OpenShift Enterprise 2 Deployment Guide

Installing and Configuring OpenShift Enterprise

Red Hat OpenShift Documentation Team

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Abstract

The Deployment Guide provides information on the initial installation and configuration of OpenShift Enterprise. This document describes a typical deployment with Red Hat Enterprise Linux Server 6.6 or greater as the underlying platform. Some of the configuration settings described must be modified to suit your requirements. This document covers the following: Introductory information that includes hardware and software prerequisites, architecture information, upgrading from previous installations, and general information about the sample installation. Instructions on how to install and configure broker hosts and all necessary components and services. Instructions on how to install and configure node hosts and all necessary components and services. Information on how to test and validate an OpenShift Enterprise installation, and install and configure a developer workstation. This document is intended for experienced system administrators.

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Chapter 1. Introduction to OpenShift Enterprise

OpenShift Enterprise by Red Hat is a Platform as a Service (PaaS) that provides developers and IT organizations with an auto-scaling, cloud application platform for deploying new applications on secure, scalable resources with minimal configuration and management overhead. OpenShift Enterprise supports a wide selection of programming languages and frameworks, such as Java, Ruby, and PHP. Integrated developer tools, such as Eclipse integration, JBoss Developer Studio, and Jenkins, support the application life cycle.

Built on Red Hat Enterprise Linux, OpenShift Enterprise provides a secure and scalable multi-tenant operating system for today's enterprise-class applications while providing integrated application runtimes and libraries.

OpenShift Enterprise brings the OpenShift PaaS platform to customer data centers, enabling organizations to implement a private PaaS that meets security, privacy, compliance, and governance requirements.

1.1. Product Features

OpenShift Enterprise automates hosting, configuration, deployment, and administration of application stacks in an elastic cloud environment. Both system administrators and developers benefit with an open source Platform-as-a-Service solution to deliver applications.

Benefits of Platform-as-a-Service

Ease of administration	With OpenShift Enterprise, system administrators no longer have to create development, testing, and production environments. Developers can create their own application stacks using the OpenShift Enterprise Management Console, client tools, or the REST API.
Choice	Developers can choose their tools, languages, frameworks, and services.
Automatic scaling	With OpenShift Enterprise, applications can scale out as necessary, adjusting resources based on demand.
Avoid lock-in	Using standard languages and middleware runtimes means that customers are not tied to OpenShift Enterprise, and can easily move to another platform.
Multiple clouds	OpenShift Enterprise can be deployed on physical hardware, private clouds, public clouds, hybrid clouds, or a mixture of these, allowing full control over where applications are run.

1.2. What's New in Current Release

For a complete list of all the new features available in the current release of OpenShift Enterprise, see the current edition of the *OpenShift Enterprise Release Notes* at https://access.redhat.com/site/documentation. New features that are available in the current release are documented in the respective sections of this book.

Chapter 2. Prerequisites

2.1. Supported Operating Systems

A base installation of Red Hat Enterprise Linux Server 6.6 or later is required to install OpenShift Enterprise 2. Red Hat recommends a "Basic Server" configuration for the base installation, although other configurations are sufficient as a starting point.

Note

Red Hat Enterprise Linux 6 is included with OpenShift Enterprise subscriptions. See Section 2.3, “Red Hat Subscription Requirements” for more information.

Important

At this time, OpenShift Enterprise 2 is only compatible with Red Hat Enterprise Linux Server 6. Future versions will be compatible with Red Hat Enterprise Linux Server 7.

2.2. Hardware Requirements

Although the instructions in this document have been primarily tested on Kernel-based Virtual Machines (KVMs), the instructions also apply to other environments.

The following hardware requirements apply to all hosts, whether configured as a broker or as a node. The hardware requirements are applicable to both physical and virtual environments.

- AMD64 or Intel® 64 architecture
- Minimum 1 GB of memory
- Minimum 8 GB of hard disk space
- Network connectivity

2.3. Red Hat Subscription Requirements

To access the repositories required to install OpenShift Enterprise, your Red Hat account must have active OpenShift Enterprise subscriptions. These subscriptions are available as supported or unsupported evaluations, or they can be purchased by contacting Red Hat Sales. See https://www.openshift.com/products/enterprise/try-enterprise for more information.

OpenShift Enterprise subscriptions include the following Red Hat products:

- Red Hat Enterprise Linux 6 Server
- Red Hat Software Collections 1
- OpenShift Enterprise Infrastructure (broker and supporting services)
- OpenShift Enterprise Application Node

- OpenShift Enterprise Client Tools
- JBoss Enterprise Web Server 2

In addition, the JBoss Enterprise Application Platform for OpenShift Enterprise add-on subscription, which provides the JBoss EAP premium cartridge, includes the following Red Hat products:

- JBoss Enterprise Application Platform 6
- Red Hat OpenShift Enterprise JBoss EAP add-on

Support for the products included in supported evaluation and purchased OpenShift Enterprise subscriptions is provided by Red Hat Global Support Services (GSS). See the OpenShift Enterprise Support Policy at https://access.redhat.com/support/policy/updates/openshift/policies for more information.

Note

Evaluation subscriptions may be bundled differently than purchased subscriptions. Contact Red Hat Sales for the latest information.

Chapter 3. Architecture

OpenShift Enterprise consists of several components. This section provides information about the primary components, and the various configurations described in this guide. The diagrams in subsequent sections depict elements using the following legend:

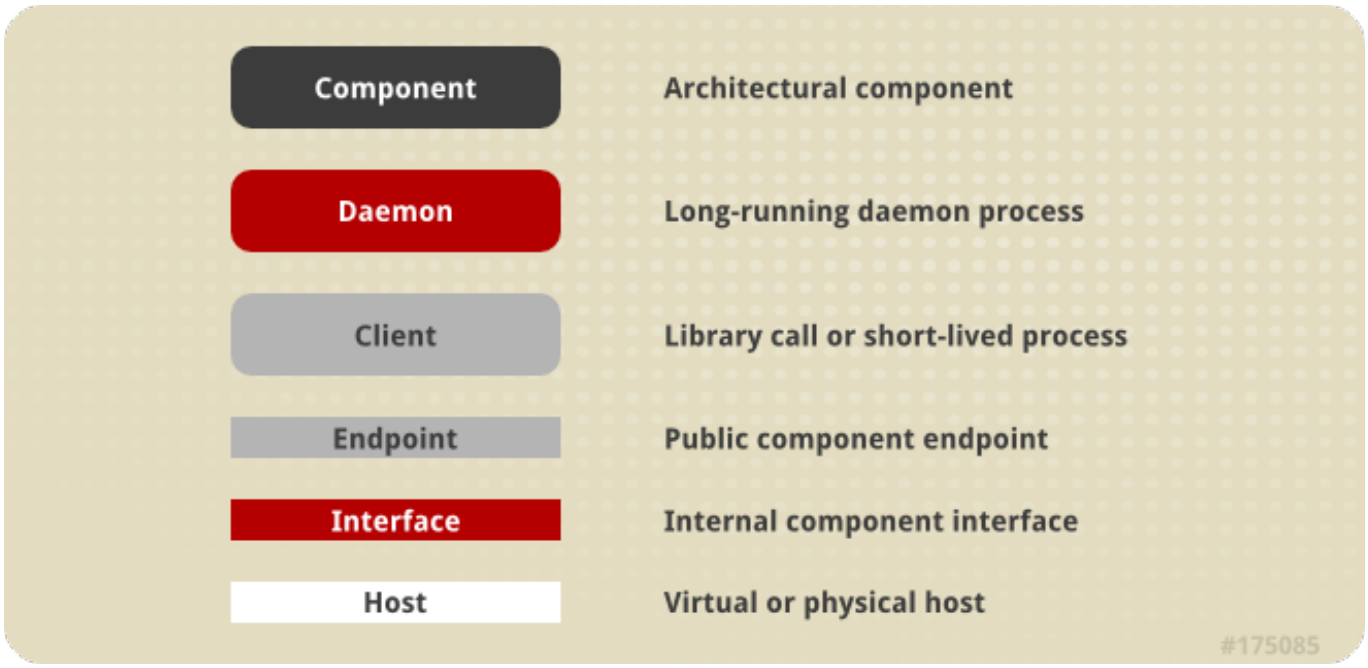


Figure 3.1. OpenShift Enterprise Components Legend

An OpenShift Enterprise deployment consists of two logical types of hosts: a broker and one or more nodes. The broker handles the creation and management of user applications, the user authentication service, and manages communication with the appropriate nodes. The nodes run the user applications in contained environments called *gears*. The broker queries and controls nodes using a messaging service. The following diagram provides a simplified version of the interaction between these two types of hosts:

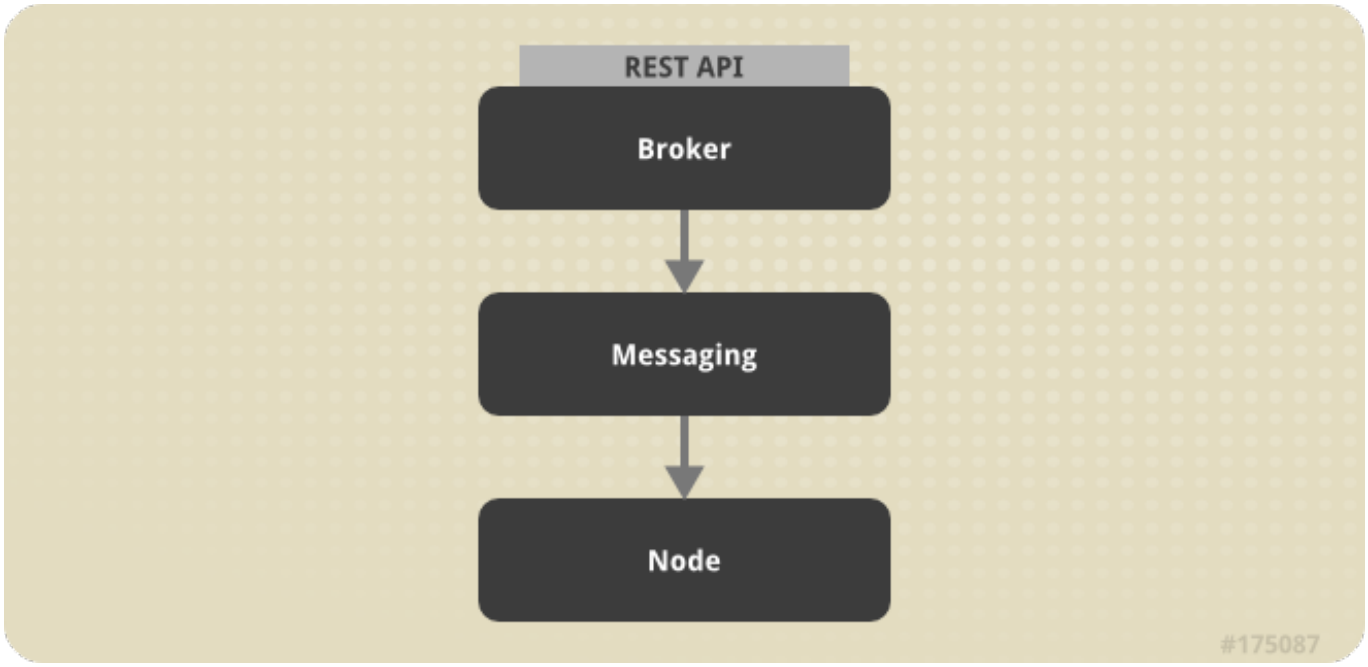


Figure 3.2. OpenShift Enterprise Host Types

Warning

The OpenShift Enterprise security model assumes that broker and node components are installed on separate hosts. Running a broker and node on the same host is not supported.

3.1. Communication Mechanisms

Communication from external clients, such as the client tools or the Management Console, occurs through the REST API that is hosted by the broker. The broker then communicates to the nodes using the messaging service component. MCollective queries a set of nodes and communicates securely with individual nodes. The following diagram provides a high-level description of this communication:

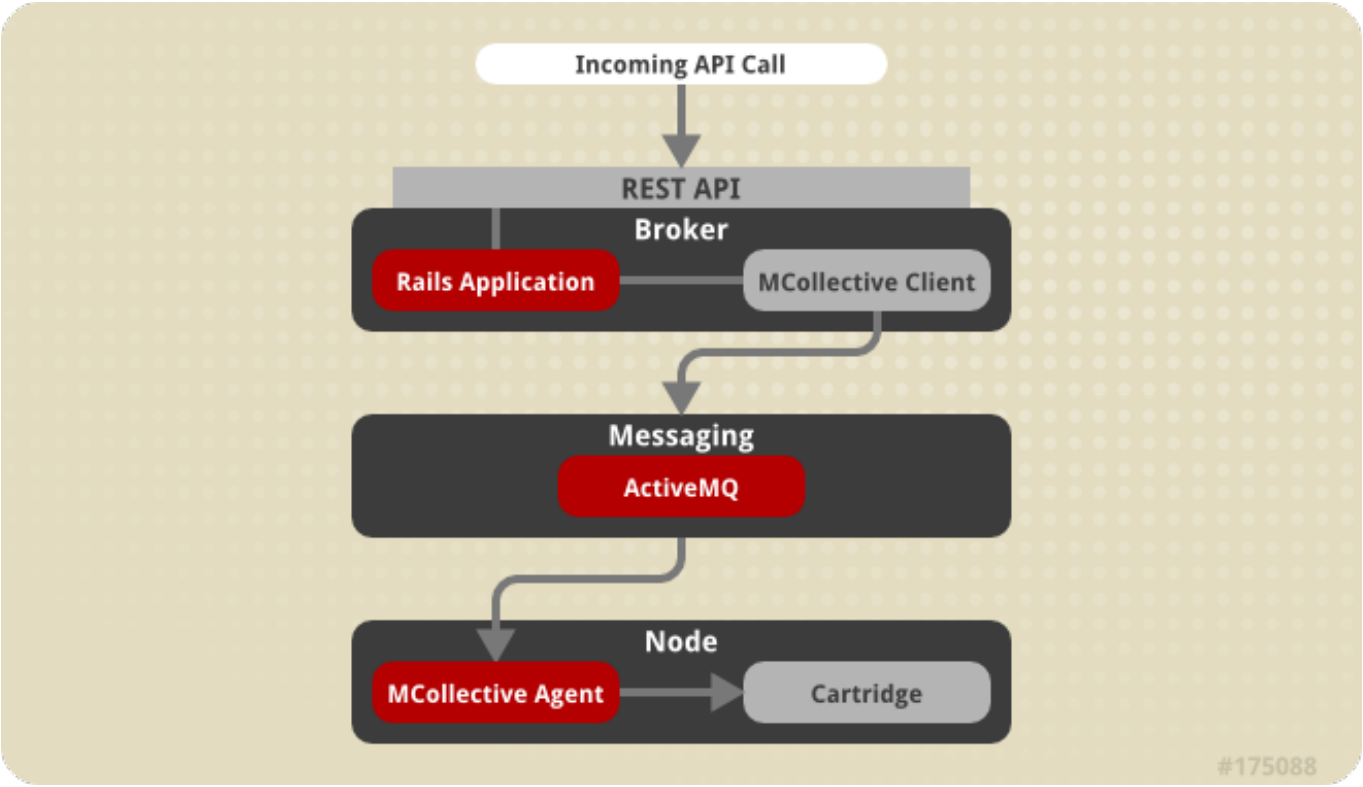


Figure 3.3. OpenShift Enterprise Communication Mechanisms

3.2. State Management

The broker is responsible for managing persistent data for OpenShift Enterprise using three distinct interfaces that represent the complete state. Three interfaces are used because each data store is pluggable and each type of data is usually managed by a separate system. The following table describes each section of application data.

Table 3.1. Sections of Application Data

Section	Description
State	This is the general application state where the data is stored using MongoDB by default.
DNS	This is the dynamic DNS state where BIND handles the data by default.

Section	Description
Auth	This is the user state for authentication and authorization. This state is stored using any authentication mechanism supported by Apache, such as mod_auth_ldap and mod_auth_kerb.

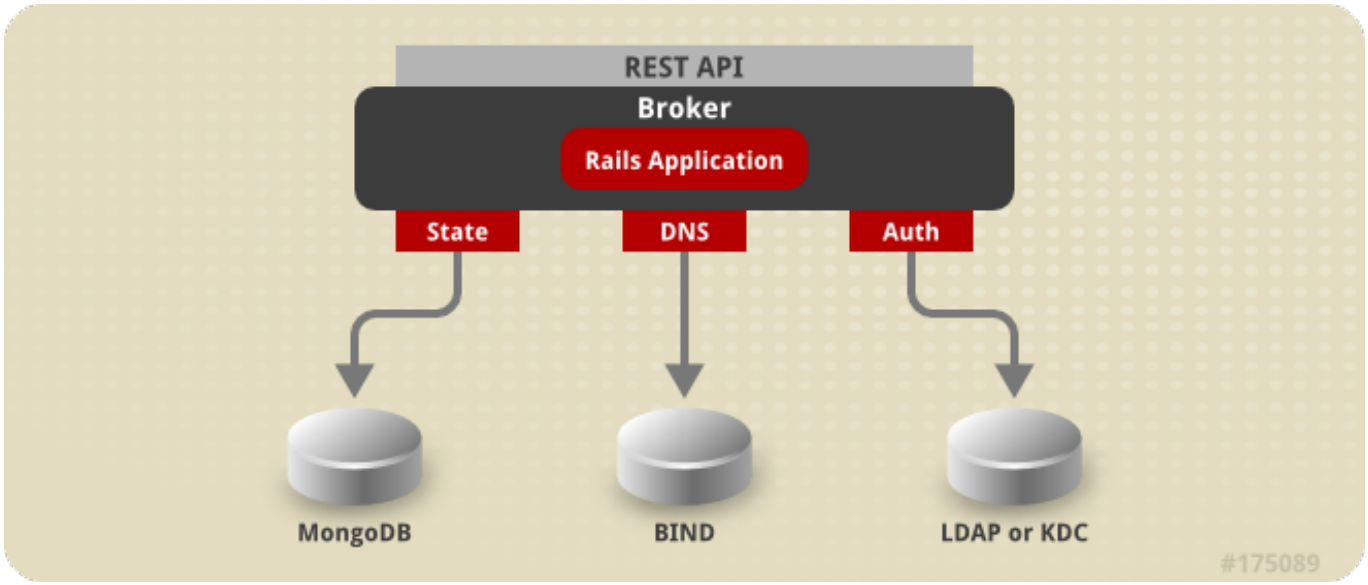


Figure 3.4. OpenShift Enterprise State Management

3.3. Redundancy

OpenShift Enterprise incorporates redundancy where each architectural component can be configured redundantly. The broker applications themselves are stateless and can be set up behind a simple HTTP load balancer. The messaging tier is also stateless, and MCollective can be configured to use multiple ActiveMQ endpoints. Multiple MongoDB instances can be combined into a replica set for fault tolerance and high-availability. This is illustrated in the following diagram:

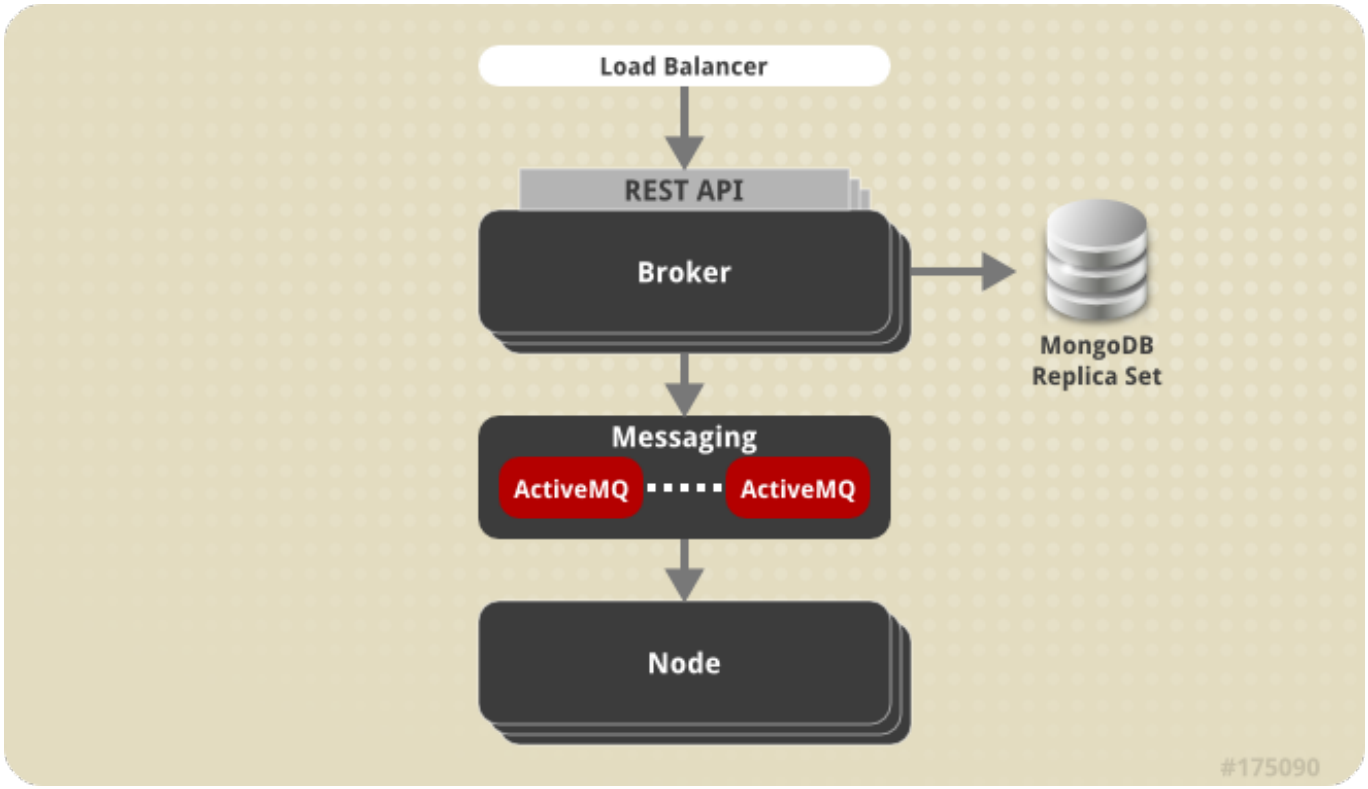


Figure 3.5. Implementing Redundancy in OpenShift Enterprise

This guide focuses on providing a functional installation, and for the sake of simplicity, does not cover how to implement redundancy with the various components. It describes how to install the broker, data stores, and messaging components on one system, while the node is configured on a separate system. The following diagram displays the resulting system topology:

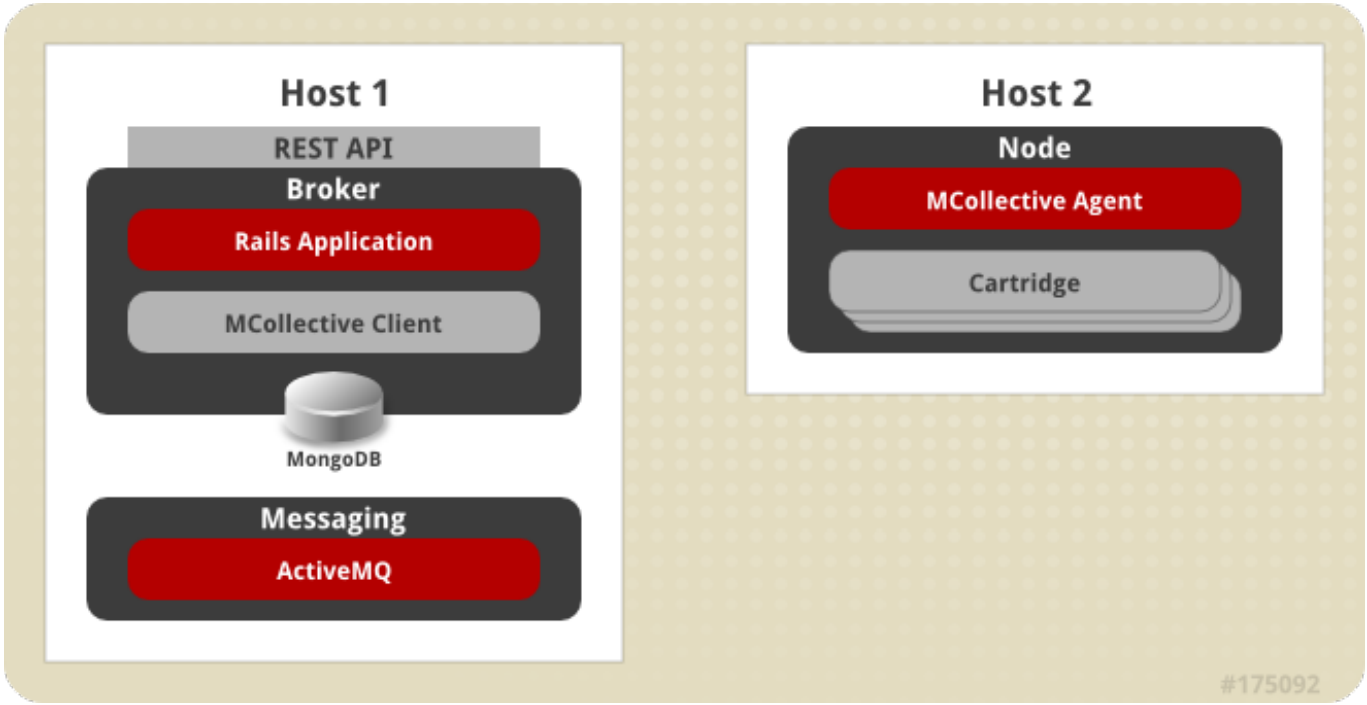


Figure 3.6. Simplified OpenShift Enterprise Installation Topology

3.4. Security

The OpenShift Enterprise multi-tenancy model is based on Red Hat Enterprise Linux, and it provides a secure isolated environment that incorporates the following three security mechanisms:

SELinux

SELinux is an implementation of a mandatory access control (MAC) mechanism in the Linux kernel. It checks for allowed operations at a level beyond what standard discretionary access controls (DAC) provide. SELinux can enforce rules on files and processes, and on their actions based on defined policy. SELinux provides a high level of isolation between applications running within OpenShift Enterprise because each gear and its contents are uniquely labeled.

Control Groups (cgroups)

Control Groups allow you to allocate processor, memory, and input and output (I/O) resources among applications. They provide control of resource utilization in terms of memory consumption, storage and networking I/O utilization, and process priority. This enables the establishment of policies for resource allocation, thus ensuring that no system resource consumes the entire system and affects other gears or services.

Kernel Namespaces

Kernel namespaces separate groups of processes so that they cannot see resources in other groups. From the perspective of a running OpenShift Enterprise application, for example, the application has access to a running Red Hat Enterprise Linux system, although it could be one of many applications running within a single instance of Red Hat Enterprise Linux.

OpenShift Node Architecture

It is important to understand how routing works on a node to better understand the security architecture of OpenShift Enterprise. An OpenShift Enterprise node includes several front ends to proxy traffic to the gears connected to its internal network.

The HTTPD Reverse Proxy front end routes standard HTTP ports 80 and 443, while the Node.js front end similarly routes WebSockets HTTP requests from ports 8000 and 8443. The port proxy routes inter-gear traffic using a range of high ports. Gears on the same host do not have direct access to each other. See Section 5.2, “Network Access” for more information on ports required by OpenShift Enterprise.

In a scaled application, at least one gear runs HAProxy to load balance HTTP traffic across the gears in the application, using the inter-gear port proxy.

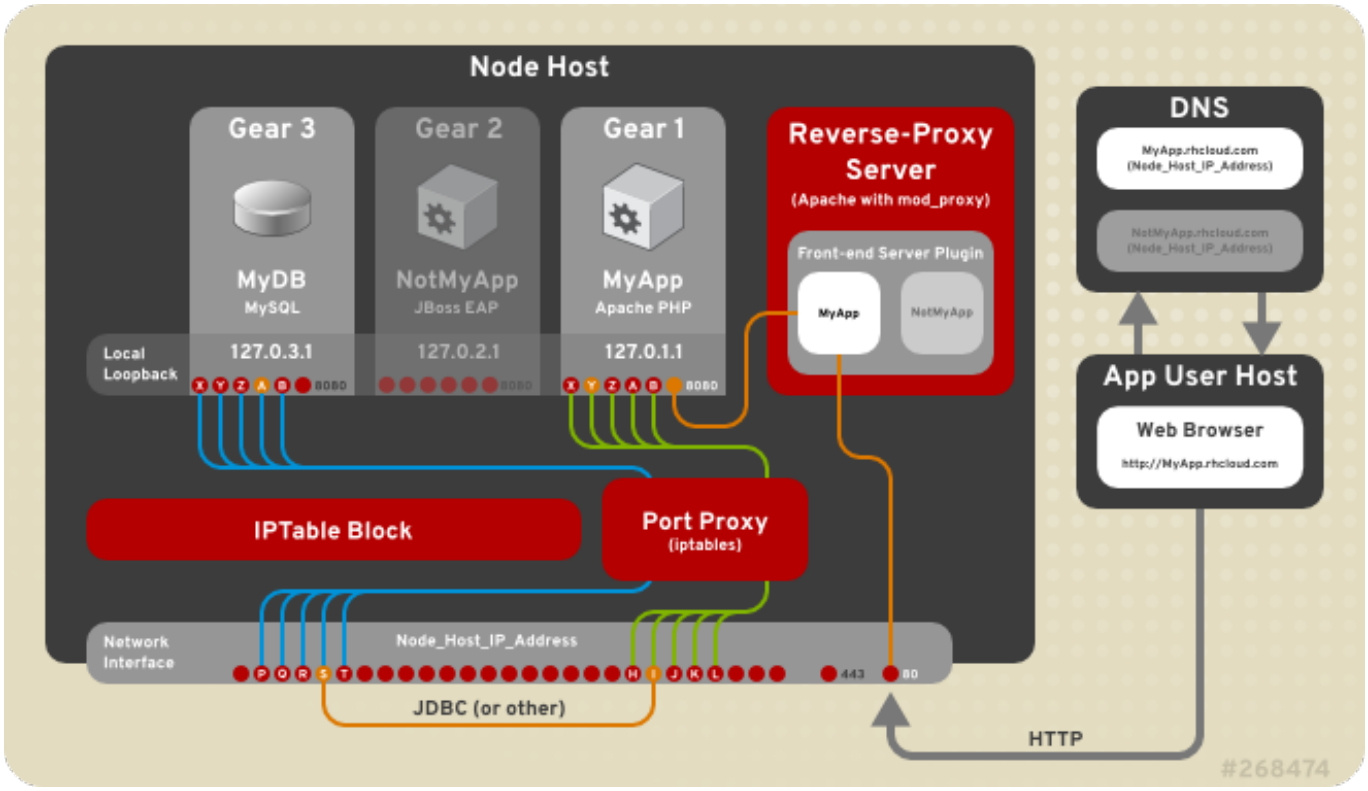


Figure 3.7. OpenShift Enterprise Networking

Warning

The OpenShift Enterprise security model assumes that broker and node components are installed on separate hosts. Running a broker and node on the same host is not supported.

Chapter 4. Upgrading from Previous Versions

The following sections describe how to upgrade from previous major or minor versions to the most current supported version of OpenShift Enterprise using the **ose-upgrade** tool. If you are deploying OpenShift Enterprise for the first time, see Section 6.3, "Using the Sample Deployment Steps" for installation instructions. If you are attempting to apply the latest errata within a minor release of OpenShift Enterprise 2 (for example, updating from release 2.1.6 to 2.1.8), see Chapter 15, *Asynchronous Errata Updates* for specific update instructions.

Upgrades across major or minor versions must be taken one upgrade at a time. For example, to upgrade from 2.0 to 2.2, you must first use the **ose-upgrade** tool to upgrade from 2.0 to 2.1, then use the tool again to upgrade from 2.1 to 2.2.

These upgrade processes require outages:

- Broker services are disabled during the upgrade.
- Applications are unavailable during certain steps of the upgrade. During the outage, users can still access their gears using **SSH**, but should be advised against performing any **Git** pushes. See the section on your relevant upgrade path for more specific outage information.
- Although it may not be necessary, Red Hat recommends rebooting all hosts after an upgrade. Due to the scheduled outage, this is a good time to apply any kernel updates that are included.

The updated OpenShift Enterprise packages are distributed in new channel repositories on Red Hat Network so that the upgrade process occurs in a prescribed order, and to avoid accidental upgrades with a **yum update** command.

4.1. Upgrade Tool

The upgrade process is managed as a series of steps that vary depending on the type of host, and is guided by the **ose-upgrade** tool.

- Each step typically consists of one or more scripts to be executed and varies depending on the type of host.
- Upgrade steps and scripts must be executed in a given order, and are tracked by the **ose-upgrade** tool. The upgrade tool tracks all steps that have been executed and those that have failed. The next step or script is not executed when a previous one has failed.
- Failed steps can be reattempted after the issues are resolved. Note that only scripts that previously failed are executed again, so ensure you are aware of the impact and that the issue has been resolved correctly. If necessary, use the **--skip** option to mark a step complete and proceed to the next step. However, only do this when absolutely required.
- The **ose-upgrade** tool log file is stored at **/var/log/openshift/upgrade.log** for review if required.

At any time, use the **ose-upgrade status** command to list the known steps and view the next step that must be performed. Performing all the steps without pausing with the **ose-upgrade all** command is only recommended for node hosts. For broker hosts, Red Hat recommends that you pause after each step to better understand the process, and understand the next step to be performed.

4.2. Preparing for an Upgrade

The following instructions describe how to prepare OpenShift Enterprise for an upgrade.

Procedure 4.1. To Prepare OpenShift Enterprise for an Upgrade:

1. Perform the required backup steps before starting with the upgrade. Only proceed to the next step after the backup is complete, and the relevant personnel are notified of the upcoming outage.
2. Disable any change management software that is being used to manage your OpenShift Enterprise installation configuration, and update it accordingly after the upgrade.
3. If a configuration file already exists on disk during an update, the RPM package that provides the file does one of the following, depending on how the package is built:
   - Backs up the existing file with an **`.rpmsave`** extension and creates the new file.
   - Leaves the existing file in place and creates the new file with an **`.rpmnew`** extension.

   Before updating, find any **`.rpm*`** files still on disk from previous updates using the following commands:

   ```
   # updatedb
   # locate --regex '\.rpm(save|new)$'
   ```

   Compare these files to the relevant configuration files currently in use and note any differences. Manually merge any desired settings into the current configuration files, then either move the **`.rpm*`** files to an archive directory or remove them.
4. Before attempting to upgrade, ensure the latest errata have been applied for the current minor version of your OpenShift Enterprise installation. Run the **`yum update`** command, then check again for any new configuration files that have changed:

   ```
   # yum update -y
   # updatedb
   # locate --regex '\.rpm(save|new)$'
   ```

   Resolve any **`.rpm*`** files found again as described in the previous step.

   Additional steps may also be required depending on the errata being applied. For more information on errata updates, see the relevant *OpenShift Enterprise Release Notes* at http://access.redhat.com/site/documentation.
5. Restart any services that had their configuration files updated.
6. Run the **`oo-admin-chk`** script on a broker host:

   ```
   # oo-admin-chk
   ```

   This command checks the integrity of the **MongoDB** datastore against the actual deployment of application gears on the node hosts. Resolve any issues reported by this script, if possible, prior to performing an upgrade. For more information on using the **`oo-admin-chk`** script and fixing gear discrepancies, see the *OpenShift Enterprise Troubleshooting Guide* at http://access.redhat.com/site/documentation.
7. Run the **`oo-diagnostics`** script on all hosts:

   ```
   # oo-diagnostics
   ```

   Use the output of this command to compare after the upgrade is complete.

4.3. Upgrading from OpenShift Enterprise 1.2 to OpenShift Enterprise 2.0

The following instructions describe how to upgrade from OpenShift Enterprise 1.2 to OpenShift Enterprise 2.0. The 2.0 upgrade packages are located in new channel repositories on Red Hat Network. The first upgrade step, the **begin** step, adjusts the **yum** configurations in preparation for the upgrade. Red Hat recommends that you perform this step in advance of the scheduled outage to ensure any subscription issues are resolved before you proceed with the upgrade.

Procedure 4.2. To Bootstrap the Upgrade and Perform the begin Step:

1. The *openshift-enterprise-release* RPM package includes the **ose-upgrade** tool that guides you through the upgrade process. Install the *openshift-enterprise-release* package on each host, and update it to the most current version.

```
# yum install openshift-enterprise-release
```

2. The **begin** step of the upgrade process applies to all hosts, and includes those hosts that contain only supporting services such as **MongoDB** and **ActiveMQ**. Hosts using Red Hat Subscription Management (RHSM) or Red Hat Network (RHN) Classic are unsubscribed from the 1.2 channels and subscribed to the new 2.0 channels.

Warning

This step assumes that the channel names come directly from Red Hat Network. If the package source is an instance of Red Hat Satellite or Subscription Asset Manager and the channel names are remapped differently, you must change this yourself. Examine the scripts in the **/usr/lib/ruby/site_ruby/1.8/ose-upgrade/host/upgrades/2/** directory for use as models. You can also add your custom script to a subdirectory to be executed with the **ose-upgrade** tool.

In addition to updating the channel set, modifications to the **yum** configuration give priority to the OpenShift Enterprise, Red Hat Enterprise Linux, and JBoss repositories. However, packages from other sources are excluded as required to prevent certain issues with dependency management that occur between the various channels.

Run the **begin** step on each host. Note that the command output is different depending on the type of host. The following example output is from a broker host:

```
# ose-upgrade begin

INFO: OpenShift broker installed.
INFO: Setting host step 'begin' status to UPGRADING
INFO: Starting upgrade number 2 to version 2.0.
[...]
INFO: Setting host step 'begin' status to COMPLETE
INFO: To continue the upgrade, install a specific upgrade package.
```

Procedure 4.3. To Install the Upgrade RPM Specific to a Host:

1. Depending on the host type, install the latest upgrade RPM package from the new OpenShift Enterprise 2.0 channels. For broker hosts, install the *openshift-enterprise-upgrade-broker* package:

```
# yum install openshift-enterprise-upgrade-broker
```

For node hosts, install the *openshift-enterprise-upgrade-node* package:

```
# yum install openshift-enterprise-upgrade-node
```

If the package is already installed because of a previous upgrade, it still must be updated to the latest package version for the OpenShift Enterprise 2.0 upgrade.

