles_data.yaml** file.

A.2. CONTAINERIZED COMPOSABLE SERVICES

The following parameters apply to all containerized composable services.

puppet_config

This section is a nested set of key value pairs that drive the creation of configuration files using puppet. Required parameters include:

puppet_tags

Puppet resource tag names that are used to generate configuration files with Puppet. Only the named configuration resources are used to generate a file. Any service that specifies tags will have the default tags of *file,concat,file_line,augeas,cron* appended to the setting. Example:

keystone_config

config_volume

The name of the volume (directory) where the configuration files are generated for this service. Use this as the location to bind mount into the running Kolla container for configuration.

config_image

The name of the docker image that will be used for generating configuration files. This is often the same container that the runtime service uses. Some services share a common set of configuration files which are generated in a common base container.

step_config

This setting controls the manifest that is used to create docker configuration files via Puppet. The Puppet tags below are used along with this manifest to generate a configuration directory for this container.

kolla_config

Creates a map of the the Kolla configuration in the container. The format begins with the absolute path of the configuration file and uses it for following sub-parameters:

command

The command to run when the container starts.

config_files

The location of the service configuration files (**source**) and the destination on the container (**dest**) before the service starts. Also includes options to either merge or replace these files on the container (**merge**), whether to preserve the file permissions and other properties (**preserve_properties**).

permissions

Set permissions for certain directories on the containers. Requires a **path**, an **owner**, and a group. You can also apply the permissions recursively (**recurse**).

The following is an example of the **kolla_config** parameter for the keystone service:

```
kolla_config:
  /var/lib/kolla/config_files/keystone.json:
    command: /usr/sbin/httpd -DFOREGROUND
    config_files:
      - source: "/var/lib/kolla/config_files/src/*"
        dest: "/"
        merge: true
        preserve_properties: true
  /var/lib/kolla/config_files/keystone_cron.json:
    command: /usr/sbin/crond -n
    config_files:
      - source: "/var/lib/kolla/config_files/src/*"
        dest: "/"
        merge: true
        preserve_properties: true
    permissions:
      - path: /var/log/keystone
        owner: keystone:keystone
        recurse: true
```

docker_config

Data passed to the **docker-cmd** hook to configure a container at each step.

- **step_0** - Containers configuration files generated per hiera settings.
- **step_1** - Load Balancer configuration
 - a. Baremetal configuration
 - b. Container configuration
- **step_2** - Core Services (Database/Rabbit/NTP/etc.)
 - a. Baremetal configuration
 - b. Container configuration
- **step_3** - Early OpenStack Service setup (Ringbuilder, etc.)
 - a. Baremetal configuration
 - b. Container configuration
- **step_4** - General OpenStack Services
 - a. Baremetal configuration
 - b. Container configuration
 - c. Keystone container post initialization (tenant, service, endpoint creation)
- **step_5** - Service activation (Pacemaker)
 - a. Baremetal configuration
 - b. Container configuration

The YAML uses a set of parameters to define the container container to run at each step and the **docker** settings associated with each container. For example:

```
docker_config:
  step_3:
    keystone:
      start_order: 2
      image: *keystone_image
      net: host
      privileged: false
      restart: always
      healthcheck:
        test: /openstack/healthcheck
      volumes: *keystone_volumes
      environment:
        - KOLLA_CONFIG_STRATEGY=COPY_ALWAYS
```

This creates a **keystone** container and uses the respective parameters to define details, including the image to use, the networking type, and environment variables.

docker_puppet_tasks

Provides data to drive the **docker-puppet.py** tool directly. The task is executed only once within the cluster (not on each node) and is useful for several Puppet snippets required for initialization of things like keystone endpoints and database users. For example:

```
docker_puppet_tasks:
  # Keystone endpoint creation occurs only on single node
  step_3:
    config_volume: 'keystone_init_tasks'
    puppet_tags:
'keystone_config,keystone_domain_config,keystone_endpoint,keystone_identity_provider,keystone_pas
e_ini,keystone_role,keystone_service,keystone_tenant,keystone_user,keystone_user_role,keystone_do
main'
    step_config: 'include ::tripleo::profile::base::keystone'
    config_image: *keystone_config_image
```

host_prep_tasks

This is an ansible snippet to execute on the node host to prepare it for containerized services. For example, you might need to create a specific directory to mount to the container during its creation.

fast_forward_upgrade_tasks

Ansible snippet to help with the fast forward upgrade process. This snippet is added to a combined playbook. Each operation uses tags to define **step** and **release**

The **step** usually follows these stages:

- **step=0** - Check running services
- **step=1** - Stop the service
- **step=2** - Stop the cluster
- **step=3** - Update repositories
- **step=4** - Database backups
- **step=5** - Pre-package update commands
- **step=6** - Package updates
- **step=7** - Post-package update commands
- **step=8** - Database updates
- **step=9** - Verification

The **tag** corresponds to a release:

- **tag=ocata** - OpenStack Platform 11
- **tag=pike** - OpenStack Platform 12
- **tag=queens** - OpenStack Platform 13