2. The **ose-upgrade** tool guides the upgrade process by listing the necessary steps that are specific to the upgrade scenario, and identifies the step to be performed next. The **ose-upgrade status** command, or **ose-upgrade**, provides a current status report. The command output varies depending on the type of host. The following example output is from a broker host:

```
# ose-upgrade status

INFO: OpenShift broker installed.
Current upgrade is number 2 to version 2.0.
Step sequence:
  begin pre outage rpms conf maintenance_mode pending_ops
confirm_nodes data gears end_maintenance_mode post
Next step is: pre
```

Procedure 4.4. To Perform the pre Step on Broker and Node Hosts:

1. The **pre** step manages the following actions:

   - Backs up OpenShift Enterprise configuration files.
   - Clears pending operations older than one hour. (Broker hosts only)
   - Performs any pre-upgrade datastore migration steps. (Broker hosts only)
   - Updates authorization indexes. (Broker hosts only)

   Run the **pre** step on one broker host and each node host:

   ```
   # ose-upgrade pre
   ```

   When one broker host begins this step, any attempts made by other broker hosts to run the **pre** step simultaneously will fail.

2. After the **pre** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.5. To Perform the outage Step on Broker and Node Hosts:

1. The **outage** step stops services as required depending on the type of host.

   Warning

   The broker enters outage mode during this upgrade step. A substantial outage also begins for applications on the node hosts. Scaled applications are unable to contact any child gears during the outage. These outages last until the **end_maintenance_mode** step is complete.

Perform this step on all broker hosts first, and then on all node hosts. This begins the broker outage, and all communication between the broker host and the node hosts is stopped. Perform the **outage** step with the following command:

```
# ose-upgrade outage
```

After the command completes on all hosts, node and broker hosts can be upgraded simultaneously until the upgrade steps are complete on all node hosts, and the broker host reaches the **confirm_nodes** step.

2. For all other hosts that are not a broker or a node host, run **yum update** to upgrade any services that are installed, such as **MongoDB** or **ActiveMQ**:

```
# yum update
```

Procedure 4.6. To Perform the rpms Step on Broker and Node Hosts:

- The **rpms** step updates RPM packages installed on the node host, and installs any new RPM packages that are required.

  Run the **rpms** step on each host:

```
# ose-upgrade rpms
```

Procedure 4.7. To Perform the conf Step on Broker and Node Hosts:

- The **conf** step changes the OpenShift Enterprise configuration to match the new codebase installed in the previous step. Each modified file is first copied to a file with the same name plus a **.ugsave** extension and a timestamp. This makes it easier to determine what files have changed.

  Run the **conf** step on each host:

```
# ose-upgrade conf
```

Warning

If the configuration files have been significantly modified from the recommended configuration, manual intervention may be required to merge configuration changes so that they can be used with OpenShift Enterprise.

Procedure 4.8. To Perform the maintenance_mode Step on Broker and Node Hosts:

- The **maintenance_mode** step manages the following actions:
  - Configures the broker to disable the API and return an outage notification to any requests. (Broker hosts only)
  - Starts the broker service and, if installed, the console service in maintenance mode so that they provide clients with an outage notification. (Broker hosts only)
  - Clears the broker and console caches. (Broker hosts only)
  - Enables gear upgrade extensions. (Node hosts only)

- Starts the **ruby193-mcollective** service. (Node hosts only)

Run the **maintenance_mode** step on each host:

```
# ose-upgrade maintenance_mode
```

Procedure 4.9. To Perform the pending_ops Step on a Broker Host:

1. The **pending_ops** step clears records of any pending application operations; the outage prevents them from ever completing. Run the **pending_ops** step on one broker host. Do not run this command on multiple broker hosts at the same time. When one broker host begins this step, any attempts made by other broker hosts to run the **pending_ops** step simultaneously will fail:

   ```
   # ose-upgrade pending_ops
   ```

2. After the **pending_ops** step completes on the first broker host, run the command on any remaining broker hosts.

Procedure 4.10. To Perform the confirm_nodes Step on Broker Hosts:

1. The **confirm_nodes** step attempts to access all known node hosts to determine whether they have all been upgraded before proceeding. This step fails if the **maintenance_mode** step has not been completed on all node hosts, or if **MCollective** cannot access any node hosts.

   Run the **confirm_nodes** step on a broker host:

   ```
   # ose-upgrade confirm_nodes
   ```

2. If this step fails due to node hosts that are no longer deployed, you may need to skip the **confirm_nodes** step. Ensure that all node hosts reported missing are not actually expected to respond, then skip the **confirm_nodes** step with the following command:

   ```
   # ose-upgrade --skip confirm_nodes
   ```

Procedure 4.11. To Perform the data Step on Broker Hosts:

1. The **data** step runs a data migration against the shared broker datastore. Run the **data** step on one broker host:

   ```
   # ose-upgrade data
   ```

   When one broker host begins this step, any attempts made by other broker hosts to run the **data** step simultaneously will fail.

2. After the **data** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.12. To Perform the gears Step on Broker Hosts:

1. The **gears** step runs a gear migration through the required changes so that they can be used in OpenShift Enterprise 2.0. Run the **gears** step on one broker host:

   ```
   # ose-upgrade gears
   ```

When one broker host begins this step, any attempts made by other broker hosts to run the **gears** step simultaneously will fail.

2. After the **gears** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.13. To Perform the test_gears_complete Step on Node Hosts:

- The **test_gears_complete** step verifies the gear migrations are complete before proceeding. This step blocks the upgrade on node hosts by waiting until the **gears** step has completed on an associated broker host. Run the **test_gears_complete** step on all node hosts:

```
# ose-upgrade test_gears_complete
```

Procedure 4.14. To Perform the end_maintenance_mode Step on Broker and Node Hosts:

1. The **end_maintenance_mode** step starts the services that were stopped in the **maintenance_mode** step or added in the interim. It gracefully restarts **httpd** to complete the node host upgrade, and restarts the broker service and, if installed, the console service. Complete this step on all node hosts first before running it on the broker hosts:

```
# ose-upgrade end_maintenance_mode
```

2. Run the **oo-accept-node** script on each node host to verify that it is correctly configured:

```
# oo-accept-node
```

Procedure 4.15. To Perform the post Step on Broker Hosts:

1. The **post** step manages the following actions on the broker host:

   - Performs any post-upgrade datastore migration steps.
   - Publishes updated district UIDs to the node hosts.
   - Clears the broker and console caches.

   Run the **post** step on a broker host:

```
# ose-upgrade post
```

   When one broker host begins this step, any attempts made by other broker hosts to run the **post** step simultaneously will fail.

2. After the **post** step completes on the first broker host, run it on any remaining broker hosts.
3. The upgrade is now complete for an OpenShift Enterprise installation. Run **oo-diagnostics** on each host to diagnose any problems:

```
# oo-diagnostics
```

Known Upgrade Issues

Although the goal is to make the upgrade process as easy as possible, some known issues must be addressed manually:

1. Because Jenkins applications cannot be migrated, follow these steps to regain functionality:
    a. Save any modifications made to existing Jenkins jobs.
    b. Remove the existing Jenkins application.
    c. Add the Jenkins application again.
    d. Add the Jenkins client cartridge as required.
    e. Reapply the required modifications from the first step.
2. There are no notifications when a gear is successfully migrated but fails to start. This may not be a migration failure because there may be multiple reasons why a gear fails to start. However, Red Hat recommends that you verify the operation of your applications after upgrading. The **`service openshift-gears status`** command may be helpful in certain situations.

4.4. Upgrading from OpenShift Enterprise 2.0 to OpenShift Enterprise 2.1

The following instructions describe how to upgrade from OpenShift Enterprise 2.0 to OpenShift Enterprise 2.1. The 2.1 upgrade packages are located in distinct channel repositories on Red Hat Network. The first upgrade step, the **`begin`** step, adjusts the **`yum`** configurations in preparation for the upgrade. Red Hat recommends that you perform this step in advance of the scheduled outage to ensure any subscription issues are resolved before you proceed with the upgrade.

Procedure 4.16. To Bootstrap the Upgrade and Perform the `begin` Step:

1. The *openshift-enterprise-release* RPM package includes the **`ose-upgrade`** tool that guides you through the upgrade process. Install the *openshift-enterprise-release* package on each host, and update it to the most current version.

```
# yum install openshift-enterprise-release
```

2. The **`begin`** step of the upgrade process applies to all hosts, and includes those hosts that contain only supporting services such as **MongoDB** and **ActiveMQ**. Hosts using Red Hat Subscription Management (RHSM) or Red Hat Network (RHN) Classic are unsubscribed from the 2.0 channels and subscribed to the new 2.1 channels.

Warning

This step assumes that the channel names come directly from Red Hat Network. If the package source is an instance of Red Hat Satellite or Subscription Asset Manager and the channel names are remapped differently, you must change this yourself. Examine the scripts in the **`/usr/lib/ruby/site_ruby/1.8/ose-upgrade/host/upgrades/3/`** directory for use as models. You can also add your custom script to a subdirectory to be executed with the **`ose-upgrade`** tool.

In addition to updating the channel set, modifications to the **`yum`** configuration give priority to the OpenShift Enterprise, Red Hat Enterprise Linux, and JBoss repositories. However, packages from other sources are excluded as required to prevent certain issues with dependency management that occur between the various channels.

Run the **`begin`** step on each host. Note that the command output is different depending on the type of host. The following example output is from a broker host:

```
# ose-upgrade begin

INFO: OpenShift broker installed.
INFO: Setting host step 'begin' status to UPGRADING
INFO: Starting upgrade number 3 to version 2.1.
[...]
INFO: updating /etc/openshift-enterprise-release
INFO: Setting host step 'begin' status to COMPLETE
INFO: To continue the upgrade, install a specific upgrade package.
```

Important

The **oo-admin-yum-validator --oo-version 2.1 --fix-all** command is run automatically during the **begin** step. When using RHN Classic, the command does not automatically subscribe a system to the OpenShift Enterprise 2.1 channels, but instead reports the manual steps required. After the channels are manually subscribed, running the **begin** step again sets the proper **yum** priorities and continues as expected.

Procedure 4.17. To Install the Upgrade RPM Specific to a Host:

1. Depending on the host type, install the latest upgrade RPM package from the new OpenShift Enterprise 2.1 channels. For broker hosts, install the *openshift-enterprise-upgrade-broker* package:

   ```
   # yum install openshift-enterprise-upgrade-broker
   ```

   For node hosts, install the *openshift-enterprise-upgrade-node* package:

   ```
   # yum install openshift-enterprise-upgrade-node
   ```

   If the package is already installed because of a previous upgrade, it still must be updated to the latest package version for the OpenShift Enterprise 2.1 upgrade.

2. The **ose-upgrade** tool guides the upgrade process by listing the necessary steps that are specific to the upgrade scenario, and identifies the step to be performed next. The **ose-upgrade status** command, or **ose-upgrade**, provides a current status report. The command output varies depending on the type of host. The following example output is from a broker host:

   ```
   # ose-upgrade status

   INFO: OpenShift broker installed.
   Current upgrade is number 3 to version 2.1.
   Step sequence:
     begin pre outage rpms conf maintenance_mode pending_ops
   confirm_nodes data gears end_maintenance_mode post
   Next step is: pre
   ```

Procedure 4.18. To Perform the pre Step on Broker and Node Hosts:

1. The **pre** step manages the following actions:

   - Backs up OpenShift Enterprise configuration files.

- Clears pending operations older than one hour. (Broker hosts only)
- Performs any pre-upgrade datastore migration steps. (Broker hosts only)

Run the **pre** step on one broker host and each node host:

```
# ose-upgrade pre
```

When one broker host begins this step, any attempts made by other broker hosts to run the **pre** step simultaneously will fail.

2. After the **pre** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.19. To Perform the outage Step on Broker and Node Hosts:

1. The **outage** step stops services as required depending on the type of host.

Warning

The broker enters outage mode during this upgrade step. A substantial outage also begins for applications on the node hosts. Scaled applications are unable to contact any child gears during the outage. These outages last until the **end_maintenance_mode** step is complete.

Perform this step on all broker hosts first, and then on all node hosts. This begins the broker outage, and all communication between the broker host and the node hosts is stopped. Perform the **outage** step with the following command:

```
# ose-upgrade outage
```

After the command completes on all hosts, node and broker hosts can be upgraded simultaneously until the upgrade steps are complete on all node hosts, and the broker host reaches the **confirm_nodes** step.

2. For all other hosts that are not a broker or a node host, run **yum update** to upgrade any services that are installed, such as **MongoDB** or **ActiveMQ**:

```
# yum update
```

Procedure 4.20. To Perform the rpms Step on Broker and Node Hosts:

- The **rpms** step updates RPM packages installed on the host, and installs any new RPM packages that are required. For node hosts, this includes the recommended cartridge dependency metapackages for any cartridge already installed on a node. See Section 9.8.3, “Installing Cartridge Dependency Metapackages” for more information about cartridge dependency metapackages.

  Run the **rpms** step on each host:

```
# ose-upgrade rpms
```

Procedure 4.21. To Perform the conf Step on Broker and Node Hosts:

- The **conf** step changes the OpenShift Enterprise configuration to match the new codebase installed in the previous step. Each modified file is first copied to a file with the same name plus a **.ugsave** extension and a timestamp. This makes it easier to determine what files have changed.

  Run the **conf** step on each host:

```
# ose-upgrade conf
```

Warning

If the configuration files have been significantly modified from the recommended configuration, manual intervention may be required to merge configuration changes so that they can be used with OpenShift Enterprise.

Procedure 4.22. To Perform the maintenance_mode Step on Broker and Node Hosts:

- The **maintenance_mode** step manages the following actions:
  - Configures the broker to disable the API and return an outage notification to any requests. (Broker hosts only)
  - Starts the broker service and, if installed, the console service in maintenance mode so that they provide clients with an outage notification. (Broker hosts only)
  - Clears the broker and console caches. (Broker hosts only)
  - Enables gear upgrade extensions. (Node hosts only)
  - Saves and regenerates configurations for any **apache-vhost** front ends. (Node hosts only)
  - Stops the **openshift-iptables-port-proxy** service. (Node hosts only)
  - Starts the **ruby193-mcollective** service. (Node hosts only)

  Run the **maintenance_mode** step on each host:

```
# ose-upgrade maintenance_mode
```

Procedure 4.23. To Perform the pending_ops Step on Broker Hosts:

1. The **pending_ops** step clears records of any pending application operations because the outage prevents them from ever completing. Run the **pending_ops** step on one broker host only:

```
# ose-upgrade pending_ops
```

2. On any remaining broker hosts, run the following command to skip the **pending_ops** step:

```
# ose-upgrade pending_ops --skip
```

Procedure 4.24. To Perform the confirm_nodes Step on Broker Hosts:

1. The **confirm_nodes** step attempts to access all known node hosts to determine whether they have all been upgraded before proceeding. This step fails if the **maintenance_mode** step has not been

completed on all node hosts, or if **MCollective** cannot access any node hosts.

Run the **confirm_nodes** step on a broker host:

```
# ose-upgrade confirm_nodes
```

2. If this step fails due to node hosts that are no longer deployed, you may need to skip the **confirm_nodes** step. Ensure that all node hosts reported missing are not actually expected to respond, then skip the **confirm_nodes** step with the following command:

```
# ose-upgrade --skip confirm_nodes
```

Procedure 4.25. To Perform the data Step on Broker Hosts:

1. The **data** step runs a data migration against the shared broker datastore. Run the **data** step on one broker host:

```
# ose-upgrade data
```

When one broker host begins this step, any attempts made by other broker hosts to run the **data** step simultaneously will fail.

2. After the **data** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.26. To Perform the gears Step on Broker Hosts:

1. The **gears** step runs a gear migration through the required changes so that they can be used in OpenShift Enterprise 2.1. Run the **gears** step on one broker host:

```
# ose-upgrade gears
```

When one broker host begins this step, any attempts made by other broker hosts to run the **gears** step simultaneously will fail.

2. After the **gears** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.27. To Perform the test_gears_complete Step on Node Hosts:

- The **test_gears_complete** step verifies the gear migrations are complete before proceeding. This step blocks the upgrade on node hosts by waiting until the **gears** step has completed on an associated broker host. Run the **test_gears_complete** step on all node hosts:

```
# ose-upgrade test_gears_complete
```

Procedure 4.28. To Perform the end_maintenance_mode Step on Broker and Node Hosts:

1. The **end_maintenance_mode** step starts the services that were stopped in the **maintenance_mode** step or added in the interim. It gracefully restarts **httpd** to complete the node host upgrade, and restarts the broker service and, if installed, the console service. Complete this step on all node hosts first before running it on the broker hosts:

```
# ose-upgrade end_maintenance_mode
```

2. Run the **oo-accept-node** script on each node host to verify that it is correctly configured:

```
# oo-accept-node
```

Procedure 4.29. To Perform the post Step on Broker Hosts:

1. The **post** step manages the following actions on the broker host:

   - Imports cartridges to the datastore.
   - Performs any post-upgrade datastore migration steps.
   - Clears the broker and console caches.

   Run the **post** step on a broker host:

```
# ose-upgrade post
```

   When one broker host begins this step, any attempts made by other broker hosts to run the **post** step simultaneously will fail.

2. After the **post** step completes on the first broker host, run it on any remaining broker hosts.

3. The upgrade is now complete for an OpenShift Enterprise installation. Run **oo-diagnostics** on each host to diagnose any problems:

```
# oo-diagnostics
```

Known Upgrade Issues

Although the goal is to make the upgrade process as easy as possible, some known issues must be addressed manually:

1. Because Jenkins applications cannot be migrated, follow these steps to regain functionality:

   a. Save any modifications made to existing Jenkins jobs.

   b. Remove the existing Jenkins application.

   c. Add the Jenkins application again.

   d. Add the Jenkins client cartridge as required.

   e. Reapply the required modifications from the first step.

2. There are no notifications when a gear is successfully migrated but fails to start. This may not be a migration failure because there may be multiple reasons why a gear fails to start. However, Red Hat recommends that you verify the operation of your applications after upgrading. The **service openshift-gears status** command may be helpful in certain situations.

4.5. Upgrading from OpenShift Enterprise 2.1 to OpenShift Enterprise 2.2

The following instructions describe how to upgrade from OpenShift Enterprise 2.1 to OpenShift Enterprise 2.2. The 2.2 upgrade packages are located in distinct channel repositories on Red Hat Network. The first upgrade step, the **begin** step, adjusts the **yum** configurations in preparation for the upgrade. Red Hat recommends that you perform this step in advance of the scheduled outage to ensure any subscription

issues are resolved before you proceed with the upgrade.

Procedure 4.30. To Bootstrap the Upgrade and Perform the `begin` Step:

1. The *openshift-enterprise-release* RPM package includes the **`ose-upgrade`** tool that guides you through the upgrade process. Install the *openshift-enterprise-release* package on each host, and update it to the most current version.

```
# yum install openshift-enterprise-release
```

2. The **`begin`** step of the upgrade process applies to all hosts, and includes those hosts that contain only supporting services such as **MongoDB** and **ActiveMQ**. Hosts using Red Hat Subscription Management (RHSM) or Red Hat Network (RHN) Classic are unsubscribed from the 2.1 channels and subscribed to the new 2.2 channels.

Warning

This step assumes that the channel names come directly from Red Hat Network. If the package source is an instance of Red Hat Satellite or Subscription Asset Manager and the channel names are remapped differently, you must change this yourself. Examine the scripts in the **`/usr/lib/ruby/site_ruby/1.8/ose-upgrade/host/upgrades/4/`** directory for use as models. You can also add your custom script to a subdirectory to be executed with the **`ose-upgrade`** tool.

In addition to updating the channel set, modifications to the **`yum`** configuration give priority to the OpenShift Enterprise, Red Hat Enterprise Linux, and JBoss repositories. However, packages from other sources are excluded as required to prevent certain issues with dependency management that occur between the various channels.

Run the **`begin`** step on each host. Note that the command output is different depending on the type of host. The following example output is from a broker host:

```
# ose-upgrade begin

INFO: OpenShift broker installed.
INFO: Setting host step 'begin' status to UPGRADING
INFO: Starting upgrade number 4 to version 2.2.
[...]
INFO: updating /etc/openshift-enterprise-release
INFO: Setting host step 'begin' status to COMPLETE
INFO: To continue the upgrade, install a specific upgrade package.
```

Important

The **`oo-admin-yum-validator --oo-version 2.2 --fix-all`** command is run automatically during the **`begin`** step. When using RHN Classic, the command does not automatically subscribe a system to the OpenShift Enterprise 2.2 channels, but instead reports the manual steps required. After the channels are manually subscribed, running the **`begin`** step again sets the proper **`yum`** priorities and continues as expected.

Procedure 4.31. To Install the Upgrade RPM Specific to a Host:

1. Depending on the host type, install the latest upgrade RPM package from the new OpenShift Enterprise 2.2 channels. For broker hosts, install the *openshift-enterprise-upgrade-broker* package:

   ```
   # yum install openshift-enterprise-upgrade-broker
   ```

   For node hosts, install the *openshift-enterprise-upgrade-node* package:

   ```
   # yum install openshift-enterprise-upgrade-node
   ```

   If the package is already installed because of a previous upgrade, it still must be updated to the latest package version for the OpenShift Enterprise 2.2 upgrade.

2. The **ose-upgrade** tool guides the upgrade process by listing the necessary steps that are specific to the upgrade scenario, and identifies the step to be performed next. The **ose-upgrade status** command, or **ose-upgrade**, provides a current status report. The command output varies depending on the type of host. The following example output is from a broker host:

   ```
   # ose-upgrade status

   INFO: OpenShift broker installed.
   Current upgrade is number 4 to version 2.2.
   Step sequence:
     begin pre outage rpms conf maintenance_mode pending_ops
   confirm_nodes data gears end_maintenance_mode post
   Next step is: pre
   ```

Procedure 4.32. To Perform the pre Step on Broker and Node Hosts:

1. The **pre** step manages the following actions:

   - Backs up OpenShift Enterprise configuration files.
   - Clears pending operations older than one hour. (Broker hosts only)
   - Performs any pre-upgrade datastore migration steps. (Broker hosts only)

   Run the **pre** step on one broker host and each node host:

   ```
   # ose-upgrade pre
   ```

   When one broker host begins this step, any attempts made by other broker hosts to run the **pre** step simultaneously will fail.

2. After the **pre** step completes on the first broker host, run it on any remaining broker hosts.

3. After the **pre** step completes on all hosts, the **ose-upgrade** tool allows you to continue through the node and broker host upgrade steps in parallel. On broker hosts, the tool will block the **confirm_nodes** step if the associated node hosts have not completed their **maintenance_mode** step. On node hosts, the tool blocks the **test_gears_complete** step if the associated broker has not completed the **gears** step.

   Continue through the following procedures for instructions on each subsequent step.

Procedure 4.33. To Perform the `rpms` Step on Broker and Node Hosts:

1. The **`rpms`** step updates RPM packages installed on the host and installs any new RPM packages that are required. For node hosts, this includes the recommended cartridge dependency metapackages for any cartridge already installed on a node. See Section 9.8.3, “Installing Cartridge Dependency Metapackages” for more information about cartridge dependency metapackages.

   Run the **`rpms`** step on each host:

   ```
   # ose-upgrade rpms
   ```

2. For all other hosts that are not a broker or a node host, run **`yum update`** to upgrade any services that are installed, such as **MongoDB** or **ActiveMQ**:

   ```
   # yum update
   ```

Procedure 4.34. To Perform the `conf` Step on Broker and Node Hosts:

- The **`conf`** step changes the OpenShift Enterprise configuration to match the new codebase installed in the previous step. Each modified file is first copied to a file with the same name plus a **`.ugsave`** extension and a timestamp. This makes it easier to determine what files have changed.

  This step also disables the SSLv3 protocol on each broker host in favor of TLS due to CVE-2014-3566.

  Run the **`conf`** step on each host:

  ```
  # ose-upgrade conf
  ```

  Warning

  If the configuration files have been significantly modified from the recommended configuration, manual intervention may be required to merge configuration changes so that they can be used with OpenShift Enterprise.

Procedure 4.35. To Perform the `maintenance_mode` Step on Broker and Node Hosts:

Warning

The broker enters maintenance mode during this upgrade step, which disables the API and returns an outage notification to all client requests. This outage lasts until the **`end_maintenance_mode`** step is complete.

1. Starting with OpenShift Enterprise 2.2, the **`apache-mod-rewrite`** front-end server proxy plug-in is deprecated. New deployments of OpenShift Enterprise 2.2 now use the **`apache-vhost`** plug-in as the default.

Important

Any new nodes added to your deployment after the upgrade will use the **apache-vhost** plug-in by default. Note that the **apache-mod-rewrite** plug-in is incompatible with the **apache-vhost** plug-in, and the front-end server configuration on all nodes across a deployment must be consistent. See Section 10.1, “Front-End Server Proxies” for more information.

The default behavior of the **maintenance_mode** step is to leave the **apache-mod-rewrite** plug-in in place, if it is installed. Do not set the **OSE_UPGRADE_MIGRATE_VHOST** environment variable at all, not even to **false** or **0**, if you require this default behavior.

However, if your OpenShift Enterprise 2.1 deployment was configured to use the **apache-mod-rewrite** plug-in before starting the 2.2 upgrade, you can optionally allow the **ose-upgrade** tool to migrate your node hosts to the newly-default **apache-vhost** plug-in. To enable this option, set the **OSE_UPGRADE_MIGRATE_VHOST** environment variable on each node host:

```
# export OSE_UPGRADE_MIGRATE_VHOST=true
```

2. The **maintenance_mode** step manages actions in the following order:

   - Configures the broker to disable the API and return an outage notification to any requests. (Broker hosts only)
   - Restarts the broker service and, if installed, the console service in maintenance mode so that they provide clients with an outage notification. (Broker hosts only)
   - Clears the broker and console caches. (Broker hosts only)
   - Stops the **ruby193-mcollective** service. (Node hosts only)
   - Saves the front-end server proxy configuration. (Node hosts only)
   - If the **OSE_UPGRADE_MIGRATE_VHOST** environment variable was set in the previous step, migrates from the **apache-mod-rewrite** plug-in to the **apache-vhost** plug-in. (Node hosts only)
   - Disables the SSLv3 protocol in favor of TLS due to CVE-2014-3566. (Node hosts only)
   - Enables gear upgrade extensions. (Node hosts only)
   - Starts the **ruby193-mcollective** service. (Node hosts only)

   Run the **maintenance_mode** step on each host:

```
# ose-upgrade maintenance_mode
```

Procedure 4.36. To Perform the pending_ops Step on Broker Hosts:

1. The **pending_ops** step clears records of any pending application operations because the outage prevents them from ever completing. Run the **pending_ops** step on one broker host:

```
# ose-upgrade pending_ops
```

When one broker host begins this step, any attempts made by other broker hosts to run the **pending_ops** step simultaneously will fail.

2. After the **pending_ops** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.37. To Perform the confirm_nodes Step on Broker Hosts:

1. The **confirm_nodes** step attempts to access all known node hosts to determine whether they have all been upgraded before proceeding. This step fails if the **maintenance_mode** step has not been completed on all node hosts, or if **MCollective** cannot access any node hosts.

   Run the **confirm_nodes** step on a broker host:

   ```
   # ose-upgrade confirm_nodes
   ```

2. If this step fails due to node hosts that are no longer deployed, you may need to skip the **confirm_nodes** step. Ensure that all node hosts reported missing are not actually expected to respond, then skip the **confirm_nodes** step with the following command:

   ```
   # ose-upgrade --skip confirm_nodes
   ```

Procedure 4.38. To Perform the data Step on Broker Hosts:

1. The **data** step runs a data migration against the shared broker datastore. Run the **data** step on one broker host:

   ```
   # ose-upgrade data
   ```

   When one broker host begins this step, any attempts made by other broker hosts to run the **data** step simultaneously will fail.

2. After the **data** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.39. To Perform the gears Step on Broker Hosts:

1. The **gears** step runs a gear migration through the required changes so that they can be used in OpenShift Enterprise 2.2. Run the **gears** step on one broker host:

   ```
   # ose-upgrade gears
   ```

   When one broker host begins this step, any attempts made by other broker hosts to run the **gears** step simultaneously will fail.

2. After the **gears** step completes on the first broker host, run it on any remaining broker hosts.

Procedure 4.40. To Perform the test_gears_complete Step on Node Hosts:

- The **test_gears_complete** step verifies the gear migrations are complete before proceeding. This step blocks the upgrade on node hosts by waiting until the **gears** step has completed on an associated broker host. Run the **test_gears_complete** step on all node hosts:

  ```
  # ose-upgrade test_gears_complete
  ```

Procedure 4.41. To Perform the end_maintenance_mode Step on Broker and Node Hosts:

Procedure 4.41. To Perform the `end_maintenance_mode` Step on Broker and Node Hosts:

1. The **`end_maintenance_mode`** step restarts the following services on the node hosts:

   - **`httpd`** (Restarts gracefully)
   - **`ruby193-mcollective`**
   - **`openshift-iptables-port-proxy`**
   - **`openshift-node-web-proxy`**
   - **`openshift-sni-proxy`**
   - **`openshift-watchman`**

   Complete this step on all node hosts first before running it on the broker hosts:

   ```
   # ose-upgrade end_maintenance_mode
   ```

2. After the **`end_maintenance_mode`** command has completed on all node hosts, run the same command on the broker hosts to disable the outage notification enabled during the broker **`maintenance_mode`** step and restart the broker service and, if installed, the console service:

   ```
   # ose-upgrade end_maintenance_mode
   ```

   This allows the broker to respond to client requests normally again.

3. Run the **`oo-accept-node`** script on each node host to verify that it is correctly configured:

   ```
   # oo-accept-node
   ```

Procedure 4.42. To Perform the `post` Step on Broker Hosts:

1. The **`post`** step manages the following actions on the broker host:

   - Imports cartridges to the datastore.
   - Performs any post-upgrade datastore migration steps.
   - Clears the broker and console caches.

   Run the **`post`** step on a broker host:

   ```
   # ose-upgrade post
   ```

   When one broker host begins this step, any attempts made by other broker hosts to run the **`post`** step simultaneously will fail.

2. After the **`post`** step completes on the first broker host, run it on any remaining broker hosts.

3. The upgrade is now complete for an OpenShift Enterprise installation. Run **`oo-diagnostics`** on each host to diagnose any problems:

   ```
   # oo-diagnostics
   ```

Known Upgrade Issues

Known Upgrade Issues

Although the goal is to make the upgrade process as easy as possible, some known issues must be addressed manually:

1. Because Jenkins applications cannot be migrated, follow these steps to regain functionality:
    a. Save any modifications made to existing Jenkins jobs.
    b. Remove the existing Jenkins application.
    c. Add the Jenkins application again.
    d. Add the Jenkins client cartridge as required.
    e. Reapply the required modifications from the first step.
2. There are no notifications when a gear is successfully migrated but fails to start. This may not be a migration failure because there may be multiple reasons why a gear fails to start. However, Red Hat recommends that you verify the operation of your applications after upgrading. The **`service openshift-gears status`** command may be helpful in certain situations.

Chapter 5. Host Preparation

Before installing any broker or node components, you must prepare each host for various requirements of OpenShift Enterprise.

5.1. Default umask Setting

OpenShift Enterprise requires that the default **umask** value (**022**) for Red Hat Enterprise Linux 6 be set on all hosts prior to installing any OpenShift Enterprise packages. If a custom **umask** setting is used, it is possible for incorrect permissions to be set during installation for many files critical to OpenShift Enterprise operation.

5.2. Network Access

The components of an OpenShift Enterprise deployment require network access to connect with one another. The deployment methods described in this guide set up a basic **iptables** firewall configuration by default to enable network access. If your environment requires a custom or external firewall solution, the configuration must accommodate the port requirements of OpenShift Enterprise.

5.2.1. Custom and External Firewalls

If you use a custom firewall configuration, consult the following table for details on the ports to which OpenShift Enterprise components require access. The table includes all ports with external interfaces or connections between hosts. It does not include the loopback interface. Some ports are optional depending on your OpenShift Enterprise configuration and usage.

Application developers and application users require access to ports marked **public** in the **Direction** column. Ensure the firewall exposes these ports publicly.

Further details on configuring an external firewall solution for use with OpenShift Enterprise are beyond the scope of this guide. Consult your network administrator for more information.

Table 5.1. Required Ports for OpenShift Enterprise

Host	Port	Protocol	Direction	Use
All	22	TCP	Inbound internal network	Remote administration.
All	53	TCP/UDP	Outbound to nameserver	Name resolution.
Broker	22	TCP	Outbound to node hosts	**rsync** access to gears for moving gears between nodes.
Broker	80	TCP	Inbound public traffic	HTTP access. HTTP requests to port 80 are redirected to HTTPS on port 443.
Broker	443	TCP	Inbound public traffic	HTTPS access to the broker REST API by **rhc** and Eclipse integration. HTTPS access to the Management Console.
Broker	27017	TCP	Outbound to datastore host.	Optional if the same host has both the broker and datastore components.
Broker	61613	TCP	Outbound to ActiveMQ hosts	ActiveMQ connections to communicate with node hosts.

Host	Port	Protocol	Direction	Use
Node	22	TCP	Inbound public traffic	Developers running **`git push`** to their gears. Developer remote administration on their gears.
Node	80	TCP	Inbound public traffic	HTTP requests to applications hosted on OpenShift Enterprise.
Node	443	TCP	Inbound public traffic	HTTPS requests to applications hosted on OpenShift Enterprise.
Node	8000	TCP	Inbound public traffic	WebSocket connections to applications hosted on OpenShift Enterprise. Optional if you are not using WebSockets.
Node	8443	TCP	Inbound public traffic	Secure WebSocket connections to applications hosted on OpenShift Enterprise. Optional if you are not using secure WebSockets.
Node	2303 - 2308 [a]	TCP	Inbound public traffic	Gear access through the SNI proxy. Optional if you are not using the SNI proxy.
Node	443	TCP	Outbound to broker hosts	REST API calls to broker hosts.
Node	35531 - 65535 [b]	TCP	Inbound public traffic	Gear access through the **`port-proxy`** service. Optional unless applications need to expose external ports in addition to the front-end proxies.
Node	35531 - 65535 [b]	TCP	Inbound/outbound with other node hosts	Communications between cartridges running on separate gears.
Node	61613	TCP	Outbound to ActiveMQ hosts	ActiveMQ connections to communicate with broker hosts.
ActiveMQ	61613	TCP	Inbound from broker and node hosts	Broker and node host connections to ActiveMQ.
ActiveMQ	61616	TCP	Inbound/outbound with other ActiveMQ brokers	Communications between ActiveMQ hosts. Optional if no redundant ActiveMQ hosts exist.
Datastore	27017	TCP	Inbound from broker hosts	Broker host connections to MongoDB. Optional if the same host has both the broker and datastore components.
Datastore	27017	TCP	Inbound/outbound with other MongoDB hosts	Replication between datastore hosts. Optional if no redundant datastore hosts exist.
Nameserver	53	TCP/UDP	Inbound from broker hosts	Publishing DNS updates.
Nameserver	53	TCP/UDP	Inbound public traffic	Name resolution for applications hosted on OpenShift Enterprise.
Nameserver	53	TCP/UDP	Outbound public traffic	DNS forwarding. Optional unless the nameserver is recursively forwarding requests to other nameservers.

[a] Note: The size and location of these SNI port range are configurable.

[b] Note: If the value of **`PROXY_BEGIN`** in the **`/etc/openshift/node.conf`** file changes from **`35531`**, adjust this port range accordingly.

5.2.2. Manually Configuring an iptables Firewall

The deployment methods described in this guide set up a basic firewall configuration by default. If your OpenShift Enterprise deployment requires additional open ports, you can use **iptables** commands to allow access on each host as needed:

Procedure 5.1. To Configure an iptables Firewall:

1. Use the following command to make any changes to an **iptables** configuration:

```
# iptables --insert Rule --in-interface Network_Interface --protocol
Protocol --source IP_Address --dport Destination_Port --jump ACCEPT
```

Example 5.1. Allowing Broker Access to MongoDB

The following is an example set of commands for allowing a set of brokers with IP addresses 10.0.0.1-3 access to the MongoDB datastore:

```
iptables --insert INPUT -i eth0 -p tcp --source 10.0.0.1 --dport
27017 --jump ACCEPT
iptables --insert INPUT -i eth0 -p tcp --source 10.0.0.2 --dport
27017 --jump ACCEPT
iptables --insert INPUT -i eth0 -p tcp --source 10.0.0.3 --dport
27017 --jump ACCEPT
```

Example 5.2. Allowing Public Access to the Nameserver

The following example allows inbound public DNS requests to the nameserver:

```
iptables --insert INPUT --protocol tcp --dport 53 -j ACCEPT
iptables --insert INPUT --protocol udp --dport 53 -j ACCEPT
```

Note that because the command is for public access, there is no **--source** option.

2. Save any firewall changes to make them persistent:

```
# service iptables save
```

5.2.3. IPv6 Tolerance

OpenShift Enterprise supports a mixed IPv4 and IPv6 topology. In such a deployment, node, broker, MongoDB, and ActiveMQ hosts must have IPv6 addresses and associated AAAA resource records, and all hosts must still have IPv4 addresses and associated A resource records.

In a mixed IPv4 and IPv6 deployment, the following OpenShift Enterprise services allow communications over IPv6:

- OpenShift Enterprise client tools (**rhc**)
- OpenShift Enterprise Management Console
- ActiveMQ and MCollective
- Application access

In a mixed IPv4 and IPv6 deployment, the following OpenShift Enterprise services have components that either require or may require communications over IPv4:

- MongoDB can be configured to listen on IPv6 so that some client tools can connect over IPv6 if the **mongo** client is running version 1.10.0 or newer. However, the broker uses **mongoid** which currently requires IPv4.
- Broker DNS updates may require IPv4, however IPv6 connectivity can be used when using the nsupdate DNS plug-in.

Caveats and Known Issues for IPv6 Tolerance

- Inter-gear communication relies on IPv6 to IPv4 fallback. If for some reason the application or library initiating the connection does not properly handle the fallback, then the connection fails.
- The OpenShift Enterprise installation script and Puppet module do not configure MongoDB to use IPv6 and configures IPv4 addresses for other settings where required, for example in the nsupdate DNS plug-in configuration.
- OpenShift Enterprise internals explicitly query interfaces for IPv4 addresses in multiple places.
- The **apache-mod-rewrite** and **nodejs-websocket** front-end server plug-ins have been tested, however the following components have not:
  - The **apache-vhost** and **haproxy-sni-proxy** front-end server plug-ins.
  - DNS plug-ins other than nsupdate.
  - Routing plug-in.
  - Rsyslog plug-in.
  - Individual cartridges for full IPv6 tolerance.
- Known Issue: BZ#1104337
- Known Issue: BZ#1107816

5.3. Configuring Time Synchronization

OpenShift Enterprise requires NTP to synchronize the system and hardware clocks. This synchronization is necessary for communication between the broker and node hosts; if the clocks are not synchronized correctly, messages are dropped by MCollective. It is also helpful to have accurate time stamps on files and in log file entries.

On each host, use the **ntpdate** command to set the system clock, replacing the NTP servers to suit your environment:

```
# ntpdate clock.redhat.com
```

You must also configure the **/etc/ntp.conf** file to keep the clock synchronized during operation.

If the error message **"the NTP socket is in use, exiting"** is displayed after running the **ntpdate** command, it means that the **ntpd** daemon is already running. However, the clock may not be synchronized due to a substantial time difference. In this case, run the following commands to stop the **ntpd** service, set the clock, and start the service again:

```
# service ntpd stop
# ntpdate clock.redhat.com
# service ntpd start
```

If you are installing OpenShift Enterprise on physical hardware, use the **hwclock** command to synchronize the hardware clock to the system clock. Skip this step if you are installing on a virtual machine, such as an Amazon EC2 instance. For a physical hardware installation, run the following command:

```
# hwclock --systohc
```

Note

If you use the kickstart or bash script, the **synchronize_clock** function performs these steps.

5.4. Enabling Remote Administration

Installing SSH keys for the root user enables you to access the hosts remotely from your personal workstation. Run the following commands to ensure that the root user's SSH configuration directory exists, and it has the correct permissions on the host:

```
# mkdir /root/.ssh
# chmod 700 /root/.ssh
```

On your workstation, you can either use the **ssh-keygen** command to generate a new key pair, or use an existing public key. In either case, edit the **/root/.ssh/authorized_keys** file on the host and append the public key, or use the **ssh-copy-id** command to do the same. For example, on your local workstation, run the following command, replacing the example IP address with the IP address of your broker host:

```
# ssh-copy-id root@10.0.0.1
```

Chapter 6. Deployment Methods

OpenShift Enterprise can be deployed using one of several methods:

- The **`oo-install`** installation utility interactively gathers information about a deployment before automating the installation of a OpenShift Enterprise host. This method is intended for trials of simple deployments.
- The installation scripts, available as either a kickstart or bash script, include configurable parameters that help automate the installation of a OpenShift Enterprise host. This method allows for increased customization of the installation process for use in production deployments.
- The sample deployment steps detailed later in this guide describe the various actions of the installation scripts. This method allows for a manual installation of a OpenShift Enterprise host.

Choose the deployment method that best suits your environment and requirements.

6.1. Using the Installation Utility

You can install OpenShift Enterprise using the **`oo-install`** installation utility, which is a front end to the basic installation scripts. The installation utility provides a UI for a single- or multi-host deployment either from your workstation, or from one of the hosts to be installed.

The installation utility is provided to make the trial installation experience easier by interactively gathering the data to run deployments. The features of this utility are planned to expand over time, but for production deployments, Red Hat recommends creating customized installation scripts to suit your environment.

A configuration file based on your selections is created as **`~/.openshift/oo-install-cfg.yml`**, which saves your responses to the installation utility so you can use them in future installations if your initial deployment is interrupted. After completing an initial deployment, only additional node hosts can be added to the deployment using the utility. To add broker, message server, or DB server components to an existing deployment, see Section 8.3, “Separating Broker Components by Host” or Section 8.4, “Configuring Redundancy” for more information.

See https://install.openshift.com for the latest information on this utility.

Prerequisites

Before running the installation utility, consider the following:

- Do you have *ruby-1.8.7* or later, *curl*, *tar*, and *gzip* installed on your system? If required, the installation utility offers suggestions to install RPM packages of utilities that are missing.
- Does **`yum repolist`** show the correct repository setup?
- Plan your host roles. Do you know which of your hosts will be the broker host and node hosts? If running the tool with the **`-a`** option, do you have hosts for MongoDB and ActivemQ?
- Do you have password-less SSH login access into the instances where you will be running the oo-install command? Do your hosts have password-less SSH as well?
- You can use an existing DNS server. During installation, the oo-install tool asks if you would like to install a DNS server on the same host as the broker host. Answering **no** results in a BIND server being set up for you. However, answering **`yes`** requires you to input the settings of your existing DNS server. This BIND instance provides lookup information for applications that are created by any application developers.

Using the Installation Utility

There are two methods for using the installation utility. Both are outlined in the following procedures:

Procedure 6.1. To Run the Installation Utility From the Internet:

1. You can run the installation utility directly from the Internet with the following command:

```
$ sh <(curl -s https://install.openshift.com/ose-2.2)
```

   Additional options can be used with the command. These options are outlined later in this section:

```
$ sh <(curl -s https://install.openshift.com/ose-2.2) -s rhsm -u
user@company.com
```

2. Follow the on-screen instructions to either deploy a new OpenShift Enterprise host, or add a node host to an existing deployment.

Procedure 6.2. To Download and Run the Installation Utility:

Alternatively, you can download and run the installation utility with the following procedure:

1. Download and unpack the installation utility:

```
$ curl -o oo-install-ose.tgz
https://install.openshift.com/portable/oo-install-ose.tgz
$ tar -zxf oo-install-ose.tgz
```

2. Execute the installation utility to interactively configure one or more hosts:

```
$ ./oo-install-ose
```

   The **oo-install-ose** utility automatically runs the installation utility in OpenShift Enterprise mode. Additional options can be used with the command. These options are outlined later in this section:

```
$ ./oo-install-ose -s rhsm -u user@company.com
```

3. Follow the on-screen instructions to either deploy a new OpenShift Enterprise host, or add a node host to an existing deployment.

Deployment Scenarios

The current iteration of the installation utility enables the initial deployment and configuration of OpenShift Enterprise according to the following scenarios:

- Broker, message server (ActiveMQ), and DB server (MongoDB) components on one host, and the node components on separate hosts.
- Broker, message server (ActiveMQ), DB server (MongoDB), and node components on separate hosts (using **-a** for advanced mode only).
- All components on one host.

Warning

While having all components on one host is an available option using the installation utility for the purposes of a trial installation, the OpenShift Enterprise security model assumes that broker and node components are installed on separate hosts. Running a broker and node on the same host is not supported.

Highly-available Deployments

Starting with OpenShift Enterprise 2.2, the installation utility can install a highly-available OpenShift Enterprise deployment by configuring your defined hosts for redundancy within the installation utility prompts. By default, and without the **-a** option, the installation utility scales and installs ActiveMQ and MongoDB services along with the defined broker hosts. If the **-a** option is used, you can define redundant services on separate hosts as well.

For applications running on your OpenShift Enterprise deployment to achieve high-availability, you must further configure your deployment with the use of an external routing layer after the installation is completed. See the *OpenShift Enterprise User Guide* [1] for more information on high-availability applications, and Section 8.6, “Using an External Routing Layer for High-Availability Applications” for instructions on implementing an external routing layer.

Configuring Your Deployment

When you run the installation utility for the first time, you are asked a number of questions related to the components of your planned OpenShift Enterprise deployment, such as the following:

- User names and either the host names or IP addresses for access to hosts.
- DNS configuration for hosts.
- Valid gear sizes for the deployment.
- Default gear capabilities for new users.
- Default gear size for new applications.
- User names and passwords for configured services, with an option to automatically generate passwords.
- Gear size for new node hosts (profile name only).
- District membership for new node hosts.
- Red Hat subscription type. Note that when using the installation utility you can add multiple pool IDs by separating each pool ID with a space. You can find the required pool IDs with the procedure outlined in Section 7.1.1, “Using Red Hat Subscription Management on Broker Hosts”.

Options for the Installation Utility

The installation utility can be used with the following options:

-a (--advanced-mode)

By default, the installation utility installs MongoDB and ActiveMQ on the system designated as the broker host. Use the **-a** option to install these services on a different host.

-c (--config-file) ***FILE_PATH***

Use the **-c** option with the desired filepath to specify a configuration file other than the default **~/.openshift/oo-install-cfg.yml** file. If the specified file does not exist, a file will be created with some basic settings.

-l (--list-workflows)

Before using the **-w** option, use the **-l** option to find the desired workflow ID.

-w (--workflow) ***WORKFLOW_ID***

If you already have an OpenShift Enterprise deployment configuration file, use the install utility with the **-w** option and the **enterprise_deploy** workflow ID to run the deployment without any user interaction. The configuration is assessed, then deployed if no problems are found. This is useful for restarting after a failed deployment or for running multiple similar deployments.

-s (--subscription-type) ***TYPE***

The **-s** option determines how the deployment will obtain the RPMs needed to install OpenShift Enterprise, and overrides any method specified in the configuration file. Use the option with one of the following types:

rhsm	Red Hat Subscription Manager is used to register and configure the OpenShift software channels according to user, password, and pool settings.
rhn	RHN Classic is used to register and configure the OpenShift software channels according to user, password, and optional activation key settings. RHN Classic is primarily intended for existing, legacy systems. Red Hat strongly recommends that you use Red Hat Subscription Manager for new installations, because RHN Classic is being deprecated.
yum	New **yum** repository entries are created in the **/etc/yum.repos.d/** directory according to several repository URL settings. This is not a standard subscription and it is assumed you have already created or have access to these repositories in the layout specified in the **openshift.sh** file.
none	The default setting. Use this option when the software subscriptions on your deployment hosts are already configured as desired and changes are not needed.

-u (--username) ***USERNAME***

Use the **-u** option to specify the user for the Red Hat Subscription Management or RHN Classic subscription methods from the command line instead of in the configuration file.

-p (--password) ***PASSWORD***

Similar to the **-u** option, use the **-p** option to specify the password for the Red Hat Subscription Management or RHN Classic subscription methods from the command line instead of in the configuration file. As an alternative, the interactive UI mode also provides an option for entering subscription parameters for a one-time use without them being saved to the system.

-d (--debug)

When using the **-d** option, the installation utility prints information regarding any attempts to establish SSH sessions as it is running. This can be useful for debugging remote deployments.

Important

If **none** is used for the subscription type, either by using the **-s** flag or by not configuring subscription information through the interactive UI or **.yml** configuration file, you must manually configure the correct **yum** repositories with the proper priorities before running the installation utility. See Section 7.1, “Configuring Broker Host Entitlements” and Section 9.1, “Configuring Node Host Entitlements” for instructions.

Post-Install Tasks

Once the oo-install tool has completed the install without errors, you have a working OpenShift Enterprise installation. Consult the following list for directions on what to do next:

- See information on creating any additional users in Section 12.2, “Creating a User Account”.
- See information on creating an application in the *OpenShift Enterprise User Guide*.
- See information on adding an external routing layer in Section 8.6, “Using an External Routing Layer for High-Availability Applications”.

6.2. Using the Installation Scripts

You can deploy OpenShift Enterprise using the installation scripts, which include configurable parameters to help automate the installation of OpenShift Enterprise components on a Red Hat Enterprise Linux 6.6 system. By supplying the scripts with parameters relevant to your deployment requirements, you can get an environment running quickly without having to manually configure all of the required services.

For kickstarts, the **openshift.ks** kickstart script is available at:

https://raw.githubusercontent.com/openshift/openshift-extras/enterprise-2.2/enterprise/install-scripts/openshift.ks

Example 6.1. Downloading the openshift.ks Kickstart Script

```
$ curl -O https://raw.githubusercontent.com/openshift/openshift-
extras/enterprise-2.2/enterprise/install-scripts/openshift.ks
```

For pre-installed Red Hat Enterprise Linux 6.6 systems, the **openshift.sh** bash script is the extracted **%post** section of the **openshift.ks** script and is available at:

https://raw.githubusercontent.com/openshift/openshift-extras/enterprise-2.2/enterprise/install-scripts/generic/openshift.sh

Example 6.2. Downloading the openshift.sh Bash Script

```
$ curl -O https://raw.githubusercontent.com/openshift/openshift-
extras/enterprise-2.2/enterprise/install-scripts/generic/openshift.sh
```

The actions and parameters related to the installation and configuration of OpenShift Enterprise are the same between the two scripts. The commented notes in the header of the scripts provide extensive information on their usage and parameters.

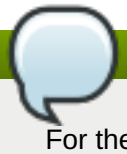
Important

The sample deployment steps detailed later in this guide describe the various actions of the installation scripts. However, these deployment methods are independent of each other; this means that you can install and configure a complete broker or node host by either following the steps manually, or by running the scripts. The corresponding functions of the scripts are identified in the respective sample deployment steps.

Supplying Parameters to the Scripts

When using the **`openshift.ks`** script, you can supply parameters as kernel parameters during the kickstart process. When using the **`openshift.sh`** script, you can similarly supply parameters as command-line arguments. See the commented notes in the header of the scripts for alternative methods of supplying parameters using the **`openshift.sh`** script.

The installation scripts are highly customizable, and as such can be used for a variety of deployment scenarios using many different configurations. The following sections highlight some important parameters, show basic script usage, and provide examples on installing and configuring sample hosts for a simple deployment.



Note

For the purposes of this guide, the following examples use the **`openshift.sh`** script by supplying parameters as command-line arguments. The same parameters can be supplied as kernel parameters for kickstarts using the **`openshift.ks`** script.

6.2.1. Selecting Components to Install

If you do not supply any parameters, the scripts install all OpenShift Enterprise components on a single host with the default configuration. Using the ***`install_components`*** parameter, the scripts can be configured to install one or more of the following components on a single host:

Table 6.1. Options for the *`install_components`* Parameter

Options	Description
`broker`	Installs the broker application and tools.
`named`	Supporting service. Installs a BIND DNS server.
`activemq`	Supporting service. Installs the messaging bus.
`datastore`	Supporting service. Installs the MongoDB datastore.
`node`	Installs node functionality, including cartridges.

Warning

The OpenShift Enterprise security model assumes that broker and node components are installed on separate hosts. Running a broker and node on the same host is not supported.

You can install any combination of components on a host, as long as broker and node components are installed on separate hosts. Any component can also be installed as a standalone host.

For example, the following command runs the **openshift.sh** script and installs the **broker**, **named**, **activemq**, and **datastore** components on a single host, using default values for all unspecified parameters:

Example 6.3. Installing the broker, named, activemq, and datastore Components Using openshift.sh

```
$ sudo sh openshift.sh install_components=broker,named,activemq,datastore
```

For another example, the following command runs the **openshift.sh** script and installs only the **node** component on a single host, using default values for all unspecified parameters:

Example 6.4. Installing the node Component Using openshift.sh

```
$ sudo sh openshift.sh install_components=node
```

6.2.2. Selecting a Package Source

If you do not supply an ***install_method*** parameter, the scripts assume that the installation source has already been configured to provide the required packages. Using the ***install_method*** parameter, the scripts can be configured to install packages from one of the following sources:

Table 6.2. Options for the *install_method* Parameter

Parameter	Description	Additional Related Parameters
yum	Configures **yum** based on supplied additional parameters.	***rhel_repo***, ***rhel_optional_repo***, ***jboss_repo_base***, ***rhscl_repo_base***, ***ose_repo_base***, ***ose_extra_repo_base***
rhsm	Uses Red Hat Subscription Management.	***rhn_user***, ***rhn_pass***, ***sm_reg_pool***, ***rhn_reg_opts***
rhn	Uses RHN Classic.	***rhn_user***, ***rhn_pass***, ***rhn_reg_opts***, ***rhn_reg_actkey***

Note

While Red Hat Network (RHN) Classic can be used to subscribe to channels, it is primarily intended for existing, legacy systems. Red Hat strongly recommends that you use Red Hat Subscription Management for new installations. For details on how to migrate from RHN Classic to RHSM, see the *OpenShift Enterprise Administration Guide*.

See the commented notes in the header of the scripts for detailed information about each of the additional related parameters.

For example, the following command runs the **openshift.sh** script and uses Red Hat Subscription Management as the package source, using default values for all unspecified parameters:

Example 6.5. Selecting a Package Source Using openshift.sh

```
$ sudo sh openshift.sh install_method=rhsm rhn_user=user@example.com
rhn_pass=password sm_reg_pool=Example_3affb61f013b3ef6a5fe0b9a
```

6.2.3. Selecting Password Options

By default, the installation scripts generate random passwords for configured services. For example, these passwords include the password that the broker and node both use to authenticate with the ActiveMQ service, as well as the password for the test OpenShift user account. If you are not deploying a production instance, you can supply the ***no_scramble*** parameter set to **true** to have default, insecure passwords used across the deployment.

You can set any password parameter manually with a unique password, which automatically overrides generating a random password for that parameter. When supplying a unique password, use alphanumeric characters as other characters may cause syntax errors; if non-alphanumeric characters are required, update them separately after the installation completes. For multi-host deployments, set unique passwords in parameters consistently across hosts for any services you are installing.

The scripts return a list of all passwords, whether randomly generated or manually set, after the installation is completed. The following table describes the available user name and password parameters for configured services, including the default user name values and related ***install_component*** options:

Table 6.3. User Name and Password Parameters

User Name Parameter	Password Parameter	Description
mcollective_user Default: **mcollective**	***mcollective_password***	These credentials are shared and must be the same between all broker and nodes for communicating over the **mcollective** topic channels in ActiveMQ. They must be specified and shared between separate ActiveMQ and broker hosts. These parameters are used by the ***install_component*** options **broker** and **node**.

User Name Parameter	Password Parameter	Description
mongodb_broker_user Default: **openshift**	***mongodb_broker_password***	These credentials are used by the broker and its MongoDB plug-in to connect to the MongoDB datastore. They must be specified and shared between separate MongoDB and broker hosts, as well as between any replicated MongoDB hosts. These parameters are used by the ***install_component*** options **datastore** and **broker**.
Not available.	***mongodb_key***	This key is shared and must be the same between any replicated MongoDB hosts. This parameter is used by the ***install_component*** option **datastore**.
mongodb_admin_user Default: **admin**	***mongodb_admin_password***	The credentials for this administrative user created in the MongoDB datastore are not used by OpenShift Enterprise, but an administrative user must be added to MongoDB so it can enforce authentication. These parameters are used by the ***install_component*** option **datastore**.
openshift_user1 Default: **demo**	***openshift_password1***	These credentials are created in the **/etc/openshift/htpasswd** file for the test OpenShift Enterprise user account. This test user can be removed after the installation is completed. These parameters are used by the ***install_component*** option **broker**.
Not available. Default: **amq**	***activemq_amq_user_password***	The password set for the ActiveMQ **amq** user is required by replicated ActiveMQ hosts to communicate with one another. The **amq** user is enabled only if replicated hosts are specified using the ***activemq_replicants*** parameter. If set, ensure the password is the same between all ActiveMQ hosts. These parameters are used by the ***install_component*** option **activemq**.

For example, the following command runs the **openshift.sh** script and sets unique passwords for various configured services, using default values for all unspecified parameters:

Example 6.6. Setting Unique Passwords Using openshift.sh

```
$ sudo sh openshift.sh install_components=broker,activemq,datastore
mcollective_password=password1 mongodb_broker_password=password2
openshift_password1=password3
```

6.2.4. Setting Broker and Supporting Service Parameters

When using the installation scripts, you can set a variety of parameters related to the broker and supporting services. The following table highlights some important parameters used during the installation of the respective components:

Table 6.4. Broker and Supporting Service Parameters

Parameter	Description
domain	This sets the network domain under which DNS entries for applications are placed.
hosts_domain	If specified and host DNS is to be created, this domain is created and used for creating host DNS records; application records are still placed in the domain specified with the ***domain*** parameter.
hostname	This is used to configure the host's actual host name. This value defaults to the value of the ***broker_hostname*** parameter if the **broker** component is being installed, otherwise ***named_hostname*** if installing **named**, ***activemq_hostname*** if installing **activemq**, or ***datastore_hostname*** if installing **datastore**.
broker_hostname	This is used as a default for the ***hostname*** parameter when installing the **broker** component. It is also used both when configuring the broker and when configuring the node, so that the node can contact the broker's REST API for actions such as scaling applications up or down. It is also used when adding DNS records, if the ***named_entries*** parameter is not specified.
named_ip_addr	This is used by every host to configure its primary name server. It defaults to the current IP address if installing the ***named*** component, otherwise it defaults to the ***broker_ip_addr*** parameter.
named_entries	This specifies the host DNS entries to be created in comma-separated, colon-delimited **hostname:ipaddress** pairs, or can be set to **none** so that no DNS entries are created for hosts. The installation script defaults to creating entries only for other components being installed on the same host when the ***named*** component is installed.
bind_key	This sets a key for updating BIND instead of generating one. If you are installing the **broker** component on a separate host from the **named** component, or are using an external DNS server, configure the BIND key so that the broker can update it. Any Base64-encoded value can be used, but ideally an HMAC-SHA256 key generated by **dnssec-keygen** should be used. For other key algorithms or sizes, ensure the ***bind_keyalgorithm*** and ***bind_keysize*** parameters are appropriately set as well.

Parameter	Description
valid_gear_sizes	This is a comma-separated list of gear sizes that are valid for use in applications, and sets the ***VALID_GEAR_SIZES*** parameter in the **/etc/openshift/broker.conf** file.
default_gear_size	This is the default gear size used when new gears are created, and sets the ***DEFAULT_GEAR_SIZE*** parameter in the **/etc/openshift/broker.conf** file.
default_gear_capabilities	This is a comma-separated list of default gear sizes allowed on a new user account, and sets the ***DEFAULT_GEAR_CAPABILITIES*** parameter in the **/etc/openshift/broker.conf** file.

See the *OpenShift Enterprise Administration Guide* for more information on the ***VALID_GEAR_SIZES***, ***DEFAULT_GEAR_SIZE***, and ***DEFAULT_GEAR_CAPABILITIES*** parameters in the **/etc/openshift/broker.conf** file.

For example, the following command runs the **openshift.sh** script and sets various parameters for the broker and supporting services, using default values for all unspecified parameters:

Example 6.7. Setting Broker and Supporting Service Parameters Using openshift.sh

```
$ sudo sh openshift.sh install_components=broker,named,activemq,datastore
domain=apps.example.com hosts_domain=hosts.example.com
broker_hostname=broker.hosts.example.com
named_entries=broker:192.168.0.1,activemq:192.168.0.1,node1:192.168.0.2
valid_gear_sizes=medium default_gear_size=medium
default_gear_capabilities=medium
```

6.2.5. Setting Node Parameters

When using the installation scripts, you can set a variety of parameters related to nodes. The following table highlights some important parameters used during installations of the node component:

Table 6.5. Node Parameters

Parameter	Description
domain	This sets the network domain under which DNS entries for applications are placed.
hosts_domain	If specified and host DNS is to be created, this domain is created and used for creating host DNS records; application records are still placed in the domain specified with the ***domain*** parameter.
hostname	This is used to configure the host's actual host name.
node_hostname	This is used as a default for the ***hostname*** parameter when installing the **node** component. It is also used when adding DNS records, if the ***named_entries*** parameter is not specified.
named_ip_addr	This is used by every host to configure its primary name server. It defaults to the current IP address if installing the ***named*** component, otherwise it defaults to the ***broker_ip_addr*** parameter.
node_ip_addr	This is used by the node to provide a public IP address if different from one on its NIC. It defaults to the current IP address when installing the node component.

Parameter	Description
broker_hostname	This is used by the node to record the host name of its broker, as the node must be able to contact the broker's REST API for actions such as scaling applications up or down.
node_profile	This sets the name of the node profile, also known as a gear profile or gear size, to be used on the node being installed. The value must also be a member of the ***valid_gear_sizes*** parameter used by the broker.
cartridges	This is a comma-separated list of cartridges to install on the node and defaults to **standard**, which installs all cartridges that do not require add-on subscriptions. See the commented notes in the header of the scripts for the full list of individual cartridges and more detailed usage.

For example, the following command runs the **openshift.sh** script and sets various node parameters, using default values for all unspecified parameters:

Example 6.8. Setting Node Parameters Using openshift.sh

```
$ sudo sh openshift.sh install_components=node domain=apps.example.com
hosts_domain=hosts.example.com node_hostname=node1.hosts.example.com
broker_ip_addr=192.168.0.1 broker_hostname=broker.hosts.example.com
node_profile=medium cartridges=php,ruby,postgresql,haproxy,jenkins
```

6.2.6. Deploying Sample Broker and Node Hosts Using openshift.sh

The examples in this section show how to install and configure sample broker and node hosts for a simple deployment using the **openshift.sh** script. Whereas the preceding **openshift.sh** examples demonstrate various parameters discussed in their respective sections, the examples in this section use a combination of the parameters discussed up to this point to demonstrate a specific deployment scenario. The broker and supporting service components are installed on one host (Host 1), and the node component is installed on a separate host (Host 2).

Deploying a Sample Broker Host Using openshift.sh

For Host 1, the command shown in the example runs the **openshift.sh** script with:

- Red Hat Subscription Manager set as the package source.
- The **broker**, **named**, **activemq**, and **datastore** options set as the installation components.
- Unique passwords set for MCollective, ActiveMQ, MongoDB, and the test OpenShift Enterprise user account.
- Various parameters set for the broker and supporting services.
- Default values set for all unspecified parameters.

Example 6.9. Installing and Configuring a Sample Broker Host Using openshift.sh

```
$ sudo sh openshift.sh install_method=rhsm rhn_user=user@example.com
rhn_pass=password sm_reg_pool=Example_3affb61f013b3ef6a5fe0b9a
install_components=broker,named,activemq,datastore
```

```
mcollective_password=password1 mongodb_broker_password=password2
openshift_password1=password3 domain=apps.example.com
hosts_domain=hosts.example.com broker_hostname=broker.hosts.example.com
named_entries=broker:192.168.0.1,activemq:192.168.0.1,node1:192.168.0.2
valid_gear_sizes=medium default_gear_size=medium
default_gear_capabilities=medium 2>&1 | tee -a openshift.sh.log
```

In this example, script output is logged to the **openshift.sh.log** file. If a new kernel package was installed during the installation, the host must be restarted before the new kernel is loaded.

Deploying a Sample Node Host Using openshift.sh

For Host 2, the command shown in the example runs the **openshift.sh** script with:

- Red Hat Subscription Manager set as the package source.
- The **node** option set as the installation component.
- The same unique password set for the MCollective user account that was set during the broker host installation.
- Various node parameters set, including which cartridges to install.
- Default values set for all unspecified parameters.

Example 6.10. Installing and Configuring a Sample Node Host Using openshift.sh

```
$ sudo sh openshift.sh install_method=rhsm rhn_user=user@example.com
rhn_pass=password sm_reg_pool=Example_3affb61f013b3ef6a5fe0b9a
install_components=node mcollective_password=password1
domain=apps.example.com hosts_domain=hosts.example.com
node_hostname=node1.hosts.example.com broker_ip_addr=192.168.0.1
broker_hostname=broker.hosts.example.com node_profile=medium
cartridges=php,ruby,postgresql,haproxy,jenkins 2>&1 | tee -a
openshift.sh.log
```

In this example, script output is logged to the **openshift.sh.log** file. If a new kernel package was installed during the installation, the host must be restarted before the new kernel is loaded.

6.2.7. Performing Required Post-Deployment Tasks

Important

Ensure that the installation has completed on both the broker and node host before continuing with the instructions in this section.

After deploying OpenShift Enterprise hosts using the installation scripts, the following tasks must be performed before the deployment is fully operational:

- Cartridge manifests must be imported on the broker host before cartridges can be used in applications.
- At least one district must be created before applications can be created.

If the default passwords were used for any deployment scenario, Red Hat recommends changing them manually after the initial installation is completed as well.

Performing Post-Deployment Tasks Manually

You can perform these tasks manually on the broker host. Run the following command to import the cartridge manifests for all cartridges installed on nodes:

```
# oo-admin-ctl-cartridge -c import-profile --activate --obsolete
```

See Section 9.14, “Configuring Districts” for instructions on creating and populating at least one district.

Performing Post-Deployment Tasks Using `openshift.sh`

Alternatively, you can perform these tasks using the **`openshift.sh`** script by running the **`post_deploy`** action. This action is not run by default, but by supplying the ***`actions`*** parameter, you can specify that it only run **`post_deploy`**. When running the **`post_deploy`** action, ensure that the script is run on the broker host using the **`broker`** installation component.

Important

If the ***`valid_gear_sizes`***, ***`default_gear_capabilities`***, or ***`default_gear_size`*** parameters were supplied during the initial broker host installation, ensure that the same values are supplied again when running the **`post_deploy`** action. Otherwise, your configured values will be overridden by default values.

If the ***`valid_gear_sizes`*** parameter is supplied when running the **`post_deploy`** action, districts are created for each size in ***`valid_gear_sizes`*** with names in the format **`default-`*`gear_size_name`***. If you do not want these default districts created, see the instructions for manually performing these tasks.

For example, the following command for the broker host runs the **`post_deploy`** action of the **`openshift.sh`** script. It supplies the same values for the ***`valid_gear_sizes`***, ***`default_gear_capabilities`***, and ***`default_gear_size`*** used during the sample broker host installation and uses default values for all unspecified parameters:

Example 6.11. Running the `post_deploy` Action on the Broker Host

```
$ sudo sh openshift.sh actions=post_deploy install_components=broker
valid_gear_sizes=medium default_gear_size=medium
default_gear_capabilities=medium 2>&1 | tee -a openshift.sh.log
```

In this example, script output is logged to the **`openshift.sh.log`** file. Cartridge manifests are imported on the broker host, and a district named **`default-medium`** is created.

6.3. Using the Sample Deployment Steps

The installation scripts provided in Section 6.2, “Using the Installation Scripts” are also detailed as manual, sample deployment steps for hosts identified in this guide as the following:

Host 1

The broker host detailed in Chapter 7, *Manually Installing and Configuring a Broker Host*.

Host 2

The node host detailed in Chapter 9, *Manually Installing and Configuring Node Hosts*.

The sample deployment steps are useful for understanding the various actions of the installation scripts, which enables administrators to further customize their deployments to their specifications.

Packages that are installed from third-party repositories and products such as EPEL or Puppet can adversely affect OpenShift Enterprise installations. This can result in issues that require additional time to troubleshoot. Therefore, Red Hat recommends that you only use packages from Red Hat Enterprise Linux Server 6 to install the base operating system and additional repositories when preparing OpenShift Enterprise hosts, and disable any third-party **yum** repositories during installation, including the unsupported Red Hat Enterprise Linux Server Optional channel. Proper **yum** configurations for OpenShift Enterprise installations are covered in Section 7.2, “Configuring Yum on Broker Hosts” and Section 9.2, “Configuring Yum on Node Hosts”.

The sample deployment steps assume that Host 1 and Host 2 are configured with a Red Hat Enterprise Linux Server entitlement and have Red Hat Enterprise Linux Server 6.6 or later installed with all base packages fully updated. Most importantly, you must have the latest version of the *selinux-policy* package installed on each host, as it is necessary for the correct operation of OpenShift Enterprise. Use the **yum update** command to update all packages before installing OpenShift Enterprise.

Warning

The OpenShift Enterprise security model assumes that broker and node components are installed on separate hosts. Running a broker and node on the same host is not supported.

6.3.1. Service Parameters

In the sample deployment steps, the broker host (Host 1) and node host (Host 2) are configured with the following parameters:

Service domain	example.com
Broker IP address	DHCP
Broker host name	broker.example.com
Node 0 IP address	DHCP
Node 0 host name	node.example.com
Datastore service	MongoDB
Authentication service	Basic Authentication using **httpd mod_auth_basic**
DNS service	BIND, configured as follows: - IP address: dynamic - Zone: example.com (same as Service Domain) - Domain suffix: example.com (same as Service Domain)
Messaging service	MCollective using ActiveMQ

All of these parameters are customizable to suit your requirements. As detailed in the instructions, the domain and host names can be modified by editing the appropriate configuration files. The messaging, authentication, and DNS services are each implemented as plug-ins to the broker.

Important

DHCP is supported, and use thereof is assumed in this guide. However, dynamic reassignment of IP addresses is not supported and can cause problems.

6.3.2. DNS Information

The sample deployment steps configure a DNS service to allow OpenShift Enterprise to dynamically publish DNS host names of applications within your chosen domain. This can only be made authoritative by an external authority, such as your system administrator, or Internet service provider. If the OpenShift Enterprise name server is not made authoritative by your DNS provider, application host names are visible only on the OpenShift Enterprise hosts, or any workstation configured to use the same DNS service. Alternatively, OpenShift Enterprise can publish to an existing authoritative service if given the necessary credentials for the domain.

The process of creating an authoritative DNS service and establishing a delegation agreement with your IT department are beyond the scope of this guide. Each organization has its own policies and procedures for managing DNS services. The requirements must be discussed with the appropriate personnel for your site to make the OpenShift Enterprise service available.

[1] https://access.redhat.com/documentation/en-US/OpenShift_Enterprise/2/html/User_Guide/chap-Applications.html#Highly-Available_Applications

Chapter 7. Manually Installing and Configuring a Broker Host

Prerequisites:

- Chapter 2, *Prerequisites*
- Chapter 5, *Host Preparation*
- Section 6.3, “Using the Sample Deployment Steps”

This chapter describes how to manually install and configure the OpenShift Enterprise broker host. The example host contains the broker application, MongoDB, ActiveMQ, and BIND. Each of these components is covered in individual sections.

Perform all of the procedures in this section only after the base operating system is fully installed and configured, and before you install and configure any node hosts.

Warning

The OpenShift Enterprise security model assumes that broker and node components are installed on separate hosts. Running a broker and node on the same host is not supported.

7.1. Configuring Broker Host Entitlements

OpenShift Enterprise requires several packages that are not available in the standard Red Hat Enterprise Linux channels. A broker host requires a subscription for the appropriate OpenShift Enterprise channels to receive these extra packages.

Table 7.1. OpenShift Enterprise Broker Host Channels

Channel Name	Purpose	Required	Provided By
Red Hat OpenShift Enterprise 2.2 Infrastructure.	Base channel for OpenShift Enterprise 2.2 broker hosts.	Yes.	"OpenShift Enterprise Broker Infrastructure" subscription.
Red Hat OpenShift Enterprise 2.2 Client Tools.	Provides access to the OpenShift Enterprise 2.2 client tools.	Not required for broker functionality, but required during installation for testing and troubleshooting purposes.	"OpenShift Enterprise Broker Infrastructure" subscription.
Red Hat Software Collections 1.	Provides access to the latest version of programming languages, database servers, and related packages.	Yes.	"OpenShift Enterprise Broker Infrastructure" subscription.

You must register your host through either Red Hat Subscription Management (RHSM) or Red Hat Network (RHN) Classic to attach any of the above subscriptions and enable the proper channels. Instructions for either of these subscription methods are provided in the following sections. Choose one subscription method and follow the relevant instructions before proceeding to Section 7.2, “Configuring Yum on Broker Hosts”.

7.1.1. Using Red Hat Subscription Management on Broker Hosts

For additional information on managing your subscription entitlements with Red Hat Subscription Management, see the Red Hat Subscription Management guides at http://access.redhat.com/site/documentation.

Procedure 7.1. To Configure Broker Host Entitlements with Red Hat Subscription Management:

1. On your Red Hat Enterprise Linux instance, register the system:

   Example 7.1. Registering Using the Subscription Manager

   ```
   # subscription-manager register

   Username:
   Password:

   The system has been registered with id: 3tghj35d1-7c19-4734-b638-
   f24tw8eh6246
   ```

2. Locate the desired OpenShift Enterprise subscription pool IDs in the list of available subscriptions for your account:

   Example 7.2. Finding the OpenShift Enterprise Pool ID

   ```
   # subscription-manager list --available

   +-------------------------------------------+
       Available Subscriptions
   +-------------------------------------------+

   Subscription Name:      OpenShift Enterprise Broker Infrastructure
   SKU:                    SYS####
   Pool Id:                Example_3affb61f013b3ef6a5fe0b9a
   Quantity:               1
   Service Level:          Layered
   Service Type:           L1-L3
   Multi-Entitlement:      No
   Ends:                   01/01/2020
   System Type:            Physical
   ```

3. Attach the desired subscription. Replace **pool-id** in the following command with your relevant **Pool ID** value from the previous step:

   ```
   # subscription-manager attach --pool pool-id
   ```

4. Enable only the **Red Hat OpenShift Enterprise 2.2 Infrastructure** channel:

   ```
   # subscription-manager repos --enable rhel-6-server-ose-2.2-infra-rpms
   ```

5. Confirm that **yum repolist** displays the enabled channel:

```
# yum repolist

repo id                              repo name

rhel-6-server-ose-2.2-infra-rpms   Red Hat OpenShift Enterprise 2.2
Infrastructure (RPMs)
```

OpenShift Enterprise broker hosts require a customized **yum** configuration to install correctly. For continued steps to correctly configure **yum**, see Section 7.2, “Configuring Yum on Broker Hosts”.

7.1.2. Using Red Hat Network Classic on Broker Hosts

For additional information regarding Red Hat Network (RHN) Classic, see the Red Hat Subscription Management guides at http://access.redhat.com/site/documentation.

Note

While Red Hat Network (RHN) Classic can be used to subscribe to channels, it is primarily intended for existing, legacy systems. Red Hat strongly recommends that you use Red Hat Subscription Management for new installations. For details on how to migrate from RHN Classic to RHSM, see the *OpenShift Enterprise Administration Guide*.

Procedure 7.2. To Configure Entitlements with Red Hat Network (RHN) Classic:

1. On your Red Hat Enterprise Linux instance, register the system. Replace **username** and **password** in the following command with your Red Hat Network account credentials.

   ```
   # rhnreg_ks --username username --password password
   ```

2. Enable only the **Red Hat OpenShift Enterprise 2.2 Infrastructure** channel.

   ```
   # rhn-channel -a -c rhel-x86_64-server-6-ose-2.2-infrastructure
   ```

3. Confirm that **yum repolist** displays the enabled channel.

   ```
   # yum repolist

   repo id                                          repo name

   rhel-x86_64-server-6-ose-2.2-infrastructure   Red Hat OpenShift
   Enterprise 2.2 Infrastructure - x86_64
   ```

   OpenShift Enterprise broker hosts require a customized **yum** configuration to install correctly. For continued steps to correctly configure **yum**, see Section 7.2, “Configuring Yum on Broker Hosts”.

7.2. Configuring Yum on Broker Hosts

The packages required for running OpenShift Enterprise are all available from Red Hat Network (RHN). Third-party RPM repositories and even other products provided by Red Hat can create conflicts with OpenShift Enterprise during initial deployment and later when applying updates. To avoid these issues, it is

best to use a combination of the *yum-plugin-priorities* package and **exclude** directives in the **yum** configuration files.

The *yum-plugin-priorities* package helps prevent other repositories from interfering with Red Hat Network content for OpenShift Enterprise. The **exclude** directives work around the cases that priorities will not solve. The **oo-admin-yum-validator** tool consolidates this **yum** configuration process for specified component types called *roles*.

Using the oo-admin-yum-validator Tool

After configuring the selected subscription method as described in Section 7.1, “Configuring Broker Host Entitlements”, use the **oo-admin-yum-validator** tool to configure **yum** and prepare your host to install the broker components. This tool reports a set of problems, provides recommendations, and halts by default so that you can review each set of proposed changes. You then have the option to apply the changes manually, or let the tool attempt to fix the issues that have been found. This process may require you to run the tool several times. You also have the option of having the tool both report all found issues, and attempt to fix all issues.

Procedure 7.3. To Configure Yum on Broker Hosts:

1. Install the latest *openshift-enterprise-release* package:

```
# yum install openshift-enterprise-release
```

2. Run the **oo-admin-yum-validator** command with the **-o** option for version **2.2** and the **-r** option for the **broker** role. This reports the first detected set of problems, provides a set of proposed changes, and halts.

Example 7.3. Detecting Problems

```
# oo-admin-yum-validator -o 2.2 -r broker

Please note: --role=broker implicitly enables --role=client to
ensure /usr/bin/rhc is available for testing and troubleshooting.
Detected OpenShift Enterprise repository subscription managed by Red
Hat Subscription Manager.

The required OpenShift Enterprise repositories are disabled:
    rhel-server-rhscl-6-rpms
    rhel-6-server-ose-2.2-rhc-rpms
    rhel-6-server-rpms
Enable these repositories by running these commands:
# subscription-manager repos --enable=rhel-server-rhscl-6-rpms
# subscription-manager repos --enable=rhel-6-server-ose-2.2-rhc-rpms
# subscription-manager repos --enable=rhel-6-server-rpms
Please re-run this tool after making any recommended repairs to this
system
```

Alternatively, use the **--report-all** option to report all detected problems.

```
# oo-admin-yum-validator -o 2.2 -r broker --report-all
```

3. After reviewing the reported problems and their proposed changes, either fix them manually or let the tool attempt to fix the first set of problems using the same command with the **--fix** option. This may require several repeats of steps 2 and 3.

Example 7.4. Fixing Problems

```
# oo-admin-yum-validator -o 2.2 -r broker --fix

Please note: --role=broker implicitly enables --role=client to
ensure /usr/bin/rhc is available for testing and troubleshooting.
Detected OpenShift Enterprise repository subscription managed by Red
Hat Subscription Manager.

Enabled repository rhel-server-rhscl-6-rpms
Enabled repository rhel-6-server-ose-2.2-rhc-rpms
Enabled repository rhel-6-server-rpms
```

Alternatively, use the **--fix-all** option to allow the tool to attempt to fix all of the problems that are found.

```
# oo-admin-yum-validator -o 2.2 -r broker --fix-all
```

Note

If the host is using Red Hat Network (RHN) Classic, the **--fix** and **--fix-all** options do not automatically enable any missing OpenShift Enterprise channels as they do when the host is using Red Hat Subscription Management. Enable the recommended channels with the **rhn-channel** command. Replace **repo-id** in the following command with the repository ID reported in the **oo-admin-yum-validator** command output.

```
# rhn-channel -a -c repo-id
```

Important

For either subscription method, the **--fix** and **--fix-all** options do not automatically install any packages. The tool reports if any manual steps are required.

4. Repeat steps 2 and 3 until the **oo-admin-yum-validator** command displays the following message.

```
No problems could be detected!
```

7.3. Installing and Configuring BIND and DNS

This section describes how to configure BIND on the broker host, and is included primarily for completeness and to help you quickly install and configure your system. Skip this section if there are alternative arrangements for handling DNS updates from OpenShift Enterprise.

If you wish to have OpenShift Enterprise update an existing BIND server in your infrastructure, see the following instructions. If you desire a different configuration, a different DNS update plug-in can be installed and configured instead. See Section 8.1, “Installing and Configuring DNS Plug-ins” for details on other supported DNS plug-ins that are available as of OpenShift Enterprise 2.1.6 and later as well as information on developing your own plug-in.

7.3.1. Installing BIND and DNS Packages

Install all the required packages:

```
# yum install bind bind-utils
```

7.3.2. Configuring BIND and DNS

Most of the instructions in this guide reference the domain name that is used to configure the sample OpenShift Enterprise installation. Configure the **$domain** environment variable to simplify the process with the following command, replacing **example.com** with the domain name to suit your environment:

```
# domain=example.com
```

Configure the **$keyfile** environment variable so that it contains the file name for a new DNSSEC key for your domain, which is created in the subsequent step:

```
# keyfile=/var/named/$domain.key
```

Use the **dnssec-keygen** tool to generate the new DNSSEC key for the domain. Run the following commands to delete any old keys and generate a new key:

```
# rm -vf /var/named/K$domain*
# pushd /var/named
# dnssec-keygen -a HMAC-SHA256 -b 256 -n USER -r /dev/urandom $domain
# KEY="$(grep Key: K$domain*.private | cut -d ' ' -f 2)"
# popd
```

Note

The **$KEY** environment variable has been set to hold the newly-generated key. This key is used in a later step.

Enabling Communication Between the Broker and BIND

Ensure that a key exists so that the broker can communicate with BIND. Use the **rndc-confgen** command to generate the appropriate configuration files for **rndc**, which is the tool that the broker uses to perform this communication:

```
# rndc-confgen -a -r /dev/urandom
```

Configuring Ownership, Permissions, and SELinux Context

Ensure that the ownership, permissions, and SELinux context are set appropriately for this new key:

```
# restorecon -v /etc/rndc.* /etc/named.*
# chown -v root:named /etc/rndc.key
# chmod -v 640 /etc/rndc.key
```

7.3.2.1. Configuring Sub-Domain Host Name Resolution

Configure BIND to resolve host names under the domain used for your OpenShift Enterprise installation. To achieve this, create a database for the domain. The **dns-nsupdate** plug-in includes an example database, used in this example as a template.

Procedure 7.4. To Configure Sub-Domain Host Name Resolution:

1. Delete and create the **/var/named/dynamic** directory:

```
# rm -rvf /var/named/dynamic
# mkdir -vp /var/named/dynamic
```

2. Create an initial **named** database in a new file called **/var/named/dynamic/$*domain*.db**, replacing *domain* with your chosen domain. If the shell syntax is unfamiliar, see the BASH documentation at http://www.gnu.org/software/bash/manual/bashref.html#Here-Documents.

```
# cat <<EOF > /var/named/dynamic/${domain}.db
\$ORIGIN .
\$TTL 1 ; 1 seconds (for testing only)
${domain}               IN SOA  ns1.${domain}. hostmaster.${domain}. (
                                2011112904 ; serial
                                60         ; refresh (1 minute)
                                15         ; retry (15 seconds)
                                1800       ; expire (30 minutes)
                                10         ; minimum (10 seconds)
                                )
                        NS      ns1.${domain}.
                        MX      10 mail.${domain}.
\$ORIGIN ${domain}.
ns1                     A       127.0.0.1
EOF
```

Procedure 7.5. To Install the DNSSEC Key for a Domain:

1. Create the file **/var/named/$*domain*.key**, where *domain* is your chosen domain:

```
# cat <<EOF > /var/named/$domain.key
key $domain {
  algorithm HMAC-SHA256;
  secret "${KEY}";
};
EOF
```

2. Set the permissions and SELinux context to the correct values:

```
# chgrp named -R /var/named
# chown named -R /var/named/dynamic
# restorecon -rv /var/named
```

This configuration also requires a new **/etc/named.conf** file.

Procedure 7.6. To Configure a New /etc/named.conf File:

1. Create the required file:

```
# cat <<EOF > /etc/named.conf
// named.conf
//
// Provided by Red Hat bind package to configure the ISC BIND named(8)
DNS
// server as a caching only nameserver (as a localhost DNS resolver
only).
//
// See /usr/share/doc/bind*/sample/ for example named configuration
files.
//

options {
  listen-on port 53 { any; };
  directory  "/var/named";
  dump-file  "/var/named/data/cache_dump.db";
        statistics-file "/var/named/data/named_stats.txt";
        memstatistics-file "/var/named/data/named_mem_stats.txt";
  allow-query     { any; };
  recursion no;

  /* Path to ISC DLV key */
  bindkeys-file "/etc/named.iscdlv.key";

};

logging {
        channel default_debug {
                file "data/named.run";
                severity dynamic;
        };
};

// use the default rndc key
include "/etc/rndc.key";

controls {
  inet 127.0.0.1 port 953
  allow { 127.0.0.1; } keys { "rndc-key"; };
};

include "/etc/named.rfc1912.zones";

include "$domain.key";
```

```
zone "$domain" IN {
  type master;
  file "dynamic/$domain.db";
  allow-update { key $domain ; } ;
};
EOF
```

2. Set the permissions and SELinux context to the correct values:

```
# chown -v root:named /etc/named.conf
# restorecon /etc/named.conf
```

7.3.2.2. Configuring Host Name Resolution

Update the **/etc/resolv.conf** file on the broker host (Host 1) so that it uses the local **named** service. This allows the broker to resolve its own host name, existing node host names, and any future nodes that are added. Also configure the firewall and **named** service to serve local and remote DNS requests for the domain.

Procedure 7.7. To Configure Host Name Resolution:

1. Edit the **/etc/resolv.conf** file on the broker host.
2. Add the following entry as the first name server:

```
nameserver  127.0.0.1
```

3. Save and close the file.
4. Open a shell and run the following commands. This allows DNS access through the firewall, and ensures the **named** service starts on boot.

```
# lokkit --service=dns
# chkconfig named on
```

5. Use the **service** command to start the **named** service (that is, BIND) for some immediate updates:

```
# service named start
```

6. Use the **nsupdate** command to open an interactive session to BIND and pass relevant information about the broker. In the following example, **server, update,** and **send** are commands to the **nsupdate** command.

Important

Remember to replace **broker.example.com** with the fully-qualified domain name, **10.0.0.1** with the IP address of your broker, and *keyfile* with the new key file.

Update your BIND configuration:

```
# nsupdate -k $keyfile
server 127.0.0.1
update delete broker.example.com A
```

```
update add broker.example.com 180 A 10.0.0.1
send
```

7. Press **Ctrl+D** to save the changes and close the session.

Note

If you use the kickstart or bash script, the **configure_named** and **configure_dns_resolution** functions perform these steps.

7.3.3. Verifying the BIND Configuration

Before continuing with further configuration, ensure BIND is configured correctly so that the broker's host name resolves.

```
# dig @127.0.0.1 broker.example.com
```

Inspect the **ANSWER SECTION** of the output, and ensure it contains the correct IP address.

Ensure the local BIND instance is being used by the broker:

```
# dig broker.example.com

(An example AUTHORITY section:)
;; AUTHORITY SECTION:
example.com.    1    IN    NS    ns1.example.com.
```

Inspect the **AUTHORITY SECTION** of the output to verify that it contains the broker host name. If you have BIND configured on a separate host, verify that it returns that host name.

The BIND instance as configured will not answer questions about domains it does not own, but if you add one or more secondary nameservers in the **/etc/resolv.conf** file, they can be queried for other domains. Because the **dig** command will only query the BIND instance by default, use the **host** command to test requests for other host names.

```
# host icann.org

icann.org has address 192.0.43.7
icann.org has IPv6 address 2001:500:88:200::7
icann.org mail is handled by 10 pechora1.icann.org.
```

7.4. Configuring DHCP and Host Name Resolution

This section describes how to perform system-wide network configurations on the broker. Note that no new packages are required to complete this configuration.

Note

This section assumes that the broker is using the eth0 network interface. If your system uses a different interface, substitute that interface name in the file names in the ensuing instructions.

7.4.1. Configuring the DHCP Client on the Broker Host

For correct configuration, ensure the DHCP client uses the local BIND instance, and the correct host name and domain name.

Use the following procedure to configure the DHCP client correctly. Remember to replace the example IP addresses, host names, and domain names with the values to suit your environment.

Procedure 7.8. To Configure DHCP on the Broker Host:

1. Create the **/etc/dhcp/dhclient-eth0.conf** file:

```
# touch /etc/dhcp/dhclient-eth0.conf
```

2. Edit the file to contain the following lines:

```
prepend domain-name-servers 10.0.0.1;
prepend domain-search "example.com";
```

3. Open the **/etc/sysconfig/network** file. Locate the line that begins with **HOSTNAME=** and ensure it is set to your broker host name:

```
HOSTNAME=broker.example.com
```

4. Run the following command to immediately set the host name. Remember to replace the example value with the fully-qualified domain name of your broker host.

```
# hostname broker.example.com
```

Note

If you use the kickstart or bash script, the **configure_dns_resolution** and **configure_hostname** functions perform these steps.

7.4.2. Verifying the DHCP Configuration

Run the following command to verify the host name of the broker host:

```
# hostname
```

7.5. Installing and Configuring MongoDB

The following configuration changes are required for MongoDB so that it can be used with OpenShift Enterprise:

- Configuring authentication
- Specifying the default database size
- Creating an administrative user
- Creating a regular user

7.5.1. Installing MongoDB

Install all of the required MongoDB packages with the following command:

```
# yum install mongodb-server mongodb
```

7.5.2. Configuring MongoDB

The MongoDB configuration consists of three main steps:

- Configuring authentication
- Configuring default database size
- Configuring the firewall and **mongod** daemon

Procedure 7.9. To Configure Authentication and Default Database Size for MongoDB:

1. Open the **/etc/mongodb.conf** file.
2. Locate the line beginning with ***auth =*** and ensure it is set to **true**:

   ```
   auth = true
   ```

3. Add the following line at the end of the file:

   ```
   smallfiles = true
   ```

4. Ensure no other lines exist that begin with either ***auth =*** or ***smallfiles =***.
5. Save and close the file.

Procedure 7.10. To Configure the Firewall and Mongo Daemon:

1. Ensure the **mongod** daemon starts on boot:

   ```
   # chkconfig mongod on
   ```

2. Start the **mongod** daemon immediately:

   ```
   # service mongod start
   ```

Note

If you use the kickstart or bash script, the **configure_datastore** function performs these steps.

Verifying MongoDB Configuration

Before continuing with further configuration, verify that you can connect to the MongoDB database:

```
# mongo
```

This command starts a MongoDB interactive session. Press **CTRL+D** to leave this session and return to the command shell.

Important

The start and restart actions of MongoDB return before the daemon is ready to accept connections. As a result, MongoDB takes time to initialize the journal, which can take several minutes. If you receive the message "Error: couldn't connect to server 127.0.0.1" with the **mongo** command, wait and try again. When MongoDB is ready, it will write a "waiting for connections" message in the **/var/log/mongodb/mongodb.log** file. A connection to the MongoDB database is required for the ensuing steps.

7.5.3. Configuring MongoDB User Accounts

The following instructions describe how to create an account in MongoDB for the broker host to use.

Note

The MongoDB user and password created for the broker host in this section are used when updating the **/etc/openshift/broker.conf** file later in Section 7.8.7, “Configuring the Broker Datastore”.

Procedure 7.11. To Create a MongoDB Account:

1. Open an interactive MongoDB session:

   ```
   # mongo
   ```

2. At the MongoDB interactive session prompt, select the **admin** database:

   ```
   > use admin
   ```

3. Add the **admin** user to the **admin** database. Replace **password** in the command with a unique password:

   ```
   > db.addUser("admin", "password")
   ```

4. Authenticate using the **admin** account created in the previous step. Replace **password** in the command with the appropriate password:

```
> db.auth("admin", "password")
```

5. Switch to the **openshift_broker** database:

```
> use openshift_broker
```

6. Add the **openshift** user to the **openshift_broker** database. Replace **password** in the command with a unique password:

```
> db.addUser("openshift", "password")
```

7. Press **CTRL+D** to exit the MongoDB interactive session.

Verifying MongoDB Account

The following instructions describe how to verify that the **openshift** account has been created.

Procedure 7.12. To Verify a MongoDB Account:

1. Open an interactive MongoDB session:

```
# mongo
```

2. Switch to the **openshift_broker** database:

```
> use openshift_broker
```

3. Authenticate using the **openshift** account. Replace **password** in the command with the appropriate password:

```
> db.auth("openshift", "password")
```

4. Retrieve a list of MongoDB users:

```
> db.system.users.find()
```

   An entry for the **openshift** user is displayed.

5. Press **CTRL+D** to exit the MongoDB interactive session.

7.6. Installing and Configuring ActiveMQ

This section describes how to install and configure ActiveMQ as the messaging platform to aid in communication between the broker and node hosts.

7.6.1. Installing ActiveMQ

Run the following command to install the required packages for ActiveMQ:

```
# yum install activemq activemq-client
```

7.6.2. Configuring ActiveMQ

Edit the **/etc/activemq/activemq.xml** file to correctly configure ActiveMQ. You can download a sample configuration file from https://raw.github.com/openshift/openshift-extras/enterprise-2.2/enterprise/install-scripts/activemq.xml. Copy this file into the **/etc/activemq/** directory, and make the following configuration changes:

1. Replace **activemq.example.com** in this file with the actual fully-qualified domain name (FQDN) of this host.
2. Substitute your own passwords for the example passwords provided, and use them in the MCollective configuration that follows.

Configure the firewall to allow MCollective to communicate on TCP port 61613, and set the **activemq** service to start on boot:

```
# lokkit --port=61613:tcp
# chkconfig activemq on
```

Start the **activemq** service:

```
# service activemq start
```

Note

If you use the kickstart or bash script, the **configure_activemq** function performs these steps.

Important

Ensure that the ActiveMQ monitor console web service requires authentication and answers only on the **localhost** interface. It is important to limit access to the ActiveMQ console for security.

Procedure 7.13. To Secure the ActiveMQ Console:

1. Ensure authentication is enabled:

   ```
   # sed -i -e '/name="authenticate"/s/false/true/'
   /etc/activemq/jetty.xml
   ```

2. For the console to answer only on the **localhost** interface, check the **/etc/activemq/jetty.xml** file. Ensure that the **Connector** bean has the **host** property with the value of **127.0.0.1**.

   Example 7.5. Connector Bean Configuration

   ```
   <bean id="Connector"
   ```

```
class="org.eclipse.jetty.server.nio.SelectChannelConnector">
      <!-- see the jettyPort bean -->
      <property name="port" value="#
{systemProperties['jetty.port']}" />
      <property name="host" value="127.0.0.1" />
</bean>
```

3. Ensure that the line for the **admin** user in the **/etc/activemq/jetty-realm.properties** file is uncommented, and change the default password to a unique one. User definitions in this file take the following form:

```
username: password [,role ...]
```

Example 7.6. admin User Definition

```
admin: password, admin
```

4. Restart the **activemq** service for the changes to take effect:

```
# service activemq restart
```

7.6.3. Verifying the ActiveMQ Configuration

MCollective can act in one of two ways: it can transport host-to-host messages, or it can broadcast messages with the appropriate hosts responding to the broadcasting host. In the latter case, a message that is broadcast has a "topic" that is used to indicate which hosts should respond.

After ActiveMQ has started, verify that it is listening for messages for the OpenShift Enterprise topics. It can take 60 seconds or longer for the **activemq** daemon to finish initializing and start answering queries.

Verify that authentication is working, replacing **password** with your password:

```
# curl --head --user admin:password
http://localhost:8161/admin/xml/topics.jsp
```

A **200 OK** message should be displayed, followed by the remaining header lines. If you see a **401 Unauthorized** message, it means your user name or password is incorrect.

Verify that the service returns a topic list, replacing **password** with your password:

```
# curl --user admin:password --silent
http://localhost:8161/admin/xml/topics.jsp | grep -A 4 topic
```

If no results are returned, run it again without the **--silent** argument, and without using **grep** to filter messages:

```
# curl http://localhost:8161/admin/xml/topics.jsp
```

If the following message is returned, it means that either the ActiveMQ service is not running, or it has not finished initializing.

```
curl: (7) couldn't connect to host
```

If this persists for more than 60 seconds, and the **activemq** daemon is running, look in the ActiveMQ log file:

```
# more /var/log/activemq/activemq.log
```

After you have verified the ActiveMQ configuration, disable the unused Jetty by commenting out the line that loads **jetty.xml**. This can be done by editing **activemq.xml** manually or by running the following command:

```
# sed -ie "s/\(.*import resource.*jetty.xml.*\)/<\!-- \1 -->/"
/etc/activemq/activemq.xml
```

Restart the **activemq** service for the changes to take effect:

```
# service activemq restart
```

7.7. Installing and Configuring MCollective Client

The broker application on Host 1 uses the MCollective client to communicate with the node hosts. In turn, the MCollective client relies on Apache ActiveMQ. The following sections describe how to install and configure the MCollective client.

7.7.1. Installing MCollective Client

Run the following command to install all required packages for the MCollective client on the broker host:

```
# yum install ruby193-mcollective-client
```

7.7.2. Configuring MCollective Client

Configure the MCollective client to use ActiveMQ on Host 1.

Replace the contents of the **/opt/rh/ruby193/root/etc/mcollective/client.cfg** file with the following configuration. Change the setting for ***plugin.activemq.pool.1.host*** from **localhost** to the actual host name of Host 1, and use the same password for the MCollective user specified in **/etc/activemq/activemq.xml**. Also ensure that you set the password for the ***plugin.psk*** parameter, and the figures for the ***heartbeat*** parameters. This prevents any node failures when you install MCollective on a node host using Section 9.7, “Installing and Configuring MCollective on Node Hosts”. However, you can leave these as the default values:

```
main_collective = mcollective
collectives = mcollective
libdir = /opt/rh/ruby193/root/usr/libexec/mcollective
logger_type = console
loglevel = warn
direct_addressing = 0

# Plugins
securityprovider = psk
plugin.psk = asimplething
```

```
connector = activemq
plugin.activemq.pool.size = 1
plugin.activemq.pool.1.host = localhost
plugin.activemq.pool.1.port = 61613
plugin.activemq.pool.1.user = mcollective
plugin.activemq.pool.1.password = marionette

plugin.activemq.heartbeat_interval = 30
plugin.activemq.max_hbread_fails = 2
plugin.activemq.max_hbrlck_fails = 2

# Broker will retry ActiveMQ connection, then report error
plugin.activemq.initial_reconnect_delay = 0.1
plugin.activemq.max_reconnect_attempts = 6

# Facts
factsource = yaml
plugin.yaml = /opt/rh/ruby193/root/etc/mcollective/facts.yaml
```

Note

If you use the kickstart or bash script, the **configure_mcollective_for_activemq_on_broker** function performs these steps.

7.8. Installing and Configuring the Broker Application

The following sections describe how to install and configure the broker Rails application that provides the REST API to the client tools.

7.8.1. Installing the Broker Application

Install the required packages for these instructions using:

```
# yum install openshift-origin-broker openshift-origin-broker-util rubygem-
openshift-origin-auth-remote-user rubygem-openshift-origin-msg-broker-
mcollective rubygem-openshift-origin-dns-nsupdate
```

Note

If you use the kickstart or bash script, the **install_broker_pkgs** function performs this step.

7.8.2. Setting Ownership and Permissions for MCollective Client Configuration File

Set the ownership and permissions for the MCollective client configuration file:

```
# chown apache:apache /opt/rh/ruby193/root/etc/mcollective/client.cfg
# chmod 640 /opt/rh/ruby193/root/etc/mcollective/client.cfg
```

Note

If you use the kickstart or bash script, the **configure_mcollective_for_activemq_on_broker** function performs this step.

7.8.3. Modifying Broker Proxy Configuration

The default installation of **mod_ssl** includes a configuration file with a VirtualHost that can cause spurious warnings. In some cases, it may interfere with requests to the OpenShift Enterprise broker application.

Modify the **/etc/httpd/conf.d/ssl.conf** file to prevent these issues:

```
# sed -i '/VirtualHost/,/VirtualHost/ d' /etc/httpd/conf.d/ssl.conf
```

7.8.4. Configuring the Required Services

A number of services must be started for the broker Rails application when Host 1 is booted up. Start these services using:

```
# chkconfig httpd on
# chkconfig network on
# chkconfig ntpd on
# chkconfig sshd on
```

Configure the firewall to allow access to these services:

```
# lokkit --nostart --service=ssh
# lokkit --nostart --service=https
# lokkit --nostart --service=http
```

Set the appropriate **ServerName** in the Apache configuration on the broker:

```
# sed -i -e "s/ServerName .*\$/ServerName `hostname`/" \
 /etc/httpd/conf.d/000002_openshift_origin_broker_servername.conf
```

Note

If you use the kickstart or bash script, the **enable_services_on_broker** function performs these steps.

Configuring Inter-Host Access Keys

Generate a broker access key, which is used by Jenkins and other optional services. The access key is configured with the **/etc/openshift/broker.conf** file. This includes the expected key file locations, which are configured in the lines shown in the sample screen output. The following ***AUTH_PRIV_KEY_FILE*** and ***AUTH_PUB_KEY_FILE*** settings show the default values, which can be changed as required. The ***AUTH_PRIV_KEY_PASS*** setting can also be configured, but it is not required.

```
AUTH_PRIV_KEY_FILE="/etc/openshift/server_priv.pem"
AUTH_PRIV_KEY_PASS=""
AUTH_PUB_KEY_FILE="/etc/openshift/server_pub.pem"
```

Note

The ***AUTH_PRIV_KEY_FILE***, ***AUTH_PRIV_KEY_PASS*** and ***AUTH_PUB_KEY_FILE*** settings must specify the same private key on all associated brokers for the Jenkins authentication to work.

The following commands generate the broker access key and assume the default key file locations are used. If you changed the ***AUTH_PRIV_KEY_FILE*** or ***AUTH_PRIV_KEY_PASS*** settings, replace */etc/openshift/server_priv.pem* or */etc/openshift/server_pub.pem* in the following commands as necessary.

```
# openssl genrsa -out /etc/openshift/server_priv.pem 2048
# openssl rsa -in /etc/openshift/server_priv.pem -pubout >
/etc/openshift/server_pub.pem
# chown apache:apache /etc/openshift/server_pub.pem
# chmod 640 /etc/openshift/server_pub.pem
```

The ***AUTH_SALT*** setting in the **/etc/openshift/broker.conf** file must also be set. It must be secret and set to the same value across all brokers in a cluster, or scaling and Jenkins integration will not work. Create the random string using:

```
# openssl rand -base64 64
```

Important

If ***AUTH_SALT*** is changed after the broker is running, the broker service must be restarted:

```
# service openshift-broker restart
```

Further, if any gears are present when the value is changed again, run the **oo-admin-broker-auth** tool to recreate the broker authentication keys. Run the following command to rekey authentication tokens for all applicable gears:

```
# oo-admin-broker-auth --rekey-all
```

See the command's **--help** output and man page for additional options and more detailed use cases.

Configure the ***SESSION_SECRET*** setting in the **/etc/openshift/broker.conf** file to sign the Rails sessions. Ensure it is the same across all brokers in a cluster. Create the random string using:

```
# openssl rand -hex 64
```

Similar to ***AUTH_SALT***, if the ***SESSION_SECRET*** setting is changed after the broker is running, the broker service must be restarted. Note that all sessions are dropped when the broker service is restarted.

Configure a suitable SSH key to share between the broker host and all node hosts to facilitate moving gears between nodes. Create the key and copy it to the appropriate directory with:

```
# ssh-keygen -t rsa -b 2048 -f ~/.ssh/rsync_id_rsa
# cp ~/.ssh/rsync_id_rsa* /etc/openshift/
```

As part of the node host configuration, copy this key to the appropriate directory on each node host. See Section 9.9, “Configuring SSH Keys on the Node Host” for more information.

Note

If you use the kickstart or bash script, the **configure_access_keys_on_broker** function performs these steps.

7.8.5. Configuring the Standard SELinux Boolean Variables

The standard SELinux policy requires correct configuration of variables for the broker application. Configure these variables using:

```
# setsebool -P httpd_unified=on httpd_execmem=on
httpd_can_network_connect=on httpd_can_network_relay=on
httpd_run_stickshift=on named_write_master_zones=on allow_ypbind=on
```

Table 7.2. SELinux Boolean Variable Options

Boolean Variable	Purpose
httpd_unified	Allow the broker to write files in the **http** file context.
httpd_execmem	Allow **httpd** processes to write to and execute the same memory. This capability is required by Passenger (used by both the broker and the console) and by The Ruby Racer/V8 (used by the console).
httpd_can_network_connect	Allow the broker application to access the network.
httpd_can_network_relay	Allow the SSL termination Apache instance to access the back-end broker application.
httpd_run_stickshift	Enable Passenger-related permissions.
named_write_master_zones	Allow the broker application to configure DNS.
allow_ypbind	Allow the broker application to use **ypbind** to communicate directly with the name server.

Next, relabel the required files and directories with the correct SELinux contexts:

```
# fixfiles -R ruby193-rubygem-passenger restore
# fixfiles -R ruby193-mod_passenger restore
# restorecon -rv /var/run
# restorecon -rv /opt
```

Note

If you use the kickstart or bash script, the **configure_selinux_policy_on_broker** function performs these steps.

7.8.6. Configuring the Broker Domain

Modify the configuration files of the broker application to suit your domain name:

```
# sed -i -e "s/^CLOUD_DOMAIN=.*\$/CLOUD_DOMAIN=$domain/"
/etc/openshift/broker.conf
```

Note

If you use the kickstart or bash script, the **configure_controller** function performs this step.

7.8.7. Configuring the Broker Datastore

Update the broker application configuration to use the MongoDB user, password, and database name that you specified during the MongoDB configuration in Section 7.5.3, “Configuring MongoDB User Accounts”. Verify that the **MONGO_USER**, **MONGO_PASSWORD**, and **MONGO_DB** fields are configured correctly in the **/etc/openshift/broker.conf** file.

Example 7.7. Example MongoDB configuration in /etc/openshift/broker.conf

```
MONGO_USER="openshift"
MONGO_PASSWORD="password"
MONGO_DB="openshift_broker"
```

7.8.8. Configuring the Broker Plug-ins

Enable the required plug-ins for authentication, DNS, and messaging in the **/etc/openshift/plugins.d** directory. For example, the **example.conf** file enables the **example** plug-in. The contents of the **example.conf** file contain configuration settings in the form of lines containing ***key=value*** pairs. In some cases, the only requirement is to copy an example configuration. Other plug-ins, such as the DNS plug-in, require further configuration.

Change to the **/etc/openshift/plugins.d/** directory to access the files needed for the following configuration steps:

```
# cd /etc/openshift/plugins.d
```

Procedure 7.14. To Configure the Required Plug-ins:

1. Copy the example configuration file for the remote user authentication plug-in:

```
# cp openshift-origin-auth-remote-user.conf.example openshift-origin-auth-remote-user.conf
```

2. Copy the example configuration file for the MCollective messaging plug-in:

```
# cp openshift-origin-msg-broker-mcollective.conf.example openshift-origin-msg-broker-mcollective.conf
```

3. Configure the **dns-nsupdate** plug-in:

```
# cat << EOF > openshift-origin-dns-nsupdate.conf
BIND_SERVER="127.0.0.1"
BIND_PORT=53
BIND_KEYNAME="$domain"
BIND_KEYVALUE="$KEY"
BIND_KEYALGORITHM=HMAC-SHA256
BIND_ZONE="$domain"
EOF
```

Important

Verify that **$domain** and **$KEY** are configured correctly as described in Section 7.3.2, “Configuring BIND and DNS”.

Note

If you use the kickstart or bash script, the **configure_httpd_auth**, **configure_messaging_plugin**, and **configure_dns_plugin** functions perform these steps.

7.8.9. Configuring OpenShift Enterprise Authentication

With the remote user authentication plug-in, the broker service relies on the **httpd** service to handle authentication and pass on the authenticated user, or "remote user". Therefore, it is necessary to configure authentication in **httpd**. In a production environment, you can configure **httpd** to use LDAP, Kerberos, or another industrial-strength technology. This example uses Apache Basic Authentication and a **htpasswd** file to configure authentication.

Procedure 7.15. To Configure Authentication for the OpenShift Enterprise Broker:

1. Copy the example file to the correct location. This configures **httpd** to use **/etc/openshift/htpasswd** for its password file.

```
# cp /var/www/openshift/broker/httpd/conf.d/openshift-origin-auth-remote-user-basic.conf.sample /var/www/openshift/broker/httpd/conf.d/openshift-origin-auth-remote-user.conf
```

Important

The **/var/www/openshift/broker/httpd/conf.d/openshift-origin-auth-remote-user.conf** file must be readable by Apache for proper authentication. Red Hat recommends not making the file unreadable by **httpd**.

2. Create the **htpasswd** file with an initial user "demo":

```
# htpasswd -c /etc/openshift/htpasswd demo

New password:
Re-type new password:
Adding password for user demo
```

Note

If you use the kickstart or bash script, the **configure_httpd_auth** function performs these steps. The script creates the **demo** user with a default password, which is set to **changeme** in OpenShift Enterprise 2.0 and prior releases. With OpenShift Enterprise 2.1 and later, the default password is randomized and displayed after the installation completes. The **demo** user is intended for testing an installation, and must not be enabled in a production installation.

7.8.10. Configuring Bundler

Run the following command to verify that Bundler can find the necessary Ruby modules (or "gems") to run the broker Rails application:

```
# cd /var/www/openshift/broker
# scl enable ruby193 'bundle --local'
```

This command produces the following output:

```
Your bundle is complete! Use `bundle show [gemname]` to see where a bundled
gem is installed.
```

Configure the broker to start when you reboot Host 1:

```
# chkconfig openshift-broker on
```

Note

If you use the kickstart or bash script, the **configure_controller** function performs these steps.

Start the broker immediately:

```
# service httpd start
# service openshift-broker start
```

7.8.11. Verifying the Broker Configuration

Use the **curl** command on the broker host to retrieve the REST API base as a quick test to verify your broker configuration:

```
# curl -Ik https://localhost/broker/rest/api
```

Verify that a **200 OK** response is returned. Otherwise, try the command again without the **-I** option and look for an error message or Ruby backtrace:

```
# curl -k https://localhost/broker/rest/api
```

Chapter 8. Continuing Broker Host Installation for Enterprise

This section describes how to customize your broker installation for enterprise use, and provides information beyond the basic installation of an OpenShift Enterprise broker host.

8.1. Installing and Configuring DNS Plug-ins

OpenShift Enterprise must be able to make dynamic, real-time updates to a DNS domain to publish applications. A DNS plug-in on the broker handles these updates by creating or deleting CNAME records. The sample broker deployment described in Chapter 7, *Manually Installing and Configuring a Broker Host* installs and configures an nsupdate plug-in that modifies a name server according to RFC 2136 [2]. However, you can instead define and use a different plug-in that updates a DNS service of your choice.

To implement a different DNS plug-in, you can either develop your own or install and configure one of the supported plug-ins that are shipped with OpenShift Enterprise. If you choose to develop your own, inspect the nsupdate plug-in code as an example. The location of the gem and the source files varies depending on the version of the RPM package. Use the following command to find out the location of these files on your broker hosts:

```
# rpm -ql rubygem-openshift-origin-dns-nsupdate
```

Then see the ***Gem_Location*/lib/openshift/nsupdate_plugin.rb** file to observe the necessary functions.

If you choose to use one of the supported DNS plug-ins, see the following sections.

8.1.1. Installing and Configuring the Fog DNS Plug-in

Available starting in OpenShift Enterprise 2.2, the Fog DNS plug-in uses cloud DNS services to publish OpenShift Enterprise applications. Currently, this plug-in can only be configured for use with Rackspace® Cloud DNS.

See http://fog.io/dns for more information on Fog cloud DNS services.

See http://www.rackspace.com/cloud/dns for more information on Rackspace® Cloud DNS.

Procedure 8.1. To Install and Configure the Fog DNS Plug-in:

Perform all of the following steps on each broker host in your deployment.

1. Install the Fog DNS plug-in:

   ```
   # yum install rubygem-openshift-origin-dns-fog
   ```

2. Copy the example to create the configuration file:

   ```
   # cp /etc/openshift/plugins.d/openshift-origin-dns-fog.conf.example
   /etc/openshift/plugins.d/openshift-origin-dns-fog.conf
   ```

3. Edit the **/etc/openshift/plugins.d/openshift-origin-dns-fog.conf** file and set your Rackspace® Cloud DNS credentials.

   Example 8.1. Fog DNS Plug-in Configuration Using Rackspace® Cloud DNS

```
FOG_RACKSPACE_USERNAME="racker"
FOG_RACKSPACE_API_KEY="apikey"
FOG_RACKSPACE_REGION="ord"
```

4. Disable any other DNS plug-in that may be in use by moving its configuration file from the **/etc/openshift/plugins.d/** directory or renaming it so that it does not end with a **.conf** extension.

5. Restart the broker service to reload the configuration:

```
# service openshift-broker restart
```

8.1.2. Installing and Configuring the DYN® DNS Plug-in

Available starting in OpenShift Enterprise 2.1.6, the DYN® DNS plug-in uses the DYN® Managed DNS service to publish OpenShift Enterprise applications.

See http://dyn.com/managed-dns for more information on DYN® Managed DNS.

Procedure 8.2. To Install and Configure the DYN® DNS Plug-in:

Perform all of the following steps on each broker host in your deployment.

1. Install the DYN® DNS plug-in:

```
# yum install rubygem-openshift-origin-dns-dynect
```

2. Copy the example to create the configuration file:

```
# cp /etc/openshift/plugins.d/openshift-origin-dns-dynect.conf.example
/etc/openshift/plugins.d/openshift-origin-dns-dynect.conf
```

3. Edit the **/etc/openshift/plugins.d/openshift-origin-dns-dynect.conf** file and set your DYN® DNS credentials.

Example 8.2. DYN® DNS Plug-in Configuration

```
ZONE=Cloud_Domain
DYNECT_CUSTOMER_NAME=Customer_Name
DYNECT_USER_NAME=Username
DYNECT_PASSWORD=Password
DYNECT_URL=https://api2.dynect.net
```

4. Disable any other DNS plug-in that may be in use by moving its configuration file from the **/etc/openshift/plugins.d/** directory or renaming it so that it does not end with a **.conf** extension.

5. Restart the broker service to reload the configuration:

```
# service openshift-broker restart
```

8.1.3. Configuring the nsupdate DNS Plug-in for Compatible DNS Services

A basic installation of OpenShift Enterprise includes the default nsupdate DNS plug-in, as described in Section 7.3, "Installing and Configuring BIND and DNS", which updates a name server according to RFC 2136 [3]. In addition to BIND, this plug-in supports integration with other compatible DNS services as well.

Using Infoblox®

Because Infoblox® supports TSIG and GSS-TSIG updates, you can configure the nsupdate DNS plug-in to use an Infoblox® service to publish OpenShift Enterprise applications. See https://www.infoblox.com for more information on Infoblox®.

Configuring your Infoblox® service with the appropriate keys is outside of the scope of this guide, but once a key has been added to your zone, the configuration requirements on your OpenShift Enterprise hosts are the same as if you were using a BIND server.

Procedure 8.3. To Configure the nsupdate DNS Plug-in to Update an Infoblox® Service:

Perform all of the following steps on each broker host in your deployment.

1. The nsupdate DNS plug-in is installed by default during a basic installation of OpenShift Enterprise, but if it is not currently installed, install the *rubygem-openshift-origin-dns-nsupdate* package:

```
# yum install rubygem-openshift-origin-dns-nsupdate
```

2. Edit the **/etc/openshift/plugins.d/openshift-origin-dns-nsupdate.conf** file and set values appropriate for your Infoblox® service and zone:

```
BIND_SERVER="Infoblox_Name_Server"
BIND_PORT=53
BIND_KEYNAME="Key_Name"
BIND_KEYVALUE="Key_Value"
BIND_KEYALGORITHM=Key_Algorithm_Type
BIND_ZONE="Zone_Name"
```

3. Disable any other DNS plug-in that may be in use by moving its configuration file from the **/etc/openshift/plugins.d/** directory or renaming it so that it does not end with a **.conf** extension.

4. Restart the broker service to reload the configuration:

```
# service openshift-broker restart
```

8.2. Configuring User Authentication for the Broker

User authentication on OpenShift Enterprise with the standard remote user authentication plug-in uses Apache HTTP Server authentication methods. When a user is successfully authenticated for the first time, the broker host creates a user record in MongoDB. Therefore, a user can be added by creating the user in your preferred authentication repository.

OpenShift Enterprise supports any form of Apache authentication capable of setting the **REMOTE_USER** Apache environment variable securely. The following sections provide details on configuring user authentication on the broker for a number of popular authentication methods.

Important

The authentication configuration must be the same for both the broker application and the Management Console. For example, if the broker application is configured to use LDAP, the same configuration must be updated for the Management Console. See Section 8.9.1, "Installing the Management Console" for more information on installing and updating the authentication configuration for the Management Console.

8.2.1. Authenticating Using htpasswd

The basic installation of OpenShift Enterprise uses a flat **/etc/openshift/htpasswd** file that contains hashes of user passwords. Although this simple and standard method allows access with the **httpd** service, it is not very manageable, nor is it scalable. It is only intended for testing and demonstration purposes.

The list of OpenShift Enterprise users is stored with each user on a separate line in the **/etc/openshift/htpasswd** file on the broker host. You must have administrative access to the broker host to create and update this file. If multiple broker hosts are used for redundancy, a copy of the **/etc/openshift/htpasswd** file must exist on each broker host.

User password hashes can be created with the **htpasswd** tool, which is available for most operating systems from http://httpd.apache.org/docs/2.2/programs/htpasswd.html. For Red Hat Enterprise Linux, the **htpasswd** tool is part of the *httpd-tools* RPM.

Run **htpasswd** from wherever it is available to create a hash for a user password:

Example 8.3. Creating a Password Hash

```
# htpasswd -n bob

New password:  ######
Re-type new password:  ######
user:$apr1$IOzWzW6K$81cqXmwmZKqp6nWJPB6q31
```

The output can then be sent to an OpenShift Enterprise administrator, who can update the **/etc/openshift/htpasswd** file to provide access to users with their chosen password. Because the user password is a hash of the password, the user's password is not visible to the administrator.

8.2.2. Authenticating Using LDAP

Edit the **/var/www/openshift/broker/httpd/conf.d/openshift-origin-auth-remote-user.conf** file to configure LDAP authentication to allow OpenShift Enterprise users. The following process assumes that an Active Directory server already exists.

OpenShift Enterprise uses the Apache module **mod_authnz_ldap** for support in authenticating to directory servers. Therefore, every other directory server with the same option is supported by OpenShift Enterprise. To configure the **mod_authnz_ldap** option, configure the **openshift-origin-auth-remote-user.conf** file on the broker host to allow both broker and node host access.

Alternatively, use the example configuration provided, specifying your existing LDAP service parameters. Use the following commands to locate the example configuration:

```
# cd /var/www/openshift/broker/httpd/conf.d/
# cp openshift-origin-auth-remote-user-ldap.conf.sample openshift-origin-auth-remote-user.conf
# vim openshift-origin-auth-remote-user.conf
```

Important

Note that if you have installed the OpenShift Enterprise Management Console, or plan on installing it, you must also perform the same actions with the **/var/www/openshift/console/httpd/conf.d/openshift-origin-auth-remote-user.conf** file.

This example file specifies an example server and query that must be modified to suit the requirements of your LDAP service. The most important information required is the ***AuthLDAPURL*** setting. Ensure the LDAP server's firewall is configured to allow access by the broker hosts. See the **mod_authnz_ldap** documentation at http://httpd.apache.org/docs/2.2/mod/mod_authnz_ldap.html for more information.

Restart the broker application for the changes to take effect:

```
# service openshift-broker restart
```

Note

Using this method, user administration must be performed with your LDAP service.

8.2.3. Authenticating Using Kerberos

Configuring Kerberos authentication to authenticate OpenShift Enterprise users is beyond the scope of this guide. Consult your IT department for more information.

However, an example configuration that can be edited is provided to specify your Kerberos service parameters:

```
# cd /var/www/openshift/broker/httpd/conf.d/
# cp openshift-origin-auth-remote-user-kerberos.conf.sample openshift-origin-auth-remote-user.conf
# vim openshift-origin-auth-remote-user.conf
```

Modify the ***KrbServiceName*** and ***KrbAuthRealms*** settings to suit the requirements of your Kerberos service. Ensure the Kerberos server's firewall is configured to allow access by the broker hosts. See the **mod_auth_kerb** documentation at http://modauthkerb.sourceforge.net/configure.html for more information.

Restart the broker application for your changes to take effect:

```
# service openshift-broker restart
```

Note

Using this method, user administration must be performed with your Kerberos service.

8.2.4. Authenticating Using Mutual SSL

Mutual SSL authentication, commonly referred to as x509 or two-way authentication, allows for an application developer, which is the SSL client, to authenticate to an application, which is the SSL server, and vice versa. Each side has a verification certificate, which is shared upon connection. Using mutual authentication ensures an additional level of security in your deployment, because without the approved authentication certificate a user is unable to connect to the SSL server.

Apache supports mutual SSL authentication natively in Red Hat Enterprise Linux 6; however, the SSL connection for the broker in OpenShift Enterprise 2 terminates by default on a separate Apache instance from the one that runs the broker application. Therefore, you must take special care when modifying the default configurations to securely pass the trusted **`REMOTE_USER`** to the broker.

Ensuring mutual SSL authentication on your OpenShift Enterprise instance requires the completion of a series of procedures, outlined below. Each procedure is for a different interaction component of your installation: the broker proxy, the broker application, and, if it has been installed, the Management Console. After the broker has been configured, developers must also configure their client tools to use mutual SSL authentication, which is covered in the *OpenShift Enterprise User Guide* [4].

Procedure 8.4. To Modify the Broker Proxy Configuration for Mutual SSL Authentication:

While it is possible to translate the following configuration changes to a proxy or load balancer of your choice, this procedure assumes that Apache is being used to terminate the SSL connection for the broker. The default proxy on the broker is configured by the **`/etc/httpd/conf.d/000002_openshift_origin_broker_proxy.conf`** file.

1. Edit the **`/etc/httpd/conf.d/000002_openshift_origin_broker_proxy.conf`** file on the broker host and add the following lines in the **`<VirtualHost *:443>`** block directly after the **`SSLProxyEngine`** directive, removing any other **`SSLCertificateFile`**, **`SSLCertificateKeyFile`**, and **`SSLCACertificateFile`** directives that may have previously been set:

```
SSLOptions +StdEnvVars
SSLCertificateFile path/to/SSL/certificate/file
SSLCertificateKeyFile path/to/certificate/keyfile
SSLCACertificateFile path/to/SSLCA/certificate/file
SSLVerifyClient optional
SSLVerifyDepth  2
RequestHeader set X-Remote-User %{SSL_CLIENT_S_DN_CN}e
env=SSL_CLIENT_S_DN_CN
```

   These directives serve the following functions for the SSL virtual host:

   - The **`SSLCertificateFile`**, **`SSLCertificateKeyFile`**, and **`SSLCACertificateFile`** directives are critical, because they set the paths to the certificates.
   - The **`SSLVerifyClient`** directive set to **`optional`** is also critical as it accommodates certain broker API calls that do not require authentication.

- The **SSLVerifyDepth** directive can be changed based on the number of certificate authorities used to create the certificates.
- The **RequestHeader** directive set to the above options allows a mostly standard broker proxy to turn the CN from the client certificate subject into an **X_REMOTE_USER** header that is trusted by the back-end broker. Importantly, ensure that the traffic between the SSL termination proxy and the broker application is trusted.

2. Restart the broker proxy:

```
# service httpd restart
```

Procedure 8.5. To Modify the Broker Application Configuration for Mutual SSL Authentication:

1. Edit the **/var/www/openshift/broker/httpd/conf.d/openshift-origin-auth-remote-user.conf** file on the broker host to be exactly as shown:

```
<Location /broker>
  # Broker handles auth tokens
  SetEnvIfNoCase Authorization Bearer passthrough

  # Console traffic will hit the local port.  mod_proxy will set this
header automatically.
  SetEnvIf X-Forwarded-For "^$" passthrough=1
  # Turn the Trusted header into the Apache environment variable for
the broker remote-user plugin
  SetEnvIf X-Remote-User "(..*)" REMOTE_USER=$1 passthrough=1

  # Old-style auth keys are POSTed as parameters. The deployment
registration
  # and snapshot-save use this.
  BrowserMatchNoCase ^OpenShift passthrough
  # Older-style auth keys are POSTed in a header.  The Jenkins
cartridge does
  # this.
  SetEnvIf broker_auth_key "^[A-Za-z0-9+/=]+$" passthrough=1

   Allow from env=passthrough

    # Allow the specific requests that can passthrough and then deny
everything else.  The following requests can passthrough:
    #
    # * Use Bearer authentication
    # * Use Broker authentication tokens
    # * Originate from the trusted Console
   Order Allow,Deny
</Location>

# The following APIs do not require auth:
#
# /api
# /environment
# /cartridges
# /quickstarts
#
# We want to match requests in the form of:
```

```
#
# /api
# /api.json
# /api/
#
# But not:
#
# /api_with_auth
<LocationMatch ^/broker/rest/(api|environment|cartridges|quickstarts)
(\.\w+|/?|/.*)$>
  <IfVersion >= 2.4>
    Require all granted
  </IfVersion>
  <IfVersion < 2.4>
    Allow from all
  </IfVersion>
</LocationMatch>
```

2. Set the following in the **/etc/openshift/plugins.d/openshift-origin-auth-remote-user.conf** file:

```
TRUSTED_HEADER="HTTP_X_REMOTE_USER"
```

3. Restart the broker service for the changes to take effect:

```
# service openshift-broker restart
```

Procedure 8.6. To Modify the Management Console Configuration for Mutual SSL Authentication:

If you have installed the optional Management Console, it must be configured before mutual SSL authentication can be used. See Section 8.9, “Management Console” first for instructions on installing the Management Console.

1. Edit the **/var/www/openshift/console/httpd/conf.d/openshift-origin-auth-remote-user.conf** file on the broker host and add the following:

```
<Location /console>
    # The node->broker auth is handled in the Ruby code
    BrowserMatch Openshift passthrough
    Allow from env=passthrough

    # Turn the Console output header into the Apache environment
variable for the broker remote-user plugin
    SetEnvIf X-Remote-User "(..*)" REMOTE_USER=$1

    Order Deny,Allow
</Location>
```

2. Set the following in the **/etc/openshift/console.conf** file:

```
REMOTE_USER_HEADER=HTTP_X_REMOTE_USER
```

3. Restart the Management Console service for the changes to take effect:

```
# service openshift-console restart
```

Procedure 8.7. To Test the Mutual SSL Configuration:

1. Run the following command and ensure it returns successfully:

```
# curl -k https://broker.example.com/broker/rest/api
```

2. Run the following command and ensure it returns with a **403 Forbidden** status code:

```
# curl -k https://broker.example.com/broker/rest/user
```

3. Run the following commands and ensure they return successfully:

```
# curl --cert path/to/certificate/file --key
path/to/certificate/keyfile --cacert path/to/SSLCA/certificate/file
https://broker.example.com/broker/rest/api
# curl --cert path/to/certificate/file --key
path/to/certificate/keyfile --cacert path/to/SSLCA/certificate/file
https://broker.example.com/broker/rest/user
```

   Note that the above commands may need to be altered with the **--key** option if your key and certificate are not located in the same PEM file. This option is used to specify the key location if it differs from your certificate file.

To test using the client tools, each application developer must first configure them to use mutual SSL authentication. See the *OpenShift Enterprise User Guide* [4] for instructions.

8.2.5. Integrating Active Directory Authentication with Identity Management

Identity Management (IdM) on Red Hat Enterprise Linux provides a simple, centralized solution to securely manage user authentication. IdM integrates industry standard protocols and servers, such as Kerberos, LDAP, DNS, NTP, and X509 Certificates, into a secure, reliable, and scalable identity management solution.

As a system administrator, you might already source your authentication methods into one location using IdM. IdM defines a domain, with servers and clients who share centrally-managed services, like Kerberos and DNS. OpenShift Enterprise can take advantage of the various features available with IdM. Integration with IdM is ideal, because the authorization and authentication framework in IdM easily supports protocols such as Kerberos, LDAP, DNS, NTP, and x509 Authentication.

Complete the following procedures in the following order presented to integrate IdM into your OpenShift Enterprise instance.

Note

The following steps assume Active Directory and IdM are installed in your OpenShift Enterprise infrastructure.

Procedure 8.8. To Configure the Firewall Ports:

Before the IdM integration can occur, ensure the IdM server can access your instance by configuring the firewall ports. Perform the following steps on all hosts (broker, nodes, etc).

1. Save the existing firewall configuration and keep as a backup:

```
# cp -p /etc/sysconfig/iptables{,.pre-idm}
```

2. Create a new chain named ipa-client-chain. This contains the firewall rules for the ports needed by IdM:

```
# iptables --new-chain ipa-client-chain
# iptables --insert INPUT --jump ipa-client-chain
```

3. Perform the following step for each required port:

```
# iptables --append ipa-client-chain --protocol Protocol --
destination-port Port_Number --jump ACCEPT
```

A list of ports that may be being used in your instance are listed in Section 5.2.1, “Custom and External Firewalls”. The **--protocol** option indicates the protocol of the rule to check. The specified protocol can be tcp, udp, udplite, icmp, esp, ah, or sctp, or you can use ""all" to indicate all protocols.

4. Save the new firewall configuration, restart the iptables service, then ensure the changes are set upon reboot:

```
# iptables-save > /etc/sysconfig/iptables
# service iptables restart
# chkconfig iptables on
```

5. For each OpenShift host, verify that the IdM server and replica are listed in the **/etc/resolv.conf** file. The IdM server and replica must be listed before any additional servers.

Example 8.4. Featured IdM Server and Replica in the /etc/resolv.conf File

```
domain broker.example.com
search broker.example.com
nameserver 10.19.140.101 nameserver 10.19.140.102
nameserver 10.19.140.423
```

6. Now that the IdM server has been configured, configure each OpenShift host to be a IdM client, then verify the Kerberos and IdM lookups. Install the ipa-client package on each host, then run the install tool:

```
# yum install ipa-client
# ipa-client-install --enable-dns-updates --ssh-trust-dns --mkhomedir
```

The **--enable-dns-updates** option permits the IdM client to dynamically register its IP address with the DNS service on the IdM server. The **--ssh-trust-dns** option configures OpenSSH to allow any IdM DNS records where the host keys are stored. The **--mkhomedir** option automatically creates a home directory on the client upon the user's first login. Note that if DNS is properly configured, then the install tool will detect the IdM server through autodiscovery. If the autodiscovery fails, the install can be run with the **--server** option with the IdM server's FQDN.

7. Next, verify that Kerberos and IdM lookups are functioning by using the following command on each host, entering a password when prompted:

```
# kinit admin
Password for admin@BROKER.EXAMPLE.COM: *******
# klist
# id admin
```

Then, use the same command for each user:

```
# id Username
```

Note

If the IdM server has been re-deployed since installation, the CA certificate may be out of sync. If so, you might receive an error with your LDAP configuration. To correct the issue, list the certificate files, re-name the certificate file, then re-run the install:

```
# ll /etc/ipa
# mv /etc/ipa/ca.crt /etc/ipa/ca.crt.bad
# ipa-client-install --enable-dns-updates --ssh-trust-dns --
mkhomedir
```

Configuring for Application Developers

While your OpenShift Enterprise instance is now configured for IdM use, the next step is to configure any application developer interaction with the broker host for use with IdM. This will allow each developer to authenticate to the broker host.

Procedure 8.9. To Authorize Developer Interaction with the Broker Host:

1. On the IdM server, create a HTTP web server for each of your running brokers. This allows the broker host to authenticate to the IdM server using Kerberos. Ensure to replace *broker1* with the hostname of the desired broker host, and *broker.example,com* with the IdM server hostname configured in the above procedure:

   ```
   # ipa service-add HTTP/broker1.broker.example.com
   ```

2. Create a HTTP Kerberos keytab on the broker host. This will provide secure access to the broker web services:

   ```
   # ipa-getkeytab -s idm-srv1.broker.example.com \
   # ipa-getkeytab -p HTTP/broker1.broker.example.com@BROKER.EXAMPLE.COM
   \
   # ipa-getkeytab -k /var/www/openshift/broker/httpd/conf.d/http.keytab
   # chown apache:apache
   /var/www/openshift/broker/httpd/conf.d/http.keytab
   ```

   If you have multiple brokers, copy the keyfile to the other brokers.

3. If your instance has not completed Section 8.2.3, “Authenticating Using Kerberos” in the *OpenShift Enterprise Deployment Guide*, follow it now to authenticate to the broker host using Kerberos.

4. Restart the broker and Console services:

```
# service openshift-broker restart
# service openshift-console restart
```

5. Create a backup of the nsupdate plug-in. The nsupdate plug-in facilitates any updates to the dynamic DNS zones without the need to edit zone files or restart the DNS server:

```
# cp -p /etc/openshift/plugins.d/openshift-origin-dns-
nsupdate.conf{,.orig}
```

Then, edit the file and replace with the contents below:

```
BIND_SERVER="10.19.140.101"
BIND_PORT=53
BIND_ZONE="broker.example.com"
BIND_KRB_PRINCIPAL="DNS/broker1.broker.example.com@BROKER.EXAMPLE.COM"
BIND_KRB_KEYTAB="/etc/dns.keytab"
```

Ensure that ***BIND_SERVER*** points to the IP address of the IdM server, ***BIND_ZONE*** points to the domain name, and the ***BIND_KRB_PRINCIPAL*** is correct. The ***BIND_KRB_KEYTAB*** is configured after the DNS service is created and when the zones are modified for dynamic DNS.

6. Create the broker DNS service. Run the following command for each broker host:

```
# ipa service-add DNS/broker1.broker.example.com
```

7. Modify the DNS zone to allow the broker host to dynamically register applications with IdM. Perform the following on the idM server:

```
# ipa dnszone-mod interop.example.com --dynamic-update=true --update-
policy= \ "grant DNS\047\broker1.broker.example.com@BROKER.EXAMPLE.COM
wildcard * ANY;\"
```

Ensure to repeat the second line for each broker if you have multiple broker hosts.

8. Generate DNS keytabs on the broker using the **ipa-getkeytab**. Repeat the following for each broker host:

```
# ipa-getkeytab -s idm-srv1.interop.example.com \
# ipa-getkeytab -p DNS/broker1.broker.example.com \
# ipa-getkeytab -k /etc/dns.keytab
# chown apache:apache /etc/dns.keytab
```

9. Restart the broker service:

```
# service openshift-broker restart
```

10. The dynamic DNS is now ready for use with the client tools. Configure the client tools by running **rhc setup** specifying the IdM broker as the server:

```
# rhc setup --server=broker.broker.example.com
```

11. To verify the client tools, check the domain connectivity and deploy a test application:

```
# rhc domain show
# rhc app create App_Name Cartridge_Name
```

To verify the OpenShift Enterprise broker host, run the **oo-accept-broker** utility from the broker host. Test the full environment with the **oo-diagnostics** utility:

```
# oo-accept-broker
# oo-diagnostics
```

Additionally, you can verify the broker and Console access by obtaining a Kerberos ticket and testing the authentication with the following command:

```
# kinit IdM_Server_Hostname
```

Then running the following commands for each broker host:

```
# curl -Ik --negotiate -u :
https://broker1.broker.example.com/broker/rest/domains
# curl -Ik --negotiate -u : https://broker1.broker.example.com/console
```

8.3. Separating Broker Components by Host

For the broker application to function properly, not all components must be installed on the same broker host where the broker application is installed. Instead, the logical components of OpenShift Enterprise can be installed and configured on separate hosts. Red Hat recommends this configuration for ease of management. The necessary configuration differences from the basic installation of each component, as detailed in Chapter 7, *Manually Installing and Configuring a Broker Host*, are described in the subsequent sections.

8.3.1. BIND and DNS

The broker application requires an update key to update a remote BIND server. This is regardless of whether you are using a BIND server that is delegated specifically for an OpenShift Enterprise installation by your organization's DNS, or if your organization provides key-based update access to an existing BIND server for the domain used by OpenShift Enterprise.

The HMAC-SHA256 key generated by the **dnssec-keygen** tool in Section 7.3.2, “Configuring BIND and DNS” is saved in the **/var/named/*domain*.key** file, where *domain* is your chosen domain. Note the value of the ***secret*** parameter and enter it in the ***CONF_BIND_KEY*** field in the OpenShift Enterprise install script. Alternatively, enter it directly in the ***BIND_KEYVALUE*** field of the **/etc/openshift/plugins.d/openshift-origin-dns-nsupdate.conf** broker host configuration file.

The **oo-register-dns** command registers a node host's DNS name with BIND, and it can be used to register a **localhost** or a remote name server. This command is intended as a convenience tool that can be used with demonstrating OpenShift Enterprise installations that use standalone BIND DNS.

Red Hat recommends defining two separate domains: one to contain the fixed OpenShift Enterprise hosts, and another for the dynamic application namespace. The two domains do not have to be related. The broker application only needs to update the dynamic domain. In most production installations, the **oo-register-dns** command is not required because existing IT processes handle host DNS. However, if the command is used for defining host DNS, the update key must be available for the domain that contains the hosts.

The **oo-register-dns** command requires a key file to perform updates. If you created the

/var/named/$*domain*.key file described in Section 7.3.2.1, "Configuring Sub-Domain Host Name Resolution", copy this to the same location on every broker host as required. Alternatively, use the randomized **.key** file generated directly by the **dnssec-keygen** command, but renamed to **$*domain*.key**. The **oo-register-dns** command passes the key file to **nsupdate**, so either format is valid.

8.3.2. MongoDB

The basic installation in Chapter 7, *Manually Installing and Configuring a Broker Host* demonstrates installing MongoDB where the broker host only has **localhost** access. Bind MongoDB to an external IP address and open the correct port in the firewall to use a remote MongoDB with the broker application.

Modify the ***bind_ip*** setting in the **/etc/mongodb.conf** file to bind MongoDB to an external address. Either use the specific IP address, or substitute **0.0.0.0** to make it available on all interfaces:

```
# sed -i -e "s/^bind_ip = .*\$/bind_ip = 0.0.0.0/" /etc/mongodb.conf
```

Restart the MongoDB service for the changes to take effect:

```
# service mongod restart
```

Use the **lokkit** command to open the MongoDB port in the firewall:

```
# lokkit --port=27017:tcp
```

Important

These instructions grant access from any host. Therefore, Red Hat recommends using **iptables** to specify which hosts (in this case, all configured broker hosts) are allowed to connect. Otherwise, use a network topology that only allows authorized hosts to connect. Most importantly, ensure that node hosts are not allowed to connect to MongoDB.

Note

Because MongoDB connections are not encrypted, anyone with the ability to intercept network traffic can capture authentication and usage information in plain text. To avoid this, ensure MongoDB binds to **localhost** and use an SSH tunnel from the remote broker hosts to provide access.

8.4. Configuring Redundancy

Redundancy typically provides high-availability and scaling. Because developers only interact with an OpenShift Enterprise broker host sporadically, scaling is less of a concern because a typical installation is not large enough to generate traffic to overwhelm even a single broker host. Therefore, this section concentrates on high-availability of your broker host through redundancy. Several options are available to configure redundancy with your OpenShift Enterprise installation.

As mentioned in Section 8.3, "Separating Broker Components by Host", the major components of OpenShift Enterprise can be installed and configured on separate hosts and multiplied for redundancy. Alternatively, here are some redundant topologies to consider:

- Install broker, ActiveMQ, MongoDB, and name server on each host
- Install broker, ActiveMQ, MongoDB, and name server separately on different hosts
- Install broker and MongoDB together on multiple hosts, and install ActiveMQ separately on multiple hosts

Each host can then be made redundant to suit your requirements. Choose a configuration that best suits your particular installation.

Note

If you have multiple broker hosts configured for redundancy, ensure that each node host has the **rsync_id_rsa.pub** public key of each broker host. See Section 9.9, “Configuring SSH Keys on the Node Host” for more information.

8.4.1. BIND and DNS

Red Hat recommends that you configure redundancy for your BIND and DNS configuration to provide high availability. Consult your IT department for more information on how to leverage your existing solutions to configure redundancy for your OpenShift Enterprise installation.

8.4.2. Authentication

Regardless of the selected authentication method for your OpenShift Enterprise installation, it is your responsibility to add redundancy to that method for high availability. Consult your IT department for more information on how to configure redundancy for the selected authentication method.

8.4.3. MongoDB

Use replica sets to achieve redundancy with MongoDB. See the following documents on the MongoDB website for more background information:

- *Replication* - http://docs.mongodb.org/manual/replication/
- *Convert a Standalone to a Replica Set* - http://docs.mongodb.org/manual/tutorial/convert-standalone-to-replica-set/

The following instructions describe how to create a replica set with the MongoDB package included with OpenShift Enterprise.

Procedure 8.10. To Install MongoDB on Each Host:

1. On a minimum of three hosts, install MongoDB and turn on the MongoDB service to make it persistent:

```
# yum install -y mongodb-server mongodb
# chkconfig mongod on
```

2. If you choose to install MongoDB using the basic install script provided, you must also delete the initial data from all but one installation to make it a part of the replica set. Stop the MongoDB service and delete the data using:

```
# service mongod stop
# rm -rf /var/lib/mongodb/*
```

Procedure 8.11. To Configure the MongoDB Service on Each Host:

1. Edit the **/etc/mongodb.conf** file and modify or add the following information:

```
bind_ip = 0.0.0.0  # allow access from all interfaces
auth = true
rest = true
smallfiles = true
keyFile = /etc/mongodb.keyfile
replSet = ose
journal = true
```

The following table provides a brief description of each setting from the example above.

Table 8.1. Descriptions of /etc/mongodb.conf Settings

Setting	Description
bind_ip	This specifies the IP address MongoDB listens on for connections. Although the value must be an external address to form a replica set, this procedure also requires it to be reachable on the **localhost** interface. Specifying **0.0.0.0** binds to both.
auth	This enables the MongoDB authentication system, which requires a login to access databases or other information.
rest	This enables the simple REST API used by the replica set creation process.
replSet	This names a replica set, and must be consistent among all the members for replication to take place.
keyFile	This specifies the shared authentication key for the replica set, which is created in the next step.
journal	This enables writes to be journaled, which enables faster recoveries from crashes.
smallfiles	This reduces the initial size of data files, limits the files to 512MB, and reduces the size of the journal from 1GB to 128MB.

2. Create the shared key file with a secret value to synchronize the replica set. For security purposes, create a randomized value, and then copy it to all of the members of the replica set. Verify that the permissions are set correctly:

```
# echo "sharedkey" > /etc/mongodb.keyfile
# chown mongodb.mongodb /etc/mongodb.keyfile
# chmod 400 /etc/mongodb.keyfile
```

3. Configure the firewall to allow MongoDB traffic on each host using the **lokkit** command:

```
# lokkit --port=27017:tcp
```

Red Hat Enterprise Linux provides different methods for configuring firewall ports. Alternatively, use **iptables** directly to configure firewall ports.

4. Start the MongoDB service on each host:

```
# service mongod start
```

Note

If you use the kickstart or bash script, the **configure_datastore_add_replicants** function performs the steps in the previous two procedures.

After all hosts to be included in the replica set are configured and started, use the MongoDB shell to connect to the primary instance and define the replica set. Although you might have already added data to the primary instance, other instances must be empty.

Procedure 8.12. To Form a Replica Set:

1. Authenticate to the **admin** database and initiate the **ose** replica set:

```
# mongo
> use admin
switched to db admin

> db.auth("admin", "password")
1

> rs.initiate()
{
 "info2" : "no configuration explicitly specified -- making one",
 "me" : "mongo1.example.com:27017",
 "info" : "Config now saved locally.  Should come online in about a
minute.",
 "ok" : 1
}
```

2. Wait a few moments then press **Enter** until you see the ***ose*:PRIMARY** prompt. Then add new members to the replica set:

```
ose:PRIMARY> rs.add("mongo2.example.com:27017")
{ "ok" : 1 }
```

   Repeat as required for all datastore hosts, using the FQDN or any resolvable name for each host.

3. Verify the replica set members:

```
ose:PRIMARY> rs.status()
{
 "set" : "ose",
 "date" : ISODate("2013-12-02T21:33:43Z"),
 "myState" : 1,
 "members" : [
  {
   "_id" : 0,
   "name" : "mongo1.example.com:27017",
   "health" : 1,
   "state" : 1,
   "stateStr" : "PRIMARY",
```

```
    "uptime" : 1416,
    "optime" : Timestamp(1386019903, 1),
    "optimeDate" : ISODate("2013-12-02T21:31:43Z"),
    "self" : true
   },
   {
    "_id" : 1,
    "name" : "mongo2.example.com:27017",
    "health" : 1,
    "state" : 2,
    "stateStr" : "SECONDARY",
    "uptime" : 120,
    "optime" : Timestamp(1386019903, 1),
    "optimeDate" : ISODate("2013-12-02T21:31:43Z"),
    "lastHeartbeat" : ISODate("2013-12-02T21:33:43Z"),
    "lastHeartbeatRecv" : ISODate("2013-12-02T21:33:43Z"),
    "pingMs" : 1,
    "syncingTo" : "mongo1.example.com:27017"
   }
  ],
  "ok" : 1
}
[...]
```

Update all broker hosts to use the new replica set.

Procedure 8.13. To Configure the Broker Application to Use a Replica Set:

1. If you have not configured a MongoDB user named **openshift** to allow access to the broker host before forming the replica set as described in Chapter 7, *Manually Installing and Configuring a Broker Host*, add it now. Database changes at this point are synchronized among all members of the replica set.

2. Edit the **/etc/openshift/broker.conf** file on all broker hosts and set ***MONGO_HOST_PORT*** to the appropriate replica set members:

```
# For replica sets, use ',' delimiter for multiple servers
# Eg: MONGO_HOST_PORT="<host1:port1>,<host2:port2>..."
MONGO_HOST_PORT="mongo1.example.com:27017,mongo2.example.com:27017,mon
go3.example.com:27017"
MONGO_USER="openshift"
MONGO_PASSWORD="password"
MONGO_DB="openshift_broker"
```

8.4.4. ActiveMQ

ActiveMQ uses the term *broker* to identify an ActiveMQ server. However, this section distinguishes ActiveMQ brokers from OpenShift Enterprise broker hosts.

Because ActiveMQ services can be configured for redundancy, this section demonstrates redundancy with three servers to configure a redundant network of ActiveMQ brokers. This configuration provides the following advantages:

- Distributes queues and topics among ActiveMQ brokers
- Allows clients to connect to any Active MQ broker on the network

- Failover to another ActiveMQ broker if one fails

Connecting all ActiveMQ brokers to each other achieves this redundancy. See the following ActiveMQ documentation for more background information:

- *Clustering* - http://activemq.apache.org/clustering.html
- *How do distributed queues work* - http://activemq.apache.org/how-do-distributed-queues-work.html

8.4.4.1. Configuring a Network of ActiveMQ Brokers

This section describes how to configure a network of ActiveMQ brokers, and the example instructions show a configuration of three ActiveMQ brokers found on the following hosts:

- **`activemq1.example.com`**
- **`activemq2.example.com`**
- **`activemq3.example.com`**

Use the same configuration for all hosts, but substitute specific information to suit the requirements of each host.

Networked ActiveMQ brokers are configured differently from what is described in the basic installation. The following procedure describes how to configure a network of ActiveMQ brokers.

Procedure 8.14. To Configure a Network of ActiveMQ Brokers:

1. Install ActiveMQ with:

```
# yum install -y activemq
```

2. Modify the **`/etc/activemq/activemq.xml`** configuration file. Red Hat recommends downloading and using the sample **`activemq.xml`** file provided at https://raw.github.com/openshift/openshift-extras/enterprise-2.2/enterprise/install-scripts/activemq-network.xml as a starting point. Modify the host names, user names, and passwords to suit your requirements.

   However, if you choose to modify the default **`/etc/activemq/activemq.xml`** configuration file, use the following instructions to do so. Each change that must be made in the default **`/etc/activemq/activemq.xml`** file is described accordingly. Red Hat recommends that you create a backup of the default **`/etc/activemq/activemq.xml`** file before modifying it, using the following command:

```
# cp /etc/activemq/activemq.xml{,.orig}
```

   a. In the **`broker`** element, modify the **`brokerName`** and **`dataDirectory`** attributes, and add **`useJmx="true"`**:

```
<broker xmlns="http://activemq.apache.org/schema/core"
                brokerName="activemq1.example.com"
useJmx="true"
                dataDirectory="${activemq.base}/data">
```

   b. Modify the **`destinationPolicy`** element:

```
<destinationPolicy>
```

```
  <policyMap>
    <policyEntries>
      <policyEntry topic=">" producerFlowControl="false"/>
      <policyEntry queue="*.reply.>"
gcInactiveDestinations="true"
                              inactiveTimoutBeforeGC="300000" />
    </policyEntries>
  </policyMap>
</destinationPolicy>
```

c. Comment out or remove the **`persistenceAdapter`** element, and replace it with the **`networkConnectors`** element. This example is for the first ActiveMQ broker.

```
<networkConnectors>
  <networkConnector name="broker1-broker2-topic"
      uri="static:(tcp://activemq2.example.com:61616)"
        userName="amquser" password="amqpass">
    <excludedDestinations>
           <queue physicalName=">" />
      </excludedDestinations>
  </networkConnector>
  <networkConnector name="broker1-broker2-queue"
      uri="static:(tcp://activemq2.example.com:61616)"
      userName="amquser" password="amqpass"
      conduitSubscriptions="false">
    <excludedDestinations>
      <topic physicalName=">" />
    </excludedDestinations>
  </networkConnector>
  <networkConnector name="broker1-broker3-topic"
      uri="static:(tcp://activemq3.example.com:61616)"
      userName="amquser" password="amqpass">
    <excludedDestinations>
      <queue physicalName=">" />
    </excludedDestinations>
  </networkConnector>
  <networkConnector name="broker1-broker3-queue"
      uri="static:(tcp://activemq3.example.com:61616)"
      userName="amquser" password="amqpass"
       conduitSubscriptions="false">
    <excludedDestinations>
      <topic physicalName=">" />
    </excludedDestinations>
  </networkConnector>
</networkConnectors>
```

The **`networkConnectors`** element provides one-way message paths to other ActiveMQ brokers on the network. For a fault-tolerant configuration, the **`networkConnector`** element for each ActiveMQ broker must point to the other ActiveMQ brokers, and is specific to each host. In the example above, the **`activemq1.example.com`** host is shown.

Each **`networkConnector`** element requires a unique name and ActiveMQ broker. The names used here are in the **`localhost -> remotehost`** format, reflecting the direction of the connection. For example, the first ActiveMQ broker has a **`networkConnector`** element name prefixed with **`broker1-broker2`**, and the address corresponds to a connection to the

second host.

The **userName** and **password** attributes are for connections between the ActiveMQ brokers, and match the definitions described in the next step.

d. Add the **plugins** element to define authentication and authorization for MCollective, inter-broker connections, and administration purposes. The **plugins** element must be after the **networkConnectors** element. Substitute user names and passwords according to your local IT policy.

```
<plugins>
  <statisticsBrokerPlugin/>
  <simpleAuthenticationPlugin>
    <users>
      <authenticationUser username="mcollective"
            password="marionette"
groups="mcollective,everyone"/>
      <authenticationUser username="amquser"
            password="amqpass" groups="admins,everyone"/>
      <authenticationUser username="admin"
            password="password"
groups="mcollective,admin,everyone"/>
    </users>
  </simpleAuthenticationPlugin>
  <authorizationPlugin>
    <map>
      <authorizationMap>
        <authorizationEntries>
          <authorizationEntry queue=">"
                write="admins" read="admins" admin="admins" />
          <authorizationEntry topic=">"
                write="admins" read="admins" admin="admins" />
          <authorizationEntry topic="mcollective.>"
                write="mcollective" read="mcollective"
admin="mcollective" />
          <authorizationEntry queue="mcollective.>"
                write="mcollective" read="mcollective"
admin="mcollective" />
          <authorizationEntry topic="ActiveMQ.Advisory.>"
                read="everyone" write="everyone"
admin="everyone"/>
        </authorizationEntries>
      </authorizationMap>
    </map>
  </authorizationPlugin>
</plugins>
```

e. Add the **stomp transportConnector** (for use by MCollective) to the **transportConnectors** element. The **openwire transportConnector** is used for ActiveMQ inter-broker transport, and must not be modified. Configure the **transportConnectors** element as shown in the following example.

```
<transportConnectors>
  <transportConnector name="openwire"
uri="tcp://0.0.0.0:61616"/>
  <transportConnector name="stomp" uri="stomp://0.0.0.0:61613"/>
```

```
</transportConnectors>
```

3. Secure the ActiveMQ console by configuring Jetty, as described in the basic installation.

   a. Enable authentication and restrict the console to **localhost**:

   ```
   # cp /etc/activemq/jetty.xml{,.orig}
   # sed -i -e '/name="authenticate"/s/false/true/'
   /etc/activemq/jetty.xml
   ```

   b. Change the default **admin** password in the **/etc/activemq/jetty-realm.properties** file. The password is the same as the **admin** password in the authentication plug-in.

   ```
   # cp /etc/activemq/jetty-realm.properties{,.orig}
   # sed -i -e '/admin:/s/admin,/password,/' /etc/activemq/jetty-
   realm.properties
   ```

4. Modify the firewall to allow ActiveMQ **stomp** and **openshift** traffic:

   ```
   # lokkit --port=61613:tcp
   # lokkit --port=61616:tcp
   ```

   The basic installation only opens port 61613. Here, port 61616 has also been opened to allow ActiveMQ inter-broker traffic.

5. Restart the ActiveMQ service and make it persistent on boot:

   ```
   # service activemq restart
   # chkconfig activemq on
   ```

Note

If you use the kickstart bash script, the **configure_activemq** function performs these steps when multiple members are specified with **CONF_ACTIVEMQ_REPLICANTS**.

8.4.4.2. Verifying a Network of ActiveMQ Brokers Using the ActiveMQ Console

Confirm that the authentication is working with the following command:

```
# curl --head --user admin:password
http://localhost:8161/admin/xml/topics.jsp

HTTP/1.1 200 OK
[...]
```

A response of **200** means authentication is working correctly.

As shown in the following example, a basic response is expected when requesting topics.

```
# curl --user admin:password --silent
http://localhost:8161/admin/xml/topics.jsp
```

```
<topics>
</topics>
```

The topics are empty at this time because there is no messaging traffic.

With all ActiveMQ brokers running, use the console for each ActiveMQ broker to verify that they are communicating with each other. Because the console is only exposed on **localhost**, use a text browser such as **elinks** to verify locally. Alternatively, connect to your workstation using a secure tunnel and use a browser of your choice, as shown in the following example:

```
# ssh -L8161:localhost:8161 activemq1.example.com
```

After connecting to your workstation, use the browser of your choice to navigate to **http://localhost:8161/**. The password from the **/etc/activemq/jetty-realm.properties** file is required.

The **Network** tab at **http://localhost:8161/admin/network.jsp** shows two connections for each server on the network. For example, for a three broker network from the first server, it may be similar to the following example.

Example 8.5. Example Network Tab Output

```
                                                  Created  Messages
Messages
  Remote Broker                Remote Address        By     Enqueued
Dequeued
                                                  Duplex
  activemq2.example.com   tcp://192.168.59.163:61616 false    15
15
  activemq3.example.com   tcp://192.168.59.147:61616 false    15
15
```

The example shows duplex connections. The connection to port 61616 is an outgoing connection to remote hosts, while the other connections are incoming and used as ephemeral ports on remote hosts. If you only see one connection for a host, verify which host was to receive the missing connection. Then confirm that the firewall settings on that particular host allow connections to port 61616. If both outgoing and incoming connections are missing from a host, then most likely the ActiveMQ service failed to start on that host, or the service has crashed.

Note

OpenShift Enterprise only uses Jetty to verify that ActiveMQ is running properly, and does not require Jetty for ActiveMQ usage. After ActiveMQ has been verified, you can disable the use of Jetty by commenting out the lines in the **/etc/activemq/activemq.xml** file for loading the **/etc/activemq/jetty.xml** file.

8.4.4.3. Configuring MCollective for Redundant ActiveMQ Services

Edit the **/opt/rh/ruby193/root/etc/mcollective/client.cfg** file on a broker host to configure MCollective to use a pool of ActiveMQ services. Likewise, edit the

/opt/rh/ruby193/root/etc/mcollective/server.cfg file on a node host to do the same. In either case, replace the single ActiveMQ host connection with a pool configuration as shown in the following example.

Example 8.6. Example MCollective Configuration File

```
connector = activemq
plugin.activemq.pool.size = 3
plugin.activemq.pool.1.host=activemq1.example.com
plugin.activemq.pool.1.port=61613
plugin.activemq.pool.1.user=mcollective
plugin.activemq.pool.1.password=marionette
plugin.activemq.pool.2.host=activemq2.example.com
plugin.activemq.pool.2.port=61613
plugin.activemq.pool.2.user=mcollective
plugin.activemq.pool.2.password=marionette
plugin.activemq.pool.3.host=activemq3.example.com
plugin.activemq.pool.3.port=61613
plugin.activemq.pool.3.user=mcollective
plugin.activemq.pool.3.password=marionette
```

Replace the user names and passwords with those you have configured on the ActiveMQ brokers.

Note

If you use the kickstart bash script, the **configure_mcollective_for_activemq_on_broker** fuction performs this step on the broker host, while the **configure_mcollective_for_activemq_on_node** function performs this step on the node host.

8.4.5. Broker Web Application

Because the broker application is stateless, enabling redundancy is relatively easy. You can set up instances on multiple hosts with a standard HTTP/HTTPS load balancer, such as Apache HTTP Server, HAProxy, or any existing solution, to distribute requests. Enabling sticky sessions is not required.

However, if access to redundant brokers is implemented with a reverse proxy, verify that the request from the proxy is for the public address. The broker API document is generated with the **Host:** header by which it is addressed; this includes URLs to various functionality. Clients can be directed to private URLs by way of the API document if the reverse proxy request does not preserve the client's **Host:** header.

For example, if you have a proxy at **broker.example.com** that distributes loads to **broker1.example.com** and **broker2.example.com**, the proxy request to **broker1.example.com** should be **https://broker.example.com**. If a **httpd** proxy is used, for example, enable the ***ProxyPreserveHost*** directive. For more information, see *ProxyPreserveHost Directive* at http://httpd.apache.org/docs/2.2/mod/mod_proxy.html#proxypreservehost.

Important

When multiple broker hosts are deployed, the authentication keys need to be the same for all broker hosts. Update **/etc/openshift/*server_pub.pem*** and **/etc/openshift/*server_priv.pem***, and update the ***AUTH_SALT*** setting in the**/etc/openshift/broker.conf** file. Failure to synchronize these will result in authentication failures where gears make requests to a broker host while using credentials created by a different broker host in scenarios such as auto-scaling, Jenkins builds, and recording deployments.

8.5. Installing and Configuring the Gear Placement Plug-in

When new gears are added to an application, a gear placement algorithm is used to find an available node on which to place each gear. You can either use the default algorithm or implement the gear placement plug-in to use a custom algorithm; see the *OpenShift Enterprise Administration Guide* for more information on the default algorithm.

The optional gear placement plug-in allows you to control the placement of gears as they are created. When in use, the plug-in receives information during gear creation about the application developer, cartridges, application, current gears that are in use, and available nodes. Then, using the configured algorithm, the plug-in is expected to return a node from the list of available nodes. An error or exception thrown by the plug-in results in the failure of the gear creation process and triggers a rollback of the operation.

You can develop a custom algorithm with a basic understanding of the Ruby programming language. This section describes how to install and configure the gear placement plug-in with default settings. After the plug-in is installed, see the following sections for information on developing custom algorithms and implementing them in your installation, including examples based on some hypothetical scenarios.

Procedure 8.15. To Install and Configure the Gear Placement Plug-in:

1. Install the gear placement plug-in on each broker host:

   ```
   # yum install rubygem-openshift-origin-gear-placement
   ```

   This installs a gem with a Rails engine containing the **GearPlacementPlugin** class.

2. On each broker host, copy the **/etc/openshift/plugins.d/openshift-origin-gear-placement.conf.example** file to **/etc/openshift/plugins.d/openshift-origin-gear-placement.conf**:

   ```
   # cp /etc/openshift/plugins.d/openshift-origin-gear-
   placement.conf.example /etc/openshift/plugins.d/openshift-origin-gear-
   placement.conf
   ```

   As long as this configuration file with a **.conf** extension exists, the broker automatically loads a gem matching the file name, and the gem can use the file to configure itself.

3. Restart the broker service:

   ```
   # service openshift-broker restart
   ```

   If you make further modifications to the configuration file of the gear placement plug-in, you must restart the broker service again after making your final changes.

4. The default implementation of the plug-in simply logs the plug-in inputs and delegates the actual gear placement to the default algorithm. You can verify that the plug-in is correctly installed and configured with the default implementation by creating an application and checking the **`/var/log/openshift/broker/production.log`** file.

Example 8.7. Checking Broker Logs for Default Gear Placement Plug-in Activity

```
2014-10-17 12:53:18.476 [INFO ] Parameters: {"cartridges"=>["php-
5.4"], "scale"=>true, "name"=>"mytestapp", "domain_id"=>"demo"}
(pid:14508)
2014-10-17 12:53:24.715 [INFO ] Using gear placement plugin to
choose node. (pid:14508)
2014-10-17 12:53:24.715 [INFO ] selecting from nodes:
node2.example.com, node1.example.com (pid:14508)
2014-10-17 12:53:24.718 [INFO ] server_infos: [#
<NodeProperties:0x00000007675438
  @district_available_capacity=5994,
  @district_id="5441e3896892df06a4000001",
  @name="node2.example.com",
  @node_consumed_capacity=3.3333333333333335,
  @region_id=nil,
  @zone_id=nil>,
 #<NodeProperties:0x00000006e302a0
  @district_available_capacity=5994,
  @district_id="5441e3896892df06a4000001",
  @name="node1.example.com",
  @node_consumed_capacity=6.666666666666667,
  @region_id=nil,
  @zone_id=nil>] (pid:14508)
2014-10-17 12:53:24.719 [INFO ] app_props: #
<ApplicationProperties:0x000000078b97a8
 @id="54446b0e6892dff4b5000001",
 @name="mytestapp",
 @web_cartridge="php-5.4"> (pid:14508)
2014-10-17 12:53:24.720 [INFO ] current_gears: [] (pid:14508)
2014-10-17 12:53:24.721 [INFO ] comp_list: [#
<ComponentProperties:0x000000076a8b08
  @cartridge_name="haproxy-1.4",
  @cartridge_vendor="redhat",
  @component_name="web_proxy",
  @version="1.4">,
 #<ComponentProperties:0x000000076a88d8
  @cartridge_name="php-5.4",
  @cartridge_vendor="redhat",
  @component_name="php-5.4",
  @version="5.4">] (pid:14508)
2014-10-17 12:53:24.724 [INFO ] user_props: #
<UserProperties:0x000000078b8f38
 @capabilities=
  {"ha"=>false,
   "subaccounts"=>false,
   "gear_sizes"=>["small"],
   "max_domains"=>10,
   "max_gears"=>100,
   "max_teams"=>0,
```

```
    "view_global_teams"=>false,
    "max_storage_per_gear"=>0},
 @consumed_gears=7,
 @id="5441e5f26892df39e9000001",
 @login="demo",
 @plan_id=nil,
 @plan_state=nil> (pid:14508)
2014-10-17 12:53:24.724 [INFO ] selected node: 'node2.example.com'
(pid:14508)
```

8.5.1. Developing and Implementing a Custom Gear Placement Algorithm

Prerequisites:

- Section 8.5, “Installing and Configuring the Gear Placement Plug-in”

You can develop a custom gear placement algorithm with a basic understanding of the Ruby programming language. After the gear placement plug-in is installed, the plug-in's configuration files, initializers, and gear placement algorithm source files are installed on the broker host. The location of the gem and these files varies depending on the version of the RPM package. Use the following command to find out the location of these files on your broker hosts:

```
# rpm -ql rubygem-openshift-origin-gear-placement
```

When developing a custom algorithm, you must modify the following files as required by your implementation:

***Gem_Location*/lib/openshift/gear_placement_plugin.rb**

This contains the **`GearPlacementPlugin`** class. Modify the **`self.select_best_fit_node_impl`** method to customize the algorithm.

***Gem_Location*/config/initializers/openshift-origin-gear-placement.rb**

This is the plug-in initializer that loads any configuration settings, if relevant.

/etc/openshift/plugins.d/openshift-origin-gear-placement.conf

This is where any relevant configuration settings for the plug-in can be defined.

Developing a Custom Algorithm

When you install the *rubygem-openshift-origin-gear-placement* RPM package, a gem with a Rails engine containing the **`GearPlacementPlugin`** class is also installed. The only method you must modify is **`self.select_best_fit_node_impl`** in the ***`Gem_Location`*`/lib/openshift/gear_placement_plugin.rb`** file, because it is the method invoked by the **`OpenShift::ApplicationContainerProxy`** class. Whenever a gear is created, the **`ApplicationContainerProxy.select_best_fit_node`** method is invoked, and if the gear placement plug-in is installed, that method invokes the plug-in.

A custom algorithm can be used for load balancing or to enforce constraints based on specified parameters. As seen in the **`self.select_best_fit_node_impl`** method signature, there are multiple data structures available for use in the algorithm:

```
GearPlacementPlugin.select_best_fit_node_impl(server_infos, app_props,
                  current_gears, comp_list, user_props, request_time)
```

Ultimately, the method must return exactly one of the entries from **`server_infos`**; it cannot be a node outside of this list. The ***`Gem_Location`*`/lib/openshift/`** directory contains several example algorithms for reference, which are also described in Section 8.5.2, “Example Gear Placement Algorithms”.

The following table describes each of the input data structures available to the algorithm:

Table 8.2. Input Data Structures

Data Structure	Description	Properties
server_infos	Array of server information: objects of class NodeProperties.	:name, :node_consumed_capacity, :district_id, :district_available_capacity, :region_id, :zone_id
app_props	Properties of the application to which the gear is being added: objects of class ApplicationProperties.	:id, :name, :web_cartridge
current_gears	Array of existing gears in the application: objects of class GearProperties.	:id, :name, :server, :district, :cartridges, :region, :zone
comp_list	Array of components that will be present on the new gear: objects of class ComponentProperties.	:cartridge_name, :component_name, :version, :cartridge_vendor
user_props	Properties of the user: object of class UserProperties.	:id, :login, :consumed_gears, :capabilities, :plan_id, :plan_state
request_time	The time that the request was sent to the plug-in: Time on the OpenShift Broker host.	Time.now

The default implementation of the plug-in simply logs the plug-in inputs and delegates the actual gear placement to the default algorithm, so you can check the example log output from the **`/var/log/openshift/broker/production.log`** file in Section 8.5, “Installing and Configuring the Gear Placement Plug-in” for examples of these inputs.

The **`server_infos`** entries provided to the algorithm are already filtered for compatibility with the gear request. They can be filtered by:

- Specified profile.
- Specified region.
- Full, deactivated, or undistricted nodes.
- Nodes without a region and zone, if regions and zones are in use.
- Zones being used in a high-availability application, depending on the configuration.
- Nodes being used in a scaled application. If this would return zero nodes, then only one is returned.
- Availability of UID and other specified constraints when a gear is being moved.

While developing your algorithm, be careful to consider many scenarios, as the above filters' effects can be subtle, depending on the circumstances. Particularly in the last two of the above filters, it would not be unusual for the **`server_infos`** list presented to the algorithm to only contain one node when the developer might expect there to be plenty of other nodes from which to choose. The intent of the plug-in currently is not to enable complete flexibility of node choice, but rather to enforce custom constraints or to load balance based on preferred parameters.

Using Configuration Settings

Optionally, you can implement configuration settings with the plug-in. To do so, you must:

1. Load them in the plug-in initializer in the ***Gem_Location*/config/initializers/openshift-origin-gear-placement.rb** file, and
2. Add and define the settings in the **/etc/openshift/plugins.d/openshift-origin-gear-placement.conf** file.

For example, the configuration settings in the default ***Gem_Location*/config/initializers/openshift-origin-gear-placement.rb** file are loaded using the following syntax:

```
config.gear_placement = { :confkey1 => conf.get("CONFKEY1", "value1"),
                          :confkey2 => conf.get("CONFKEY2", "value2"),
                          :confkey3 => conf.get("CONFKEY3", "value3") }
```

Add your new configuration settings to the initializer using the same syntax as above. The ***Gem_Location*/config/initializers/** directory contains several example initializers for use with their respective example algorithms described in Section 8.5.2, “Example Gear Placement Algorithms”.

Implementing a Custom Algorithm

Any changes to the ***Gem_Location*/lib/openshift/gear_placement_plugin.rb**, ***Gem_Location*/config/initializers/openshift-origin-gear-placement.rb**, or **/etc/openshift/plugins.d/openshift-origin-gear-placement.conf** files must be done equally across all broker hosts in your environment. After making the desired changes to any of these files, the broker service must be restarted to load the changes:

```
# service openshift-broker restart
```

You can verify that the plug-in is correctly configured with your custom implementation by creating an application and checking the **/var/log/openshift/broker/production.log** file for the expected logs.

8.5.2. Example Gear Placement Algorithms

Prerequisites:

- Section 8.5, “Installing and Configuring the Gear Placement Plug-in”
- Section 8.5.1, “Developing and Implementing a Custom Gear Placement Algorithm”

The example gear placement algorithms in this section are provided as a reference to help with the development of your own custom algorithms. They are for use on brokers that have the gear placement plug-in installed and are intended for testing or development purposes.

After installing the gear placement plug-in, these examples are also installed on the broker host for convenience. Most of the following example algorithms are located in the ***Gem_Location*/lib/openshift/** directory, with any related example initializers and configuration files located in the ***Gem_Location*/config/initializers/** and **/etc/openshift/plugins.d/** directories, respectively. See Section 8.5.1, “Developing and Implementing a Custom Gear Placement Algorithm” for information on implementing custom algorithms in your environment.

Administrator Constraint Examples

The following are administrator constraint example algorithms for the gear placement plug-in.

Example 8.8. Return the First Node in the List

```
def self.select_best_fit_node_impl(server_infos, app_props, current_gears,
comp_list, user_props, request_time)
  return server_infos.first
end
```

Example 8.9. Place PHP Applications on Specific Nodes

```
def self.select_best_fit_node_impl(server_infos, app_props, current_gears,
comp_list, user_props, request_time)
  unless %w[php-5.3 php-5.4].include? app_props.web_cartridge
    Rails.logger.debug("'#{app_props.web_cartridge}' is not a PHP app;
selecting a node normally.")
    return
OpenShift::MCollectiveApplicationContainerProxy.select_best_fit_node_impl(
server_infos)
  end
  php_hosts = Broker::Application.config.gear_placement[:php_hosts]
  Rails.logger.debug("selecting a php node from: #{php_hosts.join ', '}")
  # figure out which of the nodes given is allowed for php carts
  matched_server_infos = server_infos.select {|x| php_hosts.include?
(x.name) }
  matched_server_infos.empty? and
    raise "The gear-placement PHP_HOSTS setting doesn't match any of the
NodeProfile names"
  return matched_server_infos.sample #chooses randomly from the matched
hosts
end
```

This example can also be found in the ***Gem_Location*/lib/openshift/gear_placement_plugin.rb.pin-php-to-host-example** file. However, to prevent scalable or highly-available applications from behaving unpredictably as a result of the **server_infos** filters mentioned in Section 8.5.1, “Developing and Implementing a Custom Gear Placement Algorithm”, use the ***VALID_GEAR_SIZES_FOR_CARTRIDGE*** parameter in the **/etc/openshift/broker.conf** file in conjunction with profiles.

Example 8.10. Restrict a User's Applications to Slow Hosts

```
def self.select_best_fit_node_impl(server_infos, app_props, current_gears,
comp_list, user_props, request_time)
  config = Broker::Application.config.gear_placement
  pinned_user = config[:pinned_user]
  if pinned_user == user_props.login
    slow_hosts = config[:slow_hosts]
    Rails.logger.debug("user '#{pinned_user}' needs a gear; restrict to '#
{slow_hosts.join ', '}'")
    matched_server_infos = server_infos.select {|x| slow_hosts.include?
(x.name)}
    matched_server_infos.empty? and
      raise "The gear-placement SLOW_HOSTS setting does not match any
available NodeProfile names"
    return matched_server_infos.first
```

```
  else
    Rails.logger.debug("user '#{user_props.login}' is not pinned; choose a
node normally")
    return
OpenShift::MCollectiveApplicationContainerProxy.select_best_fit_node_impl(
server_infos)
  end
end
```

This example can also be found in the ***Gem_Location*/lib/openshift/gear_placement_plugin.rb.pin-user-to-host-example** file. However, this could prevent the user from scaling applications in some situations as a result of the **server_infos** filters mentioned in Section 8.5.1, “Developing and Implementing a Custom Gear Placement Algorithm”.

Example 8.11. Ban a Specific Vendor's Cartridges

```
def self.select_best_fit_node_impl(server_infos, app_props, current_gears,
comp_list, user_props, request_time)
  Rails.logger.debug("Using blacklist gear placement plugin to choose
node.")
  Rails.logger.debug("selecting from nodes: #{server_infos.map(:name).join
', '}")
  blacklisted_vendor =
Broker::Application.config.gear_placement[:blacklisted_vendor]
  unless blacklisted_vendor.nil?
    comp_list.each do |comp|
      if blacklisted_vendor == comp.cartridge_vendor
        raise "Applications containing cartridges from #
{blacklisted_vendor} are blacklisted"
      end
    end
  end
  Rails.logger.debug("no contraband found, choosing node as usual")
  return
OpenShift::MCollectiveApplicationContainerProxy.select_best_fit_node_impl(
server_infos)
end
```

This example can also be found in the ***Gem_Location*/lib/openshift/gear_placement_plugin.rb.blacklisted-vendor-example** file.

Resource Usage Examples

The following are resource usage example algorithms for the gear placement plug-in.

Example 8.12. Place a Gear on the Node with the Most Free Memory

```
def self.select_best_fit_node_impl(server_infos, app_props, current_gears,
comp_list, user_props, request_time)
  # collect memory statistic from all nodes
```

```
  memhash = Hash.new(0)

OpenShift::MCollectiveApplicationContainerProxy.rpc_get_fact('memoryfree')
{|name,mem| memhash[name] = to_bytes(mem)}
  Rails.logger.debug("node memory hash: #{memhash.inspect}")
  # choose the one from our list with the largest value
  return server_infos.max_by {|server| memhash[server.name]}
end

def self.to_bytes(mem)
  mem.to_f * case mem
    when /TB/; 1024 ** 4
    when /GB/; 1024 ** 3
    when /MB/; 1024 ** 2
    when /KB/; 1024
    else     ; 1
  end
end
```

This example can also be found in the ***Gem_Location*/lib/openshift/gear_placement_plugin.rb.free-memory-example** file.

Example 8.13. Sort Nodes by Gear Usage (Round Robin)

```
def self.select_best_fit_node_impl(server_infos, app_props, current_gears,
comp_list, user_props, request_time)
  return server_infos.sort_by {|x| x.node_consumed_capacity.to_f}.first
end
```

This example can also be found in the ***Gem_Location*/lib/openshift/gear_placement_plugin.rb.round-robin-example** file. The nodes in each profile fill evenly, unless complications arise, for example due to scaled applications, gears being deleted unevenly, or MCollective fact updates trailing behind. Implementing true round robin requires writing out a state file owned by this algorithm and using that for scheduling the placement rotation.

8.6. Using an External Routing Layer for High-Availability Applications

Using an external routing layer, you can enable scalable applications to become highly available. OpenShift Enterprise exposes the following gear events from scalable applications, which are significant because they expose and conceal ports on gears where web traffic is received:

- Adding and deleting applications
- Scaling applications up or down
- Adding or removing aliases and custom certificates

You can implement a routing plug-in in OpenShift Enterprise that allows an external routing solution in your existing infrastructure, such as **nginx**, **Nginx Plus**®, or **F5 BIG-IP LTM® (Local Traffic Manager™)**, to balance web traffic loads using these exposed ports. Introducing a router that dynamically controls this traffic to gears allows an OpenShift Enterprise deployment to achieve high availability. Without this feature, the

DNS-based routing has a single point of failure on the scalable application's **HAProxy** gear. See the *OpenShift Enterprise User Guide* [5] for more information on basic routing for scalable applications when a routing layer is not being used.

You can either develop your own routing plug-in to handle these events or use the included sample routing plug-in. The sample plug-in takes the gear events and publishes corresponding messages on **ActiveMQ** as topic notifications. You must then configure a routing listener, which can be a script or daemon, that listens for these notifications and programs your chosen routing solution dynamically to route the traffic to the gears.

If you are using the sample routing plug-in, starting in OpenShift Enterprise 2.2 you can configure a sample routing daemon to be the listener, which currently is supported for use with an **nginx** or **Nginx Plus**® routing back end. Starting in OpenShift Enterprise 2.2.4, the routing daemon also supports an external **LTM®** version 11.6.0 routing back end. Otherwise, you must develop your own routing listener based on your chosen routing solution.

See Also:

- Section 8.6.1, “Selecting an External Routing Solution”
- Section 8.6.2, “Configuring the Sample Routing Plug-In”
- Section 8.6.3, “Configuring a Routing Daemon or Listener”
- Section 8.6.4, “Enabling Support for High-Availability Applications”

8.6.1. Selecting an External Routing Solution

If you plan to configure a routing plug-in and listener to enable scalable applications to become highly available, you must first have an external routing solution, such as **nginx**, **Nginx Plus**®, or **F5 BIG-IP LTM**®, installed and configured in your environment to serve as the routing back end.

The following sections highlight and provide basic installation information for a few of these routing solutions. Note that currently only **nginx**, **Nginx Plus**®, and **LTM**® are supported for integration with the sample routing daemon described later in Section 8.6.3, “Configuring a Routing Daemon or Listener”, but you can develop a custom routing listener based on your chosen routing solution.

Using nginx or Nginx Plus®

nginx is a web and proxy server with a focus on high concurrency, performance, and low memory usage. It can be installed on a Red Hat Enterprise Linux 6 host and is currently included in Red Hat Software Collections 1.2. The Red Hat Software Collections version does not include the **Nginx Plus**® commercial features. If you want to use the **Nginx Plus**® commercial features, install **Nginx Plus**® using the subscription model offered directly from http://nginx.com.

The sample routing daemon, available starting in OpenShift Enterprise 2.2, supports integration with **nginx** or **Nginx Plus**® and automatically creates and manage `server.conf` and `pool_*.conf` files under the configured directory. After each update, the routing daemon reloads the configured **nginx** or **Nginx Plus**® service.

The routing daemon also includes configuration options that enable the use of an **Nginx Plus**® feature that enabled proactive health checks for upstream group members. It is not necessary to use this feature unless you want to ensure a seamless transition if an upstream group member is not responding successfully.

Important

Normally HTTPS can be used to resolve application requests. However, to do so when the routing daemon is configured to use **nginx** or **Nginx Plus**® external routing, users must first add a custom domain alias and SSL certificate to their application. For example, a user can do so by running the following:

```
# rhc alias add App_Name Custom_Domain_Alias
# rhc alias update-cert App_Name Custom_Domain_Alias --certificate
Cert_File --private-key Key_File
```

If you configure the current version of the routing daemon to use **nginx** or **Nginx Plus**®, you must inform users of your deployment about the above requirement. See the *OpenShift Enterprise User Guide* [6] for more information on user management of custom domains and SSL certificates.

Detailed configuration instructions for the routing daemon itself are provided later in Section 8.6.3, “Configuring a Routing Daemon or Listener”.

Procedure 8.16. To Install nginx from Red Hat Software Collections:

1. Register a Red Hat Enterprise Linux 6 host to Red Hat Network and ensure the **Red Hat Enterprise Linux 6 Server** and **Red Hat Software Collections 1** channels are enabled. For example, after registering the host with Red Hat Subscription Management (RHSM), enable the channels with the following command:

   ```
   # subscription-manager repos --enable=rhel-6-server-rpms --
   enable=rhel-server-rhscl-6-rpms
   ```

2. Install **nginx**:

   ```
   # yum install nginx16
   ```

3. Enable the following SELinux Boolean:

   ```
   # setsebool -P httpd_can_network_connect=true
   ```

4. Start the **nginx** service:

   ```
   # chkconfig nginx16-nginx on
   # service nginx16-nginx start
   ```

See http://nginx.org/en/docs for the official **nginx** documentation.

Using F5 BIG-IP LTM®

Starting in OpenShift Enterprise 2.2.4, the sample routing daemon supports integration with **F5 BIG-IP LTM® (Local Traffic Manager™)** version 11.6.0. See the official **LTM**® documentation for installation instructions.

Important

Custom alias HTTPS termination at **LTM**® requires SNI configuration in **LTM**®. See the **F5**® Knowledge Base for configuration details.

To integrate with OpenShift Enterprise, you must configure your **LTM**® instance with two virtual servers: one for HTTP traffic and one for HTTPS traffic. Each virtual server must be assigned at least one VIP. A default **`client-ssl`** profile must also be configured as the default SNI **`client-ssl`** profile. Although the naming of the default **`client-ssl`** profile is unimportant, it must be added to the HTTPS virtual server.

OpenShift Enterprise integration requires an **LTM**® user with the **`Administrator`** role, for example, the default **`admin`** account. Without this role, the user that the routing daemon authenticates will not have the correct privileges or configuration to use the advanced shell. Also, the **LTM**® **`admin`** user's **`Terminal Access`** must be set to **`Advanced Shell`** so that remote bash commands can be executed.

Procedure 8.17. To Grant a User Advanced Shell Execution:

1. On the **F5**® console, navigate to **System**->**Users**->**User List**->*Username*.
2. In the dropdown box labeled **`Terminal Access`**, choose the **`Advanced Shell`** option.
3. Click on the **`Update`** button.

Note

See the **LTM**® documentation for more information on assigning a user the **`Administrator`** role, and the different options for the **`Terminal Access`** dropdown box.

Additionally, for the remote key management commands to execute, the **`BIGIP_SSHKEY`** public key must be added to the **LTM**® **`admin`** user's **`.ssh/authorized_keys`** file.

When configured for **LTM**®, the routing daemon automatically:

- Creates pools and associated local-traffic policy rules.
- Adds profiles to the virtual servers.
- Adds members to the pools.
- Deletes members from the pools.
- Deletes empty pools and unused policy rules when appropriate.

The routing daemon names the pools after applications following the template **`/Common/ose-#{app_name}-#{namespace}`** and creates policy rules to forward requests to pools comprising the gears of the named application. Detailed configuration instructions for the routing daemon itself are provided later in Section 8.6.3, “Configuring a Routing Daemon or Listener”.

See Also:

- Section 8.6.2, “Configuring the Sample Routing Plug-In”
- Section 8.6.3, “Configuring a Routing Daemon or Listener”

8.6.2. Configuring the Sample Routing Plug-In

OpenShift Enterprise includes a sample routing plug-in for publishing routing information on an **ActiveMQ** queue, which allows an external routing layer to route traffic for high-availability applications. In addition to enabling the sample plug-in on the broker host, the **ActiveMQ** configuration must be modified.

Procedure 8.18. To Enable and Configure the Sample Routing Plug-in:

1. Add a new user, topic, and queue to **ActiveMQ**. On each **ActiveMQ** broker, edit the **`/etc/activemq/activemq.xml`** file and add the following line within the **`<users>`** section, replacing ***`routinginfopasswd`*** with your own password:

```
<authenticationUser username="routinginfo"
password="routinginfopasswd" groups="routinginfo,everyone"/>
```

Example 8.14. Example <users> Section

```
<users>
  <authenticationUser username="mcollective" password="marionette"
groups="mcollective,everyone"/>
  <authenticationUser username="admin" password="secret"
groups="mcollective,admin,everyone"/>
  <authenticationUser username="routinginfo"
password="routinginfopasswd" groups="routinginfo,everyone"/>
</users>
```

2. Add the following lines within the **`<authorizationEntries>`** section:

```
<authorizationEntry topic="routinginfo.>" write="routinginfo"
read="routinginfo" admin="routinginfo" />
<authorizationEntry queue="routinginfo.>" write="routinginfo"
read="routinginfo" admin="routinginfo" />
```

Example 8.15. Example <authorizationEntries> Section

```
<authorizationEntries>
  <authorizationEntry queue=">" write="admins" read="admins"
admin="admins" />
  <authorizationEntry topic=">" write="admins" read="admins"
admin="admins" />
  <authorizationEntry topic="mcollective.>" write="mcollective"
read="mcollective" admin="mcollective" />
  <authorizationEntry queue="mcollective.>" write="mcollective"
read="mcollective" admin="mcollective" />
  <authorizationEntry topic="ActiveMQ.Advisory.>" read="everyone"
write="everyone" admin="everyone"/>
  <authorizationEntry topic="routinginfo.>" write="routinginfo"
read="routinginfo" admin="routinginfo" />
  <authorizationEntry queue="routinginfo.>" write="routinginfo"
read="routinginfo" admin="routinginfo" />
</authorizationEntries>
```

3. Add the following lines within the **<plugins>** section:

```
<redeliveryPlugin fallbackToDeadLetter="true"
                  sendToDlqIfMaxRetriesExceeded="true">
  <redeliveryPolicyMap>
    <redeliveryPolicyMap>
      <redeliveryPolicyEntries>
        <redeliveryPolicy queue="routinginfo"
                          maximumRedeliveries="4"
                          useExponentialBackOff="true"
                          backOffMultiplier="4"
                          initialRedeliveryDelay="2000" />
        </redeliveryPolicyEntries>
      </redeliveryPolicyMap>
    </redeliveryPolicyMap>
  </redeliveryPlugin>
```

4. Add the **schedulerSupport="true"** directive within the **<broker>** section:

```
<broker xmlns="http://activemq.apache.org/schema/core"
 brokerName="activemq.example.com"
 dataDirectory="${activemq.data}"
 schedulePeriodForDestinationPurge="60000"
 schedulerSupport="true"
 >
```

5. Restart the **activemq** service:

```
# service activemq restart
```

6. On the broker host, verify that the *rubygem-openshift-origin-routing-activemq* package is installed:

```
# yum install rubygem-openshift-origin-routing-activemq
```

7. Copy the **/etc/openshift/plugins.d/openshift-origin-routing-activemq.conf.example** file to **/etc/openshift/plugins.d/openshift-origin-routing-activemq.conf**:

```
# cp /etc/openshift/plugins.d/openshift-origin-routing-
activemq.conf.example /etc/openshift/plugins.d/openshift-origin-
routing-activemq.conf
```

8. Edit the **/etc/openshift/plugins.d/openshift-origin-routing-activemq.conf** file and ensure the **ACTIVEMQ_HOST** and **ACTIVEMQ_PORT** parameters are set appropriately for your **ActiveMQ** broker. Set the **ACTIVEMQ_PASSWORD** parameter to the password chosen for the **routinginfo** user:

Example 8.16. Example Routing Plug-in Configuration File

```
ACTIVEMQ_TOPIC='/topic/routinginfo'
ACTIVEMQ_USERNAME='routinginfo'
```

```
ACTIVEMQ_PASSWORD='routinginfopasswd'
ACTIVEMQ_HOST='127.0.0.1'
ACTIVEMQ_PORT='61613'
```

In OpenShift Enterprise 2.1.2 and later, you can set the **ACTIVEMQ_HOST** parameter as a comma-separated list of *host*:*port* pairs if you are using multiple **ActiveMQ** brokers:

Example 8.17. Example ACTIVEMQ_HOST Setting Using Multiple ActiveMQ Brokers

```
ACTIVEMQ_HOST='192.168.59.163:61613,192.168.59.147:61613'
```

9. You can optionally enable SSL connections per **ActiveMQ** host. To do so, set the **MCOLLECTIVE_CONFIG** parameter in the **/etc/openshift/plugins.d/openshift-origin-routing-activemq.conf** file to the MCollective client configuration file used by the broker:

```
MCOLLECTIVE_CONFIG='/opt/rh/ruby193/root/etc/mcollective/client.cfg'
```

Note that while setting the **MCOLLECTIVE_CONFIG** parameter overrides the **ACTIVEMQ_HOST** and **ACTIVEMQ_PORT** parameters in this file, the **ACTIVEMQ_USERNAME** and **ACTIVEMQ_PASSWORD** parameters in this file are still used by the routing plug-in and must be set.

10. Restart the broker service:

```
# service openshift-broker restart
```

See Also:

- Section 8.6.3, “Configuring a Routing Daemon or Listener”

8.6.3. Configuring a Routing Daemon or Listener

Prerequisites:

- Section 8.6.1, “Selecting an External Routing Solution”
- Section 8.6.2, “Configuring the Sample Routing Plug-In”

After configuring a routing plug-in on the broker host, you must configure a routing listener, which can be a script or daemon, that listens for notifications of application life-cycle events. The listener must program your chosen external routing solution using the notifications to dynamically route traffic to the gears.

If you are using the sample routing plug-in described in Section 8.6.2, “Configuring the Sample Routing Plug-In”, starting in OpenShift Enterprise 2.2 you can install and configure a sample routing daemon to listen to the event notifications published on **ActiveMQ** by the sample routing plug-in. The routing daemon supports integration with an external **nginx** or **Nginx Plus**® routing back end. Starting in OpenShift Enterprise 2.2.4, the routing daemon also supports integration with an external **F5 BIG-IP LTM® (Local Traffic Manager™)** version 11.6.0 routing back end. Otherwise, you must develop your own routing daemon or listener for your chosen routing solution.

Both options, configuring the sample daemon or developing your own listener, are detailed below.

Configuring the Sample Routing Daemon

The following procedure assumes that you have already set up **nginx**, **Nginx Plus**®, or **LTM**® as a routing back end as described in Section 8.6.1, "Selecting an External Routing Solution".

Procedure 8.19. To Install and Configure the Sample Routing Daemon:

1. The sample routing daemon is provided by the *rubygem-openshift-origin-routing-daemon* package. The host you are installing the routing daemon on must have the **Red Hat OpenShift Enterprise 2.2 Infrastructure** channel enabled to access the package. See Section 7.1, "Configuring Broker Host Entitlements" for more information.

   For **nginx** or **Nginx Plus**® usage, because the routing daemon directly manages the **nginx** configuration files, you must install the package on the same host where **nginx** or **Nginx Plus**® is running. **Nginx Plus**® offers features such as a REST API and clustering, but the current version of the routing daemon must still be run on the same host.

   For **LTM**® usage, you must install the package on a Red Hat Enterprise Linux 6 host that is separate from the host where **LTM**® is running. This is because the daemon manages **LTM**® using a SOAP or REST interface.

   Install the *rubygem-openshift-origin-routing-daemon* package on the appropriate host:

   ```
   # yum install rubygem-openshift-origin-routing-daemon
   ```

2. Edit the **/etc/openshift/routing-daemon.conf** file and set the **ACTIVEMQ_*** parameters to the appropriate host address, credentials, and **ActiveMQ** topic or queue destination:

   ```
   ACTIVEMQ_HOST=broker.example.com
   ACTIVEMQ_USER=routinginfo
   ACTIVEMQ_PASSWORD=routinginfopasswd
   ACTIVEMQ_PORT=61613
   ACTIVEMQ_DESTINATION=/topic/routinginfo
   ```

   In OpenShift Enterprise 2.1.2 and later, you can set the **ACTIVEMQ_HOST** parameter as a comma-separated list of *host*:*port* pairs if you are using multiple **ActiveMQ** brokers:

   ```
   ACTIVEMQ_HOST='192.168.59.163:61613,192.168.59.147:61613'
   ```

3. If you optionally enabled SSL connections per **ActiveMQ** host in the routing plug-in, set the **plugin.activemq*** parameters in this file to the same values used in the **/opt/rh/ruby193/root/etc/mcollective/client.cfg** file on the broker:

   ```
   plugin.activemq.pool.size = 1
   plugin.activemq.pool.1.host = activemq.example.com
   plugin.activemq.pool.1.port = 61614
   plugin.activemq.pool.1.ssl = true
   plugin.activemq.pool.1.ssl.ca = /etc/keys/activemq.example.com.crt
   plugin.activemq.pool.1.ssl.key = /etc/keys/activemq.example.com.key
   plugin.activemq.pool.1.ssl.cert = /etc/keys/activemq.example.com.crt
   ```

   If you have multiple pools, ensure that **plugin.activemq.pool.size** is set appropriately and create unique blocks for each pool:

   ```
   plugin.activemq.pool.size = 2
   plugin.activemq.pool.1.host = activemq1.example.com
   plugin.activemq.pool.1.port = 61614
   ```

```
plugin.activemq.pool.1.ssl = true
plugin.activemq.pool.1.ssl.ca = /etc/keys/activemq1.example.com.crt
plugin.activemq.pool.1.ssl.key = /etc/keys/activemq1.example.com.key
plugin.activemq.pool.1.ssl.cert = /etc/keys/activemq1.example.com.crt

plugin.activemq.pool.2.host = activemq2.example.com
plugin.activemq.pool.2.port = 61614
plugin.activemq.pool.2.ssl = true
plugin.activemq.pool.2.ssl.ca = /etc/keys/activemq2.example.com.crt
plugin.activemq.pool.2.ssl.key = /etc/keys/activemq2.example.com.key
plugin.activemq.pool.2.ssl.cert = /etc/keys/activemq2.example.com.crt
```

The files set in the ***ssl.ca**, ***ssl.key**, and ***ssl.cert** parameters must be copied from the **ActiveMQ** broker or brokers and placed locally for the routing daemon to use.

Note that while setting the **plugin.activemq*** parameters overrides the **ACTIVEMQ_HOST** and **ACTIVEMQ_PORT** parameters in this file, the **ACTIVEMQ_USERNAME** and **ACTIVEMQ_PASSWORD** parameters in this file are still used by the routing daemon and must be set.

4. Set the **CLOUD_DOMAIN** parameter to the domain you are using:

```
CLOUD_DOMAIN=example.com
```

5. To use a different prefix in URLs for high-availability applications, you can modify the ***HA_DNS_PREFIX*** parameter:

```
HA_DNS_PREFIX="ha-"
```

This parameter and the ***HA_DNS_PREFIX*** parameter in the **/etc/openshift/broker.conf** file, covered in Section 8.6.4, “Enabling Support for High-Availability Applications”, must be set to the same value.

6. If you are using **nginx** or **Nginx Plus**®, set the ***LOAD_BALANCER*** parameter to the **nginx** module:

```
LOAD_BALANCER=nginx
```

If you are using **LTM**®, set the ***LOAD_BALANCER*** parameter to the **f5** module:

```
LOAD_BALANCER=f5
```

Ensure that only one ***LOAD_BALANCER*** line is uncommented and enabled in the file.

7. If you are using **nginx** or **Nginx Plus**®, set the appropriate values for the following **nginx** module parameters if they differ from the defaults:

```
NGINX_CONFDIR=/opt/rh/nginx16/root/etc/nginx/conf.d
NGINX_SERVICE=nginx16-nginx
```

If you are using **Nginx Plus**®, you can uncomment and set the following parameters to enable health checking. This enables active health checking and takes servers out of the upstream pool without having a client request initiate the check.

```
NGINX_PLUS=true
NGINX_PLUS_HEALTH_CHECK_INTERVAL=2s
```

```
NGINX_PLUS_HEALTH_CHECK_FAILS=1
NGINX_PLUS_HEALTH_CHECK_PASSES=5
NGINX_PLUS_HEALTH_CHECK_URI=/
NGINX_PLUS_HEALTH_CHECK_MATCH_STATUS=200
NGINX_PLUS_HEALTH_CHECK_SHARED_MEMORY=64k
```

8. If you are using **LTM**®, set the appropriate values for the following parameters to match your **LTM**® configuration:

```
BIGIP_HOST=127.0.0.1
BIGIP_USERNAME=admin
BIGIP_PASSWORD=passwd
BIGIP_SSHKEY=/etc/openshift/bigip.key
```

Set the following parameters to match the **LTM**® virtual server names you created:

```
VIRTUAL_SERVER=ose-vserver
VIRTUAL_HTTPS_SERVER=https-ose-vserver
```

Also set the ***MONITOR_NAME*** parameter to match your **LTM**® configuration:

```
MONITOR_NAME=monitor_name
```

For the **lbaas** module, set the appropriate values for the following parameters to match your LBaaS configuration:

```
LBAAS_HOST=127.0.0.1
LBAAS_TENANT=openshift
LBAAS_TIMEOUT=300
LBAAS_OPEN_TIMEOUT=300
LBAAS_KEYSTONE_HOST=10.0.0.1
LBAAS_KEYSTONE_USERNAME=user
LBAAS_KEYSTONE_PASSWORD=passwd
LBAAS_KEYSTONE_TENANT=lbms
```

9. By default, new pools are created and named with the form **pool_ose_{appname}_{namespace}_80**. You can optionally override this defaults by setting appropriate value for the **POOL_NAME** parameter:

```
POOL_NAME=pool_ose_%a_%n_80
```

If you change this value, set it to contain the following format so each application gets its own uniquely named pool:

- **%a** is expanded to the name of the application.
- **%n** is expanded to the application's namespace (domain).

10. The **BIG-IP LTM** back end can add an existing monitor to newly created pools. The following settings control how these monitors are created:

```
#MONITOR_NAME=monitor_ose_%a_%n
#MONITOR_PATH=/health_check.php
#MONITOR_UP_CODE=1
```

```
MONITOR_TYPE=http-ecv
#MONITOR_TYPE=https-ecv
#MONITOR_INTERVAL=10
#MONITOR_TIMEOUT=5
```

Set the ***MONITOR_NAME*** parameter to the name of the monitor to use, and set the ***MONITOR_PATH*** parameter to the path name to use for the monitor. Alternatively, leave either parameter unspecified to disable the monitor functionality.

As with the ***POOL_NAME*** and ***ROUTE_NAME*** parameters, the ***MONITOR_NAME*** and ***MONITOR_PATH*** parameters both can contain **%a** and **%n** formats, which are expanded the same way. Unlike the ***POOL_NAME*** and ***ROUTE_NAME*** parameters, however, you may or may not want to reuse the same monitor for different applications. The routing daemon automatically creates a new monitor when the format used from the ***MONITOR_NAME*** parameter expands a string that does not match the name of any existing monitor.

Set the ***MONITOR_UP_CODE*** parameter to the code that indicates that a pool member is up, or leave it unspecified to use the default value of **1**.

MONITOR_TYPE specifies the type of probe that the external load-balancer should use to check the health status of applications. The only other recognized value for ***MONITOR_TYPE*** is **https-ecv**, which defines the protocol to be HTTPS. All other values for ***MONITOR_TYPE*** translate to HTTP.

Note that ECV stands for “extended content verification", referring to the fact that the monitor makes an HTTP request and looks at the reply to verify that it is the expected response (meaning the application server is responding), as opposed to merely pinging the server to ensure it is returning an ICMP ping reply (meaning the operating system is responding).

Set the ***MONITOR_INTERVAL*** parameter to the interval at which the monitor sends requests, or leave it unspecified to use the default value of **10**.

Set the ***MONITOR_TIMEOUT*** parameter to the monitor's timeout for its requests, or leave it unset to use the default value of **5**.

It is expected that for each pool member, the routing solution sends a **GET** request to the resource identified on that host by the value of the **MONITOR_PATH** parameter for the associated monitor, and that the host responds with the value of the ***MONITOR_UP_CODE*** parameter if the host is up or some other response if the host is not up.

11. You can change the port that **nginx** or **Nginx Plus**® listens on for HTTP or HTTPS, if required, by setting the following parameters:

```
SSL_PORT=443
HTTP_PORT=80
```

For **Nginx Plus**®, setting the above parameters is all that is required. For **nginx** 1.6 (from Red Hat Software Collections), however, you must also modify the **/opt/rh/nginx16/root/etc/nginx/nginx.conf** file to listen on different ports. For example for HTTP, change **80** on the following line to another port:

```
listen       80;
```

In both cases (**nginx** 1.6 and **Nginx Plus**®), ensure the **SSL_PORT** and **HTTP_PORT** parameters are set to the ports you intend **nginx** or **Nginx Plus**® to listen to, and ensure your host firewall configuration allows ingress traffic on these ports.

12. Start the routing daemon:

```
# chkconfig openshift-routing-daemon on
# service openshift-routing-daemon start
```

Developing a Custom Routing Listener

If you are not using the sample routing daemon, you can develop your own listener to listen to the event notifications published on **ActiveMQ** by the sample routing plug-in. The plug-in creates notification messages for the following events:

Table 8.3. Sample Routing Plug-in Notifications

Event	Message Format	Additional Details
Application created	:action => :create_application, :app_name => app.name, :namespace => app.domain.namespace, :scalable => app.scalable, :ha => app.ha,	
Application deleted	:action => :delete_application, :app_name => app.name, :namespace => app.domain.namespace :scalable => app.scalable, :ha => app.ha,	
Public endpoint created	:action => :add_public_endpoint, :app_name => app.name, :namespace => app.domain.namespace, :gear_id => gear._id.to_s, :public_port_name => endpoint_name, :public_address => public_ip, :public_port => public_port.to_i, :protocols => protocols, :types => types, :mappings => mappings	Values for the **protocols** variable include: - **tcp**, **http**, **https**, **ws**, **wss**, **tls**, **mongodb**, **mysql** Values for the **types** variable include: - **load_balancer**, **web_framework**, **database**, **plugin**, **other** These variables depend on values set in the cartridge manifest.

Event	Message Format	Additional Details
Public endpoint deleted	:action => :remove_public_endpoint, :app_name => app.name, :namespace => app.domain.namespace, :gear_id => gear._id.to_s, :public_address => public_ip, :public_port => public_port.to_i	
SSL certificate added	:action => :add_ssl, :app_name => app.name, :namespace => app.domain.namespace, :alias => fqdn, :ssl => ssl_cert, :private_key => pvt_key, :pass_phrase => passphrase	
SSL certificate removed	:action => :remove_ssl, :app_name => app.name, :namespace => app.domain.namespace, :alias => fqdn	
Alias added	:action => :add_alias, :app_name => app.name, :namespace => app.domain.namespace, :alias => alias_str	
Alias removed	:action => :remove_alias, :app_name => app.name, :namespace => app.domain.namespace, :alias => alias_str	

Note

The **`add_gear`** and **`delete_gear`** actions have been deprecated. Use **`add_public_endpoint`** for **`add_gear`** and **`remove_public_endpoint`** for **`delete_gear`** instead.

Follow these guidelines when developing a routing listener for the sample routing plug-in:

Routing Listener Guidelines

1. Listen to the **ActiveMQ** topic **`routinginfo`**. Verify that the user credentials match those configured in the **`/etc/openshift/plugins.d/openshift-origin-routing-activemq.conf`** file of the sample routing plug-in.
2. For each gear event, reload the routing table of the router.
    a. Use the **`protocols`** value provided with the **`add_public_endpoint`** action to tailor your routing methods.
    b. Use the **`types`** value to identify the type of endpoint.
    c. Use the **`mappings`** value to identify URL routes. Routes that are not root may require source IP or SSL certificate verifications. A common use case involves administrative consoles such as **phpMyAdmin**.
3. Look for actions involving SSL certificates, such as **`add_ssl`** and **`remove_ssl`**, and decide whether to configure the router accordingly for incoming requests.
4. Look for actions involving aliases, such as **`add_alias`** and **`remove_alias`**. Aliases must always be accommodated for during the application's life cycle.

Note

The **`add_public_endpoint`** and **`remove_public_endpoint`** actions do not correspond to the actual addition and removal of gears, but rather to the exposure and concealment of ports. One gear added to an application may result in several exposed ports, which will all result in respective **`add_public_endpoint`** notifications at the router level.

Example 8.18. Simple Routing Listener

The following **`listener.rb`** script file is an example model for a simple routing listener. This Ruby script uses **Nginx** as the external routing solution, and the pseudo code provided is an example only. The example handles the following tasks:

- Look for messages with an **`add_public_endpoint`** action and a **`load_balancer`** type, then edit the router configuration file for the application.
- Look for messages with a **`remove_public_endpoint`** action and a **`load_balancer`** type, then edit the router configuration file for the application.
- Look for messages with a **`delete_application`** action and remove the router configuration file for the application.

```
#!/usr/bin/ruby

require 'rubygems'
require 'stomp'
require 'yaml'

CONF_DIR='/etc/nginx/conf.d/'

def add_haproxy(appname, namespace, ip, port)
```

```
  scope = "#{appname}-#{namespace}"
  file = File.join(CONF_DIR, "#{scope}.conf")
  if File.exist?(file)
    `sed -i 's/upstream #{scope} {/&\\n      server #{ip}:#{port};/' #
{file}`
  else
    # write a new one
    template = <<-EOF
    upstream #{scope} {
      server #{ip}:#{port};
    }
    server {
      listen 8000;
      server_name ha-#{scope}.dev.rhcloud.com;
      location / {
        proxy_pass http://#{scope};
      }
    }
EOF
    File.open(file, 'w') { |f| f.write(template) }
  end
  `nginx -s reload`
end


c = Stomp::Client.new("routinginfo", "routinginfopasswd", "localhost",
61613, true)
c.subscribe('/topic/routinginfo') { |msg|
  h = YAML.load(msg.body)
  if h[:action] == :add_public_endpoint
    if h[:types].include? "load_balancer"
       add_haproxy(h[:app_name], h[:namespace], h[:public_address],
h[:public_port])
       puts "Added routing endpoint for #{h[:app_name]}-#{h[:namespace]}"
    end
  elsif h[:action] == :remove_public_endpoint
  # script does not actually act upon the remove_public_endpoint as
written
  elsif h[:action] == :delete_application
     scope = '#{h[:app_name]}-#{h[:namespace]}'
     file = File.join(CONF_DIR, "#{scope}.conf")
     if File.exist?(file)
       `rm -f #{file}`
       `nginx -s reload`
       puts "Removed configuration for #{scope}"
     end
  end
}
c.join
```

8.6.4. Enabling Support for High-Availability Applications

Prerequisites:

- Section 8.6.1, “Selecting an External Routing Solution”

- Section 8.6.2, “Configuring the Sample Routing Plug-In”
- Section 8.6.3, “Configuring a Routing Daemon or Listener”

If you have configured an external routing layer, either the included sample or your own, to route application traffic, you must enable support for high-availability applications and configure specific DNS management options before developers can take advantage of these features.

Procedure 8.20. To Enable Support for High-Availability Applications:

1. To allow scalable applications to become highly available using the configured external router, edit the **/etc/openshift/broker.conf** file on the broker host and set the ***ALLOW_HA_APPLICATIONS*** parameter to **"true"**:

   ```
   ALLOW_HA_APPLICATIONS="true"
   ```

   Note that this parameter controls whether high-availability applications are allowed in general, but does not adjust user account capabilities. User account capabilities are discussed in a later step.

2. A scaled application that is not highly available uses the following URL form:

   ```
   http://${APP_NAME}-${DOMAIN_NAME}.${CLOUD_DOMAIN}
   ```

   When high-availability is enabled, HAproxy instances are deployed in multiple gears of the application, which are spread across multiple node hosts. In order to load balance user requests, a high-availability application requires a new high-availability DNS name that points to the external routing layer rather than directly to the application head gear. The routing layer then forwards requests directly to the application's HAproxy instances, which are then distributed to the framework gears. In order to create DNS entries for high-availability applications that point to the routing layer, OpenShift Enterprise adds either a prefix or suffix, or both, to the regular application name:

   ```
   http://${HA_DNS_PREFIX}${APP_NAME}-
   ${DOMAIN_NAME}${HA_DNS_SUFFIX}.${CLOUD_DOMAIN}
   ```

   To change the prefix or suffix used in the high-availability URL, you can modify the ***HA_DNS_PREFIX*** or ***HA_DNS_SUFFIX*** parameters:

   ```
   HA_DNS_PREFIX="ha-"
   HA_DNS_SUFFIX=""
   ```

   If you modify the ***HA_DNS_PREFIX*** parameter and are using the sample routing daemon, ensure this parameter and the ***HA_DNS_PREFIX*** parameter in the **/etc/openshift/routing-daemon.conf** file are set to the same value.

3. DNS entries for high-availability applications can either be managed by OpenShift Enterprise or externally. By default, this parameter is set to **"false"**, which means the entries must be created externally; failure to do so could prevent the application from receiving traffic through the external routing layer. To allow OpenShift Enterprise to create and delete these entries when applications are created and deleted, set the ***MANAGE_HA_DNS*** parameter to **"true"**:

   ```
   MANAGE_HA_DNS="true"
   ```

Then set the ***ROUTER_HOSTNAME*** parameter to the public hostname of the external routing layer, which the DNS entries for high-availability applications point to. Note that the routing layer host must be resolvable by the broker:

```
ROUTER_HOSTNAME="www.example.com"
```

4. For developers to enable high-availability support with their scalable applications, they must have the **HA allowed** capability enabled on their account. By default, the ***DEFAULT_ALLOW_HA*** parameter is set to **"false"**, which means user accounts are created with the **HA allowed** capability initially disabled. To have this capability enabled by default for new user accounts, set ***DEFAULT_ALLOW_HA*** to **"true"**:

```
DEFAULT_ALLOW_HA="true"
```

You can also adjust the **HA allowed** capability per user account using the **oo-admin-ctl-user** command with the **--allowha** option:

```
# oo-admin-ctl-user -l user --allowha true
```

5. To make any changes made to the **/etc/openshift/broker.conf** file take effect, restart the broker service:

```
# service openshift-broker restart
```

Note

You can also set the ratio or the number of HAProxy cartridges for scaled applications. See the *oo-admin-ctl-app* section in the *OpenShift Enterprise Administration Guide* at https://access.redhat.com/site/documentation for more information.

Note that this procedure only enables the support for high-availability applications. See the *OpenShift Enterprise User Guide* for a procedure on how a user can make an application highly-available.

8.7. Integrating with External Single Sign-on (SSO) Providers

Developers hosting applications on your OpenShift Enterprise instance may need to integrate their applications with external single sign-on (SSO) providers. To enable this, starting in OpenShift Enterprise 2.2.6 you can configure an SSO plug-in that broadcasts controller actions through ActiveMQ to be read and acted upon by an external SSO provider. These actions include:

- Gear creation and deletion
- Alias addition and removal
- Environment variables addition, modification, and deletion

The external SSO provider can then listen for certain events occurring in the OpenShift Enterprise environment that are critical for utilizing the external SSO solution.

Procedure 8.21. To Install and Configure the SSO Plug-in:

1. On the broker host, install the *rubygem-openshift-origin-sso-activemq* package:

```
# yum install rubygem-openshift-origin-sso-activemq
```

2. Before enabling this plug-in, you must add a new user, topic, and queue to ActiveMQ. Edit the **/etc/activemq/activemq.xml** file and add the following user in the appropriate section:

```
<authenticationUser username="ssoinfo" password="ssoinfopasswd"
groups="ssoinfo,everyone"/>
```

   Also add the following topic and queue to the appropriate sections:

```
<authorizationEntry topic="ssoinfo.>" write="ssoinfo" read="ssoinfo"
admin="ssoinfo" />
<authorizationEntry queue="ssoinfo.>" write="ssoinfo" read="ssoinfo"
admin="ssoinfo" />
```

3. Restart ActiveMQ:

```
# service activemq restart
```

4. To enable the plug-in, copy the **/etc/openshift/plugins.d/openshift-origin-sso-activemq.conf.example** file to **/etc/openshift/plugins.d/openshift-origin-sso-activemq.conf** on the broker host:

```
# cp /etc/openshift/plugins.d/openshift-origin-sso-
activemq.conf.example \ /etc/openshift/plugins.d/openshift-origin-sso-
activemq.conf
```

5. In the **/etc/openshift/plugins.d/openshift-origin-sso-activemq.conf** file you just created, uncomment the last line specifying the **/opt/rh/ruby193/root/etc/mcollective/client.cfg** file:

```
MCOLLECTIVE_CONFIG="/opt/rh/ruby193/root/etc/mcollective/client.cfg"
```

   Alternatively, edit the values for the ***ACTIVE_**** parameters with the appropriate information for your environment.

6. Restart the broker service for your changes take effect:

```
# service openshift-broker restart
```

7. Create a listener that will connect to ActiveMQ on the new topic that was added. The listener can be run on any system that can connect to the ActiveMQ server. The following is an example that simply echoes any messages received:

```
#!/usr/bin/ruby

require 'rubygems'
require 'stomp'
require 'yaml'

c = Stomp::Client.new("ssoinfo", "ssoinfopasswd", "127.0.0.1", 61613)
puts "Got stomp client, listening for messages on '/topic/ssoinfo':"
c.subscribe('/topic/ssoinfo') { |msg|
```

```
        h = YAML.load(msg.body)
        puts "Message received: "
 puts h.inspect
}
c.join
```

8. Save and run your listener script. For example, if the script was saved at **/root/listener.rb**:

```
# ruby /root/listener.rb
```

9. To verify that the plug-in and listener are working, perform several application actions with the client tools or Management Console using a test user account. For example, create an application, add an alias, remove an alias, and remove the application. You should see messages reported by the listener script for each action performed.

8.8. Backing Up Broker Host Files

The authentication service, DNS service, and the MongoDB datastore components of the broker host contain persistent state. Consult your system administrator for advice on how to implement fault tolerance for the authentication and DNS services you have selected for your OpenShift Enterprise installation.

See Section 8.4.3, “MongoDB” for instructions on how to configure redundancy with MongoDB. See the following MongoDB documentation for more information on how to implement fault tolerance with data storage and take regular backups:

- *Backup Strategies for MongoDB Systems* - http://docs.mongodb.org/manual/administration/backups/

In the example installation, the MongoDB data is stored in the **/var/lib/mongodb** directory, which can be used as a potential mount point for fault tolerance or as a backup storage.

8.9. Management Console

The OpenShift Enterprise Management Console is a web application that is installed on the broker host, and exposes the REST API. The Management Console interacts with OpenShift Enterprise through the REST API in a similar fashion to the client tools.

8.9.1. Installing the Management Console

This section describes how to install the Management Console on a broker host.

Procedure 8.22. To Install the OpenShift Enterprise Management Console:

1. Install the required software package:

```
# yum install openshift-origin-console
```

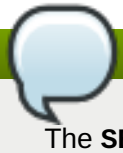
2. Modify the corresponding sample httpd configuration file located in the **/var/www/openshift/console/httpd/conf.d** directory to suit the requirements of your authentication model. For example, use **openshift-origin-auth-remote-user-ldap.conf.sample** to replace **openshift-origin-auth-remote-user.conf**, and modify it as necessary to suit your authentication configuration. This is similar to what was done for broker authentication in the **/var/www/openshift/broker/httpd/conf.d/** directory.

3. Make the service persistent on boot, and start the service using the following commands:

```
# chkconfig openshift-console on
# service openshift-console start
```

After the Management Console is installed, configure the **SESSION_SECRET** setting in the **/etc/openshift/console.conf** file, which is used for signing the Rails sessions. Run the following command to create the random string:

```
# openssl rand -hex 64
```



Note

The **SESSION_SECRET** must be the same across all consoles in a cluster, but does not necessarily need to be the same as the **SESSION_SECRET** used in **/etc/openshift/broker.conf**.

Important

Ensure that the **CONSOLE_SECURITY** setting in the **/etc/openshift/console.conf** file has the default setting of **remote_user**. This is a requirement of OpenShift Enterprise and ensures proper HTTP authentication.

```
CONSOLE_SECURITY=remote_user
```

Restart the Management Console to apply your changes. This is required each time the **SESSION_SECRET** setting is modified. Note that all sessions are dropped.

```
# service openshift-console restart
```

Access the Management Console from **https://*broker.example.com*/console** using a web browser. Use the correct domain name according to your installation.

8.9.2. Creating an SSL Certificate

Because the Management Console is accessed with a web browser, developers are likely to receive security warnings if the default SSL certificate is left in place. This is because the certificate is self-assigned, and may not match the URL. These warnings are avoided if the certificate is signed by a proper authority and reflects the correct URL for the site.

Both the broker application and the Management Console application are reached with the host's httpd proxy, which is what presents the secure server's certificate. The default key is **/etc/pki/tls/private/localhost.key**, and the default certificate is **/etc/pki/tls/certs/localhost.crt**. These files are created automatically when ***mod_ssl*** is installed. You can recreate the key and the certificate files with suitable parameters using the **openssl** command, as shown in the following example.

```
# openssl req -new \
 -newkey rsa:2048 -keyout /etc/pki/tls/private/localhost.key \
 -x509 -days 3650 \
 -out /etc/pki/tls/certs/localhost.crt
```

The **openssl** command prompts for information to be entered in the certificate. The most important field is **Common Name**, which is the host name that developers use to browse the Management Console; for example, broker.example.com. This way the certificate created now correctly matches the URL for the Management Console in the browser, although it is still self-signed.

Obtain a properly signed certificate by generating a signing request with the following commands:

```
# openssl req -new \
 -key /etc/pki/tls/private/localhost.key \
 -out /etc/pki/tls/certs/localhost.csr
```

The **openssl** command prompts for information to be entered in the certificate, including **Common Name**. The **localhost.csr** signing request file must then be processed by an appropriate certificate authority to generate a signed certificate for use with the secure server.

When you have replaced the key and the certificate, restart the **httpd** service to enable them for use:

```
# service httpd restart
```

8.10. Administration Console

An optional Administration Console is available for OpenShift Enterprise that allows administrators to search and navigate entities to plan the capacity of an OpenShift Enterprise deployment. Note that the current iteration of the Administration Console is read-only, so the settings or data cannot be modified.

8.10.1. Installing the Administration Console

The Administration Console runs as a plug-in to the OpenShift Enterprise broker application. The plug-in is loaded if the gem is installed and the configuration file is present in the default **/etc/openshift/plugins.d/openshift-origin-admin-console.conf** directory. Install the *rubygem-openshift-origin-admin-console* RPM package to install both the gem and the configuration file:

```
# yum install rubygem-openshift-origin-admin-console
```

The **/etc/openshift/plugins.d/openshift-origin-admin-console.conf** configuration file contains comments on the available parameters. Edit the file to suit your requirements.

After installing and configuring the plug-in, restart the broker service to load the plug-in or to reload a modified Administration Console configuration file:

```
# service openshift-broker restart
```

8.10.2. Accessing the Administration Console

The Administration Console configuration file does not provide access control, and there is no concept of an OpenShift Enterprise administrative role. The current iteration of the Administration Console is informational only, and you must log in to an OpenShift Enterprise host to perform all administrative actions.

When the broker application loads the Administration Console, the standard **httpd** proxy configuration of the OpenShift Enterprise broker host blocks external access to the URI of the Administration Console. Refusing external access is a security feature to avoid exposing the Administration Console publicly by accident.

Note

The Administration Console's URI is **/admin-console** by default, but is configurable in **/etc/openshift/plugins.d/openshift-origin-admin-console.conf**.

To access the Administration Console from a system other than the broker, you can either forward the port for local viewing or modify the proxy configuration. Choose one of the following procedures.

Procedure 8.23. To View the Administration Console Using Port Forwarding:

You can view the Administration Console without exposing it externally by forwarding its port to your local workstation.

1. On your local workstation, replace *user@broker.example.com* in the following example with your relevant user name and broker host:

   ```
   $ ssh -f user@broker.example.com -L 8080:localhost:8080 -N
   ```

   This command uses a secure shell (SSH) to connect to *user@broker.example.com* and attaches the local workstation port **8080** (the first number) to the broker host's local port **8080** (the second number), where the broker application listens behind the host proxy.

2. Browse to **http://localhost:8080/admin-console** using a web browser to access the Administration Console.

Procedure 8.24. To Enable External Access to the Administration Console:

You can configure the broker host **httpd** proxy to enable external access through the broker host.

1. On each broker host, edit the **/etc/httpd/conf.d/000002_openshift_origin_broker_proxy.conf** configuration file. Inside the **<VirtualHost *:443>** section, add additional **ProxyPass** entries for the Administration Console and its static assets after the existing **ProxyPass** entry for the broker. The completed **<VirtualHost *:443>** section looks similar to the following:

   Example 8.19. Example <VirtualHost *:443> section

   ```
   ProxyPass /broker http://127.0.0.1:8080/broker
   ProxyPass /admin-console http://127.0.0.1:8080/admin-console
   ProxyPass /assets http://127.0.0.1:8080/assets
   ProxyPassReverse / http://127.0.0.1:8080/
   ```

2. Optionally, you can add any **httpd** access controls you deem necessary to prevent access to the Administration Console. See Section 8.10.3, “Configuring Authentication for the Administration Console” for examples.

3. Restart the **httpd** service to load the new configuration:

```
# service httpd restart
```

8.10.3. Configuring Authentication for the Administration Console

If you enable external access to the Administration Console by modifying the broker host **httpd** proxy configuration as described in Section 8.10.2, "Accessing the Administration Console", you can also configure authentication for the Administration Console by implementing a **<Location /admin-console>** section in the same **/etc/httpd/conf.d/000002_openshift_origin_broker_proxy.conf** file. For example, you can configure the Administration Console to authenticate based on user credentials or client IP. See the Apache HTTP Server documentation at http://httpd.apache.org/docs/2.2/howto/auth.html for more information on available authentication methods.

Because the Administration Console runs as a plug-in to the broker application, access to the Administration Console can be controlled using any of the Apache HTTP Server authentication methods described in Section 8.2, "Configuring User Authentication for the Broker". However, while the broker application and Management Console both validate authorization, the Administration Console does not.

Example Authentication Configurations

The following examples show how you can configure authentication for the Administration Console using various methods. You can add one of the example **<Location /admin-console>** sections before the **ProxyPass /admin-console** entry inside the **<VirtualHost *:443>** section in the **/etc/httpd/conf.d/000002_openshift_origin_broker_proxy.conf** file on each broker host. Note that the **httpd** service must be restarted to load any configuration changes.

Example 8.20. Authenticating by Host Name or IP Address

Using the **mod_authz_host** Apache module, you can configure authentication for the Administration Console based on the client host name or IP address.

The following section allows access for all hosts in the **example.com** domain and denies access for all other hosts:

```
<Location /admin-console>
    Order Deny,Allow
    Deny from all
    Allow from example.com
</Location>
```

See the **mod_authz_host** documentation at http://httpd.apache.org/docs/2.2/mod/mod_authz_host.html for more example usage.

Example 8.21. Authenticating Using LDAP

Using the **mod_authnz_ldap** Apache module, you can configure user authentication for the Administration Console to use an LDAP directory. This example assumes that an LDAP server already exists. See Section 8.2.2, "Authenticating Using LDAP" for details on how the **mod_authnz_ldap** module is used for broker user authentication.

The following section enables user authentication using an LDAP directory:

```
<Location /admin-console>
    AuthName "OpenShift Administration Console"
```

```
    AuthType Basic
    AuthBasicProvider ldap
    AuthLDAPURL "ldap://localhost:389/ou=People,dc=my-domain,dc=com?uid?
sub?(objectClass=*)"
    require valid-user

    Order Deny,Allow
    Deny from all
    Satisfy any
</Location>
```

The above section specifies an example server and query that must be modified to suit the requirements of your LDAP service. The most important information required is the ***AuthLDAPURL*** setting. Ensure the LDAP server's firewall is configured to allow access by the broker hosts.

The **require valid-user** directive in the above section uses the **mod_authz_user** module and grants access to all successfully authenticated users. You can change this to instead only allow specific users or only members of a group. See the **mod_authnz_ldap** documentation at http://httpd.apache.org/docs/2.2/mod/mod_authnz_ldap.html for more example usage.

Example 8.22. Authenticating Using Kerberos

Using the **mod_auth_kerb** Apache module, you can configure user authentication for the Administration Console to use a Kerberos service. This example assumes that a Kerberos server already exists. See Section 8.2.3, “Authenticating Using Kerberos” for details on how the **mod_auth_kerb** module is used for broker user authentication.

The following section enables user authentication using a Kerberos service:

```
<Location /admin-console>
    AuthName "OpenShift Administration Console"
    AuthType Kerberos
    KrbMethodNegotiate On
    KrbMethodK5Passwd On
    # The KrbLocalUserMapping enables conversion to local users, using
    # auth_to_local rules in /etc/krb5.conf. By default it strips the
    # @REALM part. See krb5.conf(5) for details how to set up specific
rules.
    KrbLocalUserMapping On
    KrbServiceName HTTP/www.example.com
    KrbAuthRealms EXAMPLE.COM
    Krb5KeyTab /var/www/openshift/broker/httpd/conf.d/http.keytab
    require valid-user

    Order Deny,Allow
    Deny from all
    Satisfy any
</Location>
```

Modify the ***KrbServiceName*** and ***KrbAuthRealms*** settings to suit the requirements of your Kerberos service. Ensure the Kerberos server's firewall is configured to allow access by the broker hosts.

The **require valid-user** directive in the above section uses the **mod_authz_user** module and grants access to all successfully authenticated users. You can change this to instead only allow specific users. See the **mod_auth_kerb** documentation at http://modauthkerb.sourceforge.net/configure.html for more example usage.

Example 8.23. Authenticating Using htpasswd

Using the **mod_auth_basic** Apache module, you can configure user authentication for the Administration Console to use a flat **htpasswd** file. This method is only intended for testing and demonstration purposes. See Section 8.2.1, "Authenticating Using htpasswd" for details on how the **/etc/openshift/htpasswd** file is used for broker user authentication by a basic installation of OpenShift Enterprise.

The following section enables user authentication using the **/etc/openshift/htpasswd** file:

```
<Location /admin-console>
    AuthName "OpenShift Administration Console"
    AuthType Basic
    AuthUserFile /etc/openshift/htpasswd
    require valid-user

    Order Deny,Allow
    Deny from all
    Satisfy any
</Location>
```

The **require valid-user** directive in the above section uses the **mod_authz_user** module and grants access to all successfully authenticated users. You can change this to instead only allow specific users or only members of a group. See the **mod_auth_basic** documentation at http://httpd.apache.org/docs/2.2/mod/mod_auth_basic.html and http://httpd.apache.org/docs/2.2/howto/auth.html for more example usage.

8.11. Clearing Broker and Management Console Application Cache

In production mode, Rails caches certain values on the broker for faster retrieval. Clearing the broker and Console cache allows the retrieval of updated values. The number of files in both caches will increase over time, until eventually the system will run out of inodes. This can be harmful to your system.

Performing Regular Cache Maintenance

Creating a cron job to regularly clear the cache at a low-traffic time of the week is useful to prevent your cache from reaching capacity. Add the following to the **/etc/cron.d/openshift-rails-caches** file to perform a weekly cron job:

```
# Clear rails caches once a week on Sunday at 1am
0 1 * * Sun root /usr/sbin/oo-admin-broker-cache -qc
0 1 * * Sun root /usr/sbin/oo-admin-console-cache -qc
```

Manually Clearing the Cache

Alternatively, you can manually clear each cache for an immediate refresh. Clear the broker cache with the following command:

```
# oo-admin-broker-cache --clear
```

Clear the Management Console cache with the following command:

```
# oo-admin-console-cache --clear
```

[2] http://www.ietf.org/rfc/rfc2136.txt

[3] http://www.ietf.org/rfc/rfc2136.txt

[4] https://access.redhat.com/documentation/en-US/OpenShift_Enterprise/2/html-single/User_Guide/index.html#Mutual_SSL

[5] https://access.redhat.com/documentation/en-US/OpenShift_Enterprise/2/html-single/User_Guide/index.html#Scaled_and_Non-Scaled_Applications1

[6] https://access.redhat.com/documentation/en-US/OpenShift_Enterprise/2/html-single/User_Guide/index.html#sect-Custom_Domains_and_SSL_Certificates

Chapter 9. Manually Installing and Configuring Node Hosts

Prerequisites:

- Chapter 2, *Prerequisites*
- Chapter 5, *Host Preparation*
- Section 6.3, “Using the Sample Deployment Steps”

The following sections describe how to manually install and configure OpenShift Enterprise node hosts. These hosts support gears which, in turn, contain applications. Many of the steps required to configure a node are similar to the steps involved in configuring a broker, so some explanatory details are omitted from the following process.

Perform all of the procedures in this section only after the base operating system is fully installed and configured.

Warning

The OpenShift Enterprise security model assumes that broker and node components are installed on separate hosts. Running a broker and node on the same host is not supported.

9.1. Configuring Node Host Entitlements

OpenShift Enterprise requires several packages that are not available in the standard Red Hat Enterprise Linux channels. A node host requires a subscription for the appropriate OpenShift Enterprise channels to receive these extra packages.

Some subscriptions may be optional based on your requirements. For example, if you intend to install certain premium cartridges, they may require access to particular channels. The following table notes channels that are required for basic node host installation, as well as use cases for optional channels. Note that channel names may differ slightly between the RHSM and RHN Classic subscription methods.

Table 9.1. OpenShift Enterprise Node Host Channels

Channel Name	Purpose	Required	Provided By
Red Hat OpenShift Enterprise 2.2 Application Node (for RHSM), or Red Hat OpenShift Enterprise 2.2 Node (for RHN Classic).	Base channel for OpenShift Enterprise 2.2 node hosts.	Yes.	"OpenShift Enterprise" subscription.
Red Hat Software Collections 1.	Provides access to the latest versions of programming languages, database servers, and related packages.	Yes.	"OpenShift Enterprise" subscription.

Channel Name	Purpose	Required	Provided By
Red Hat OpenShift Enterprise 2.2 JBoss EAP add-on.	Provides the JBoss EAP premium xPaaS cartridge.	Only to support the JBoss EAP cartridge.	"JBoss Enterprise Application Platform for OpenShift Enterprise" subscription.
JBoss Enterprise Application Platform.	Provides JBoss EAP.	Only to support the JBoss EAP cartridge.	"JBoss Enterprise Application Platform for OpenShift Enterprise" subscription.
Red Hat OpenShift Enterprise 2.2 JBoss Fuse add-on.	Provides the JBoss Fuse premium xPaaS cartridge (available starting in OpenShift Enterprise 2.1.7).	Only to support the JBoss Fuse cartridge.	"JBoss Fuse for xPaaS" subscription.
Red Hat OpenShift Enterprise 2.2 JBoss A-MQ add-on.	Provides the JBoss A-MQ premium xPaaS cartridge (available starting in OpenShift Enterprise 2.1.7).	Only to support the JBoss A-MQ cartridge.	"JBoss A-MQ for xPaaS" subscription.
JBoss Enterprise Web Server 2.	Provides Tomcat 6 and Tomcat 7.	Only to support the JBoss EWS (Tomcat 6 and 7) standard cartridges.	"OpenShift Enterprise" subscription.
Red Hat OpenShift Enterprise Client Tools 2.2.	Provides access to the OpenShift Enterprise 2.2 client tools.	Only if client tools are used on the node host.	"OpenShift Enterprise" subscription.

You must register your node host using either the Red Hat Subscription Management (RHSM) or Red Hat Network (RHN) Classic subscription method to attach any of the above subscriptions and enable the proper channels. Instructions for both subscription methods are provided in Section 9.1.1, “Using Red Hat Subscription Management on Node Hosts” and Section 9.1.2, “Using Red Hat Network Classic on Node Hosts”. Choose one of these subscription methods and follow the relevant instructions before proceeding to Section 9.2, “Configuring Yum on Node Hosts”.

9.1.1. Using Red Hat Subscription Management on Node Hosts

You can use Red Hat Subscription Management (RHSM) as the subscription method for your node host, which allows the system to access the channels and packages required for installation. The following instructions describe the basic RHSM configuration steps to prepare an OpenShift Enterprise node host for installation. See the Red Hat Subscription Management documentation at https://access.redhat.com/documentation/en-US/Red_Hat_Subscription_Management if you require additional information on subscription management per your environment.

Procedure 9.1. To Configure Node Host Subscriptions Using Red Hat Subscription Management:

1. Use the **`subscription-manager register`** command to register your Red Hat Enterprise Linux system.

   Example 9.1. Registering the System

   ```
   # subscription-manager register

   Username:
   ```

```
Password:

The system has been registered with id: 3tghj35d1-7c19-4734-b638-
f24tw8eh6246
```

2. Use the **subscription-manager list --available** command and locate any desired OpenShift Enterprise subscription pool IDs in the output of available subscriptions on your account.

Example 9.2. Finding Subscription Pool IDs

```
# subscription-manager list --available

+-------------------------------------------+
    Available Subscriptions
+-------------------------------------------+

Subscription Name:      OpenShift Enterprise
SKU:                    MCT####
Pool Id:                Example_3cf49557013d418c52992690
Quantity:               1
Service Level:          Standard
Service Type:           L1-L3
Multi-Entitlement:      No
Ends:                   01/01/2020
System Type:            Physical

Subscription Name:      JBoss Enterprise Application Platform for
OpenShift Enterprise
SKU:                    SYS####
Pool Id:                Example_3cf49557013d418c52182681
Quantity:               1
Service Level:          Premium
Service Type:           L1-L3
Multi-Entitlement:      No
Ends:                   01/01/2020
System Type:            Physical
```

The "OpenShift Enterprise" subscription is the only subscription required for basic node operation. Additional subscriptions, detailed in Section 9.1, “Configuring Node Host Entitlements”, are optional and only required based on your planned usage of OpenShift Enterprise. For example, locate the pool ID for the "JBoss Enterprise Application Platform for OpenShift Enterprise" subscription if you plan to install the JBoss EAP premium xPaaS cartridge.

3. Attach the desired subscription(s). Replace **pool-id** in the following command with your relevant **Pool Id** value(s) from the previous step:

```
# subscription-manager attach --pool pool-id --pool pool-id
```

4. Enable the **Red Hat OpenShift Enterprise 2.2 Application Node** channel:

```
# subscription-manager repos --enable rhel-6-server-ose-2.2-node-rpms
```

5. Verify that the **yum repolist** command lists the enabled channel(s).

Example 9.3. Verifying the Enabled Node Channel

```
# yum repolist

repo id                              repo name

rhel-server-6-ose-2.2-node-rpms   Red Hat OpenShift Enterprise 2.2
Application Node (RPMs)
```

OpenShift Enterprise node hosts require a customized **yum** configuration to install correctly. For continued steps to correctly configure **yum**, see Section 9.2, “Configuring Yum on Node Hosts”.

9.1.2. Using Red Hat Network Classic on Node Hosts

You can use Red Hat Network (RHN) Classic as the subscription method for your node host, which allows the system to access the channels and packages required for installation. The following instructions describe the basic RHN Classic configuration steps to prepare an OpenShift Enterprise node host for installation.

Note

While RHN Classic can be used to subscribe to channels, it is primarily intended for existing, legacy systems. Red Hat strongly recommends that you use Red Hat Subscription Management (RHSM) for new installations. For details on how to migrate from RHN Classic to RHSM, see the *OpenShift Enterprise Administration Guide*.

Procedure 9.2. To Configure Node Host Subscriptions Using Red Hat Network Classic:

1. Use the **rhnreg_ks** command to register your Red Hat Enterprise Linux system. Replace **username** and **password** in the following command with your Red Hat Network account credentials:

```
# rhnreg_ks --username username --password password
```

2. Enable the **Red Hat OpenShift Enterprise 2.2 Node** channel:

```
# rhn-channel -a -c rhel-x86_64-server-6-ose-2.2-node
```

3. Verify that the **yum repolist** command lists the enabled channel(s).

Example 9.4. Verifying the Enabled Node Channel

```
# yum repolist

repo id                                repo name

rhel-x86_64-server-6-ose-2.2-node   Red Hat OpenShift Enterprise 2.2
Node - x86_64
```

OpenShift Enterprise node hosts require a customized **yum** configuration to install correctly. For continued steps to correctly configure **yum**, see Section 9.2, “Configuring Yum on Node Hosts”.

9.2. Configuring Yum on Node Hosts

The packages required for running OpenShift Enterprise are all available from Red Hat Network (RHN). Third-party RPM repositories and even other products provided by Red Hat can create conflicts with OpenShift Enterprise during initial deployment and later when applying updates. To avoid these issues, it is best to use a combination of the *yum-plugin-priorities* package and **exclude** directives in the **yum** configuration files.

The *yum-plugin-priorities* package helps prevent other repositories from interfering with Red Hat Network content for OpenShift Enterprise. The **exclude** directives work around the cases that priorities will not solve. The **oo-admin-yum-validator** tool consolidates this **yum** configuration process for specified component types called *roles*.

Using the oo-admin-yum-validator Tool

After configuring the selected subscription method as described in Section 9.1, “Configuring Node Host Entitlements”, use the **oo-admin-yum-validator** tool to configure **yum** and prepare your host to install the node components. This tool reports a set of problems, provides recommendations, and halts by default so that you can review each set of proposed changes. You then have the option to apply the changes manually, or let the tool attempt to fix the issues that have been found. This process may require you to run the tool several times. You also have the option of having the tool both report all found issues, and attempt to fix all issues.

Procedure 9.3. To Configure Yum on Node Hosts:

1. Install the latest *openshift-enterprise-release* package:

```
# yum install openshift-enterprise-release
```

2. Run the **oo-admin-yum-validator** command with the **-o** option for version **2.2** and the **-r** option for the **node** role.

   If you intend to install one or more xPaaS premium cartridge and the relevant subscription(s) are in place as described in Section 9.1, “Configuring Node Host Entitlements”, replace **node** with one or more of the **node-eap**, **node-amq**, or **node-fuse** roles as needed for the respective cartridge(s). If you add more than one role, use an **-r** option when defining each role.

   The command reports the first detected set of problems, provides a set of proposed changes, and halts.

   Example 9.5. Finding Problems

```
# oo-admin-yum-validator -o 2.2 -r node-eap

Detected OpenShift Enterprise repository subscription managed by Red
Hat Subscription Manager.

The required OpenShift Enterprise repositories are disabled:
    jb-ews-2-for-rhel-6-server-rpms
    rhel-6-server-rpms
```

```
    rhel-6-server-ose-2.2-jbosseap-rpms
    rhel-server-rhscl-6-rpms
    jb-eap-6-for-rhel-6-server-rpms
Enable these repositories by running these commands:
# subscription-manager repos --enable=jb-ews-2-for-rhel-6-server-
rpms
# subscription-manager repos --enable=rhel-6-server-rpms
# subscription-manager repos --enable=rhel-6-server-ose-2.2-
jbosseap-rpms
# subscription-manager repos --enable=rhel-server-rhscl-6-rpms
# subscription-manager repos --enable=jb-eap-6-for-rhel-6-server-
rpms
Please re-run this tool after making any recommended repairs to this
system
```

Alternatively, use the **--report-all** option to report all detected problems.

```
# oo-admin-yum-validator -o 2.2 -r node-eap --report-all
```

3. After reviewing the reported problems and their proposed changes, either fix them manually or let the tool attempt to fix the first set of problems using the same command with the **--fix** option. This may require several repeats of steps 2 and 3.

Example 9.6. Fixing Problems

```
# oo-admin-yum-validator -o 2.2 -r node-eap --fix

Detected OpenShift Enterprise repository subscription managed by Red
Hat Subscription Manager.

Enabled repository jb-ews-2-for-rhel-6-server-rpms
Enabled repository rhel-6-server-rpms
Enabled repository rhel-6-server-ose-2.2-jbosseap-rpms
Enabled repository rhel-server-rhscl-6-rpms
Enabled repository jb-eap-6-for-rhel-6-server-rpms
```

Alternatively, use the **--fix-all** option to allow the tool to attempt to fix all of the problems that are found.

```
# oo-admin-yum-validator -o 2.2 -r node-eap --fix-all
```

Note

If the host is using Red Hat Network (RHN) Classic, the **--fix** and **--fix-all** options do not automatically enable any missing OpenShift Enterprise channels as they do when the host is using Red Hat Subscription Management. Enable the recommended channels with the **rhn-channel** command. Replace **repo-id** in the following command with the repository ID reported in the **oo-admin-yum-validator** command output.

```
# rhn-channel -a -c repo-id
```

Important

For either subscription method, the **--fix** and **--fix-all** options do not automatically install any packages. The tool reports if any manual steps are required.

4. Repeat steps 2 and 3 until the **oo-admin-yum-validator** command displays the following message.

```
No problems could be detected!
```

9.3. Creating a Node DNS Record

For correct communication between the node host (Host 2) and the broker host (Host 1), verify that the host name for Host 1 resolves correctly. See Section 7.3, “Installing and Configuring BIND and DNS” for instructions on BIND server configuration.

Update the DNS records (in these instructions, the Host 1 BIND server) to resolve the host name for Host 2.

Run the following command on Host 1. Replace **example.com** with the chosen domain name, **node** with Host 2's short name, and **10.0.0.2** with Host 2's IP address:

```
# oo-register-dns -h node -d example.com -n 10.0.0.2
```

This command is provided as a convenience, equivalent to the **nsupdate** command demonstrated in the Host 1 configuration.

Note

This step is not performed by the kickstart or bash script, but the ***named_entries*** parameter can be used to define all hosts in advance when installing **named**.

9.4. Configuring Node Host Name Resolution

Configure Host 2 to use the **named** service running on the broker (Host 1). This allows Host 2 to resolve the host names of the broker and any other broker or node hosts configured, and vice versa, so that Host 1 can resolve the host name of Host 2.

Edit the contents of **/etc/resolv.conf** on Host 2 and add the following entry as the first name server. Replace **10.0.0.1** with the IP address of Host 1:

```
nameserver 10.0.0.1
```

Note

If you use the kickstart or bash script, the **configure_dns_resolution** function performs this step.

9.5. Configuring the Node Host DHCP and Host Name

The node host (Host 2) requires general network configuration. Replace **eth0** in the file names with the appropriate network interface for your system in the examples that follow.

Procedure 9.4. To Configure the DHCP Client and Host Name on the Node Host:

1. Create the **/etc/dhcp/dhclient-*eth0*.conf** file, then add the following lines to configure the DHCP client to send DNS requests to the broker (Host 1) and assume the appropriate host name and domain name. Replace **10.0.0.1** with the actual IP address of Host 1 and **example.com** with the actual domain name of Host 2. If you are using a network interface other than **eth0**, edit the configuration file for that interface instead.

   ```
   prepend domain-name-servers 10.0.0.1;
   prepend domain-search "example.com";
   ```

2. Edit the **/etc/sysconfig/network** file on Host 2, and set the ***HOSTNAME*** parameter to the fully-qualified domain name (FQDN) of Host 2. Replace **node.example.com** in the following example with the host name of Host 2.

   ```
   HOSTNAME=node.example.com
   ```

   Important

   Red Hat does not recommend changing the node host name after the initial configuration. When an application is created on a node host, application data is stored in a database. If the node host name is modified, the data does not automatically change, which can cause the instance to fail. The node host name cannot be changed without deleting and recreating all gears on the node host. Therefore, verify that the host name is configured correctly before deploying any applications on a node host.

3. Set the host name immediately:

   ```
   # hostname node.example.com
   ```

Note

If you use the kickstart or bash script, the **configure_dns_resolution** and **configure_hostname** functions perform these steps.

4. Run the **hostname** command on Host 2:

```
# hostname
```

9.6. Installing the Core Node Host Packages

Install the various packages that provide the core node host functionality with the following command:

```
# yum install rubygem-openshift-origin-node ruby193-rubygem-passenger-native
openshift-origin-node-util policycoreutils-python rubygem-openshift-origin-
container-selinux rubygem-openshift-origin-frontend-nodejs-websocket rubygem-
openshift-origin-frontend-apache-mod-rewrite
```

Note

If you use the kickstart or bash script, the **install_node_pkgs** function performs this step.

9.7. Installing and Configuring MCollective on Node Hosts

The broker host uses MCollective to communicate with node hosts. MCollective on the node host must be configured so that the node host (Host 2) can communicate with the broker service on Host 1.

In a production environment, two or more messaging hosts would typically be configured on machines separate from the broker to provide high availability. This means that if one messaging host fails, the broker and node hosts can still communicate.

Procedure 9.5. To Install and Configure MCollective on the Node Host:

1. Install all required packages for MCollective on Host 2 with the following command:

```
# yum install openshift-origin-msg-node-mcollective
```

2. Replace the contents of the **/opt/rh/ruby193/root/etc/mcollective/server.cfg** file with the following configuration. Remember to change the setting for ***plugin.activemq.pool.1.host*** from **broker.example.com** to the host name of Host 1. Use the same password for the MCollective user specified in the **/etc/activemq/activemq.xml** file on Host 1. Use the same password for the ***plugin.psk*** parameter, and the same numbers for the ***heartbeat*** parameters specified in the **/opt/rh/ruby193/root/etc/mcollective/client.cfg** file on Host 1:

```
main_collective = mcollective
collectives = mcollective
libdir = /opt/rh/ruby193/root/usr/libexec/mcollective
logfile = /var/log/openshift/node/ruby193-mcollective.log
```

```
loglevel = debug

daemonize = 1
direct_addressing = 0

# Plugins
securityprovider = psk
plugin.psk = asimplethingy

connector = activemq
plugin.activemq.pool.size = 1
plugin.activemq.pool.1.host = broker.example.com
plugin.activemq.pool.1.port = 61613
plugin.activemq.pool.1.user = mcollective
plugin.activemq.pool.1.password = marionette

plugin.activemq.heartbeat_interval = 30
plugin.activemq.max_hbread_fails = 2
plugin.activemq.max_hbrlck_fails = 2

# Node should retry connecting to ActiveMQ forever
plugin.activemq.max_reconnect_attempts = 0
plugin.activemq.initial_reconnect_delay = 0.1
plugin.activemq.max_reconnect_delay = 4.0

# Facts
factsource = yaml
plugin.yaml = /opt/rh/ruby193/root/etc/mcollective/facts.yaml
```

3. Configure the **ruby193-mcollective** service to start on boot:

```
# chkconfig ruby193-mcollective on
```

4. Start the **ruby193-mcollective** service immediately:

```
# service ruby193-mcollective start
```

Note

If you use the kickstart or bash script, the **configure_mcollective_for_activemq_on_node** function performs these steps.

5. Run the following command on the broker host (Host 1) to verify that Host 1 recognizes Host 2:

```
# oo-mco ping
```

9.7.1. Facter

The Facter used by MCollective is an important architectural component of OpenShift Enterprise. Facter is a script that compiles the **/opt/rh/ruby193/root/etc/mcollective/facts.yaml** file, and lists the facts of interest about a node host for inspection using MCollective. Visit www.puppetlabs.com for more information about how Facter is used with MCollective. There is no central registry for node hosts, so any

node host listening with MCollective advertises its capabilities as compiled by the Facter.

The broker host uses the **facts.yaml** file to determine the capabilities of all node hosts. The broker host issues a filtered search that includes or excludes node hosts based on entries in the **facts.yaml** file to find a host for a particular gear.

The Facter script runs on the node host in one minute increments, which can be modified in the **/etc/cron.minutely/openshift-facts** cron job file. You can also run this script manually to immediately inspect the new **facts.yaml** file.

9.8. Installing Cartridges

At this point, install any web or add-on cartridge packages for your OpenShift Enterprise deployment.

Web cartridges provide support for specific types of applications to run on OpenShift Enterprise. For example, there is a web cartridge that supports PHP development, and another for Ruby development.

Add-on cartridges include database and management cartridges, and exist to support additional functions on which an application may rely. For example, cartridges exist for the MySQL and PostgreSQL database servers.

If a particular cartridge is not installed at this point, it can be installed later. However, a cartridge must be installed before developers can create applications for the supported framework or service.

Important

Administrators choose the set of installed cartridges. However, node hosts require installation of this same set on each node host. Gear placement does not currently take into account differences in the installed cartridges per node host. All node hosts are assumed to have the same cartridge set, and gear creation fails on a node host that is missing cartridges required for the gear.

9.8.1. Installing Web Cartridges

The following table lists the web cartridges available for installation.

Table 9.2. Available Web Cartridges

Package Name	Description
openshift-origin-cartridge-amq	JBoss A-MQ support [a]
openshift-origin-cartridge-diy	DIY ("do it yourself") application type
openshift-origin-cartridge-fuse	JBoss Fuse support [a]
openshift-origin-cartridge-fuse-builder	JBoss Fuse Builder support [a]
openshift-origin-cartridge-haproxy	HAProxy support
openshift-origin-cartridge-jbossews	JBoss EWS support
openshift-origin-cartridge-jbosseap	JBoss EAP support [a]
openshift-origin-cartridge-jenkins	Jenkins server for continuous integration
openshift-origin-cartridge-nodejs	Node.js support
openshift-origin-cartridge-ruby	Ruby Rack support running on Phusion Passenger
openshift-origin-cartridge-perl	**mod_perl** support
openshift-origin-cartridge-php	PHP support

Package Name	Description
openshift-origin-cartridge-python	Python support

[a] Premium cartridge. If installing, see Section 9.1, “Configuring Node Host Entitlements” to ensure the correct premium add-on subscriptions are configured.

Install any web cartridges using the following command:

```
# yum install package_name
```

Note

If you use the kickstart or bash script, the **install_cartridges** function performs this step. This function currently installs all cartridges listed. Edit this function to install a different set of cartridges.

Important

If needed, administrators can choose to configure the JBoss EWS cartridge *tomcat7* binary provided by the EWS 3 product to work around known security issues with the JBoss EWS-2 *tomcat7* binary. See *Known Issues* to learn more.

9.8.2. Installing Add-on Cartridges

The following table lists the add-on cartridges available for installation.

Table 9.3. Available Add-on Cartridges

Package Name	Description
openshift-origin-cartridge-cron	Embedded **crond** support.
openshift-origin-cartridge-jenkins-client	Embedded Jenkins client.
openshift-origin-cartridge-mysql	Embedded MySQL.
openshift-origin-cartridge-postgresql	Embedded PostgreSQL.
openshift-origin-cartridge-mongodb	Embedded MongoDB. Available starting in OpenShift Enterprise 2.1.1.

Install any add-on cartridges using the following command:

```
# yum install package_name
```

Note

If you use the kickstart or bash script, the **install_cartridges** function performs this step. This function currently installs all cartridges listed. Edit this function to install a different set of cartridges.

9.8.3. Installing Cartridge Dependency Metapackages

OpenShift Enterprise 2 supports the latest version of Red Hat Enterprise Linux 6, and some features provided by the base Red Hat Enterprise Linux channel are required. To avoid complications from nonessential package updates in an OpenShift Enterprise environment, base cartridge packages only include packages that are absolutely required. For example, the base cartridge package for PHP is *openshift-origin-cartridge-php*.

To provide additional, nonessential packages for a cartridge, two *cartridge dependency metapackages* are available for each cartridge, allowing greater control over the installation of recommended and optional packages. For example, the cartridge dependency metapackages for PHP are:

- *openshift-origin-cartridge-dependencies-recommended-php*
- *openshift-origin-cartridge-dependencies-optional-php*

For example, certain libraries provided by a nonessential package might not be allowed in an organization. Because the package is only included in a cartridge dependency metapackage, this allows you to choose whether or not the libraries are installed on your hosts. These metapackages also give Red Hat a way to indicate which sets of dependencies might not be supported in the future.

The following table provides further details on each type of cartridge dependency metapackage.

Table 9.4. Available Cartridge Dependency Metapackages

Type	Package Name Format	Description
Recommended	openshift-origin-cartridge-dependencies-recommended-*cartridge_short_name*	Provides the additional recommended packages for the base cartridge. Useful for compatibility with OpenShift Online.
Optional	openshift-origin-cartridge-dependencies-optional-*cartridge_short_name*	Provides both the additional recommended and optional packages for the base cartridge. Useful for compatibility with OpenShift Online, however these packages might be removed from a future version of OpenShift Enterprise.

Install any cartridge dependency metapackages using the following command:

```
# yum install package_name
```

Note

If you use the kickstart or bash script, the **`install_cartridges`** function performs this step. By default, this function currently installs the recommended cartridge dependency metapackages for all installed cartridges.

9.9. Configuring SSH Keys on the Node Host

Copy the appropriate SSH key from the broker host to each node host. This is necessary to move gears between node hosts. The following instructions describe how to configure your SSH keys.

You can have multiple broker hosts configured for redundancy. Ensure that each node host has the **`rsync_id_rsa.pub`** public key of each broker host by repeating steps three through five of the following procedure for each broker host.

Procedure 9.6. To Configure SSH Keys on the Node Host:

1. On the node host, create a **/root/.ssh** directory if it does not exist:

```
# mkdir -p /root/.ssh
```

2. Configure the appropriate permissions for the **/root/.ssh** directory:

```
# chmod 700 /root/.ssh
```

3. Copy the SSH key from the broker host to each node host:

```
# scp root@broker.example.com:/etc/openshift/rsync_id_rsa.pub
/root/.ssh/
```

4. Supply the root user password of the broker host when prompted:

```
root@broker.example.com's password:
```

5. Copy the contents of the SSH key to the **/root/.ssh/authorized_keys** file:

```
# cat /root/.ssh/rsync_id_rsa.pub >> /root/.ssh/authorized_keys
```

6. Configure the appropriate permissions for the **/root/.ssh/authorized_keys** file:

```
# chmod 600 /root/.ssh/authorized_keys
```

7. Remove the SSH key:

```
# rm -f /root/.ssh/rsync_id_rsa.pub
```

Important

Ensure you have performed this procedure on all node hosts.

9.10. Configuring Required Services on Node Hosts

Node hosts must run a number of services to provide application developers with the full range of features and functionality that the product offers.

The **sshd** daemon is required to provide access to Git repositories, and the node host must also allow **HTTP** and **HTTPS** connections to the applications running within gears on the node host. The **openshift-node-web-proxy** daemon is required for WebSockets usage, which also requires that ports 8000 and 8443 be opened.

Further configuration steps are described in the following sections.

Run the following commands to correctly configure the firewall and ensure the required services start when the node boots:

```
# lokkit --nostart --service=ssh
# lokkit --nostart --service=https
```

```
# lokkit --nostart --service=http
# lokkit --nostart --port=8000:tcp
# lokkit --nostart --port=8443:tcp
# chkconfig httpd on
# chkconfig network on
# chkconfig ntpd on
# chkconfig sshd on
# chkconfig oddjobd on
# chkconfig openshift-node-web-proxy on
```

Note

If you use the kickstart or bash script, the **enable_services_on_node** function performs these steps.

9.10.1. Configuring PAM

OpenShift Enterprise uses a custom PAM configuration to restrict users who connect to gears using**SSH**. Only gear login accounts are polyinstantiated; other local users are unaffected.

Run the following commands on the node host (Host 2) to configure PAM:

```
# sed -i -e 's|pam_selinux|pam_openshift|g' /etc/pam.d/sshd
# for f in "runuser" "runuser-l" "sshd" "su" "system-auth-ac"
do
 t="/etc/pam.d/$f"
 if ! grep -q "pam_namespace.so" "$t"

 then
  printf 'session\t\t[default=1 success=ignore]\tpam_succeed_if.so quiet
shell = /usr/bin/oo-trap-user\n' >> "$t"
  printf 'session\t\trequired\tpam_namespace.so no_unmount_on_close\n' >>
"$t"
 fi
done
```

Configure the polyinstantiation settings on the node host (Host 2):

```
# printf '/tmp $HOME/.tmp/ user:iscript=/usr/sbin/oo-namespace-init
root,adm\n' > /etc/security/namespace.d/tmp.conf
 printf '/dev/shm tmpfs tmpfs:mntopts=size=5M:iscript=/usr/sbin/oo-
namespace-init root,adm\n' > /etc/security/namespace.d/shm.conf
```

Ultimately, the content for these configuration files should look similar to the following:

```
# cat /etc/security/namespace.d/tmp.conf
/tmp $HOME/.tmp/ user:iscript=/usr/sbin/oo-namespace-init root,adm

# cat /etc/security/namespace.d/shm.conf
/dev/shm tmpfs tmpfs:mntopts=size=5M:iscript=/usr/sbin/oo-namespace-init
root,adm
```

Note

If you use the kickstart or bash script, the **configure_pam_on_node** function performs these steps.

9.10.2. Configuring Cgroups

Node hosts use Linux kernel **cgroups** to contain application processes and to allocate resources fairly. **cgroups** use two services that must both be running for **cgroups** containment to be in effect:

- The **cgconfig** service provides the LVFS interface to the **cgroup** subsystems. Use the **/etc/cgconfig.conf** file to configure this service.
- The **cgred** "rules" daemon assigns new processes to a **cgroup** based on matching rules. Use the **/etc/cgrules.conf** file to configure this service.

Run the following commands to configure **cgroups**:

```
# for f in "runuser" "runuser-l" "sshd" "system-auth-ac"
do t="/etc/pam.d/$f"
 if ! grep -q "pam_cgroup" "$t"
 then printf 'session\t\toptional\tpam_cgroup.so\n' >> "$t"
 fi
done

# cp -vf /opt/rh/ruby193/root/usr/share/gems/doc/openshift-origin-node-
*/cgconfig.conf /etc/cgconfig.conf
# restorecon -v /etc/cgconfig.conf
# restorecon -v /etc/cgrules.conf
# mkdir -p /cgroup
# restorecon -rv /cgroup
# chkconfig cgconfig on
# chkconfig cgred on
# service cgconfig restart
# service cgred restart
```

Important

Start the **cgroups** services in the following order for OpenShift Enterprise to function correctly:

1. **cgconfig**
2. **cgred**

Use the **service *service-name* start** command to start each of these services in order.

Note

If you use the kickstart or bash script, the **configure_cgroups_on_node** function performs these steps.

Verifying the cgroups Configuration

When **cgroups** have been configured correctly you should see the following:

- The **/etc/cgconfig.conf** file exists with SELinux label ***system_u:object_r:cgconfig_etc_t:s0***.
- The **/etc/cgconfig.conf** file mounts **cpu, cpuacct, memory,** and **net_cls** on the **/cgroup** directory.
- The **/cgroup** directory exists, with SELinux label ***system_u:object_r:cgroup_t:s0***.
- The command **service cgconfig status** returns **Running**.
- The **/cgroup** directory exists and contains subsystem files for **cpu, cpuacct, memory,** and **net_cls**.

When the **cgred** service is running correctly you should see the following:

- The **/etc/cgrules.conf** file exists with SELinux label ***system_u:object_r:cgrules_etc_t:s0***.
- The **service cgred status** command shows that **cgred** is running.

Important

If you created the configuration files interactively as a root user, the SELinux user label would be ***unconfined_u*** and not ***system_u***. For example, the SELinux label in **/etc/cgconfig.conf** would be ***unconfined_u:object_r:cgconfig_etc_t:s0***.

9.10.3. Configuring Disk Quotas

User quotas enforce disk quotas per gear because each gear corresponds to a system user. The quota values are set in the **/etc/openshift/resource_limits.conf** file. Modify these values to suit your requirements.

Table 9.5. Disk Quota Configuration Options:

Option	Description
quota_files	The number of files the gear is allowed to own.
quota_blocks	The amount of space the gear is allowed to consume in blocks (1 block = 1024 bytes).

Important

The minimum allowed value for the ***quota_blocks*** parameter is 1 GB.

Enable enforcement of disk quotas at the file system level.

Procedure 9.7. To Enable Disk Quotas:

1. Consult the **/etc/fstab** file to determine which device is mounted as **/var/lib/openshift**. In a simple setup, it is the root partition, but in a production system, it is more likely a RAID or NAS mount at **/var/lib/openshift**. The following steps in this procedure use the root partition as the

example mount point. Adjust these to suit your system requirements.

2. Add a **usrquota** option for that mount point entry in the **/etc/fstab** file.

   Example 9.7. Example Entry in the /etc/fstab file

   ```
   UUID=4f182963-5e00-4bfc-85ed-9f14149cbc79  /  ext4
   defaults,usrquota  1 1
   ```

3. Reboot the node host or remount the mount point:

   ```
   # mount -o remount /
   ```

4. Generate user quota information for the mount point:

   ```
   # quotacheck -cmug /
   ```

5. Fix the SELinux permissions on the **aquota.user** file located in the top directory of the mount point:

   ```
   # restorecon /aquota.user
   ```

6. Re-enable quotas on the mount point:

   ```
   # quotaon /
   ```

Verifying the Disk Quota Configuration

Create an application and then run the following command to verify that your disk quota is correct:

```
# repquota -a | grep gear-uuid
```

9.10.4. Configuring SELinux

Node hosts require a specific SELinux policy and context configuration to operate correctly. Run the following commands to set the required Boolean values:

```
# setsebool -P httpd_unified=on httpd_can_network_connect=on
httpd_can_network_relay=on httpd_read_user_content=on
httpd_enable_homedirs=on httpd_run_stickshift=on allow_polyinstantiation=on
```

Table 9.6. Boolean Value Options

Boolean Value	Purpose
httpd_unified	Allow the node host to write files in the **http** file context.
httpd_can_network_connect	Allow the node host to access the network.
httpd_can_network_relay	Allow the node host to access the network.
httpd_read_user_content	Allow the node host to read application data.
httpd_enable_homedirs	Allow the node host to read application data.

Boolean Value	Purpose
httpd_run_stickshift	Allow the node host to read application data.
allow_polyinstantiation	Allow polyinstantiation for gear containment.

Relabel a number of files with the correct SELinux contexts. Specify these contexts with:

```
# restorecon -rv /var/run
# restorecon -rv /var/lib/openshift /etc/openshift/node.conf
/etc/httpd/conf.d/openshift
```

Note

If you use the kickstart or bash script, the **configure_selinux_policy_on_node** function performs these steps.

9.10.5. Configuring System Control Settings

OpenShift Enterprise uses semaphores, ports, and connection tracking extensively. Apply the following changes to the default **/etc/sysctl.conf** file to enable this usage.

Procedure 9.8. To Configure the sysctl Settings:

1. Open the **/etc/sysctl.conf** file and append the following line to increase kernel semaphores to accommodate more httpds:

   ```
   kernel.sem = 250  32000 32  4096
   ```

2. Append the following line to the same file to increase the ephemeral port range to accommodate application proxies:

   ```
   net.ipv4.ip_local_port_range = 15000 35530
   ```

3. Append the following line to the same file to increase the connection-tracking table size:

   ```
   net.netfilter.nf_conntrack_max = 1048576
   ```

4. Append the following line to the same file to enable forwarding for the port proxy:

   ```
   net.ipv4.ip_forward = 1
   ```

5. Append the following line to the same file to allow the port proxy to route using loopback addresses:

   ```
   net.ipv4.conf.all.route_localnet = 1
   ```

6. Run the following command to reload the **sysctl.conf** file and activate the new settings:

   ```
   # sysctl -p /etc/sysctl.conf
   ```

Note

If you use the kickstart or bash script, the **configure_sysctl_on_node** function performs these steps.

9.10.6. Configuring Secure Shell Access

Use the following procedure to correctly configure the **sshd** service on the node host:

1. Append the following line to the **/etc/ssh/sshd_config** file to configure the **sshd** daemon to pass the **GIT_SSH** environment variable:

```
AcceptEnv GIT_SSH
```

2. The **sshd** daemon handles a high number of **SSH** connections from developers connecting to the node host to push their changes. Increase the limits on the number of connections to the node host to accommodate this volume:

```
# sed -i -e "s/^#MaxSessions .*\$/MaxSessions 40/"
/etc/ssh/sshd_config
# sed -i -e "s/^#MaxStartups .*\$/MaxStartups 40/"
/etc/ssh/sshd_config
```

Note

If you use the kickstart or bash script, the **configure_sshd_on_node** function performs these steps.

9.10.7. Configuring the Port Proxy

All OpenShift Enterprise applications are contained within gears. These applications listen for connections on the loopback interface. The node host uses **iptables** to listen on external-facing ports and forwards incoming requests to the appropriate application.

Procedure 9.9. To Configure the OpenShift Port Proxy:

1. Verify that **iptables** is running and will start on boot.

```
# service iptables restart
# chkconfig iptables on
```

2. Verify that the port proxy starts on boot:

```
# chkconfig openshift-iptables-port-proxy on
```

3. Modify the **iptables** rules:

```
# sed -i '/:OUTPUT ACCEPT \[.*\]/a :rhc-app-comm - [0:0]'
/etc/sysconfig/iptables
```

```
# sed -i '/-A INPUT -i lo -j ACCEPT/a -A INPUT -j rhc-app-comm'
/etc/sysconfig/iptables
```

Warning

After you run these commands, do not run any further **lokkit** commands on the node host. Running **lokkit** commands after this point overwrites the required **iptables** rules and causes the **openshift-iptables-port-proxy** service to fail during startup.

Restart the **iptables** service for the changes to take effect:

```
# service iptables restart
```

4. Start the service immediately:

```
# service openshift-iptables-port-proxy start
```

5. Run the following command so that the **openshift-gears** service script starts on boot. The **openshift-gears** service script starts gears when a node host is rebooted:

```
# chkconfig openshift-gears on
```

Note

If you use the kickstart or bash script, the **configure_port_proxy** function performs these steps.

9.10.8. Configuring Node Settings

The following instructions describe how to configure the settings for your chosen host names and domain name.

Procedure 9.10. To Configure the Node Host Settings:

1. Open the **/etc/openshift/node.conf** file and set the value of ***PUBLIC_IP*** to the IP address of the node host.
2. Set the value of ***CLOUD_DOMAIN*** to the domain you are using for your OpenShift Enterprise installation.
3. Set the value of ***PUBLIC_HOSTNAME*** to the host name of the node host.
4. Set the value of ***BROKER_HOST*** to the host name or IP address of your broker host (Host 1).
5. Open the **/etc/openshift/env/OPENSHIFT_BROKER_HOST** file and enter the host name of your broker host (Host 1).
6. Open the **/etc/openshift/env/OPENSHIFT_CLOUD_DOMAIN** file and enter the domain you are using for your OpenShift Enterprise installation.

7. Run the following command to set the appropriate **ServerName** in the node host's Apache configuration:

```
# sed -i -e "s/ServerName .*\$/ServerName `hostname`/" \
/etc/httpd/conf.d/000001_openshift_origin_node_servername.conf
```

Note

If you use the kickstart or bash script, the **configure_node** function performs these steps.

9.10.9. Updating the Facter Database

Facter generates metadata files for MCollective and is normally run by **cron**. Run the following command to execute **facter** immediately to create the initial database, and to ensure it runs properly:

```
# /etc/cron.minutely/openshift-facts
```

Note

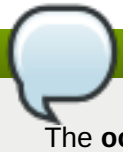
If you use the kickstart or bash script, the **update_openshift_facts_on_node** function performs this step.

Important

Reboot the node host to apply all of the changes that have been made.

9.11. Enabling Network Isolation for Gears

Prior to OpenShift Enterprise 2.2, network isolation for gears was not applied by default. Without isolation, gears could bind and connect to **localhost** as well as IP addresses belonging to other gears on the node, allowing users access to unprotected network resources running in another user's gear. To prevent this, starting with OpenShift Enterprise 2.2 the **oo-gear-firewall** command is invoked by default at installation when using the **oo-install** installation utility or the installation scripts. It must be invoked explicitly on each node host during manual installations.



Note

The **oo-gear-firewall** command is available in OpenShift Enterprise 2.1 starting with release 2.1.9.

The **oo-gear-firewall** command configures nodes with firewall rules using the **iptables** command and SELinux policies using the **semanage** command to prevent gears from binding or connecting on IP addresses that belong to other gears.

Gears are identified as a range of user IDs on the node host. The **oo-gear-firewall** command creates static sets of rules and policies to isolate all possible gears in the range. The UID range must be the same across all hosts in a gear profile. By default, the range used by the **oo-gear-firewall** command is taken from existing district settings if known, or 1000 through 6999 if unknown. The tool can be re-run to apply rules and policies for an updated UID range if the range is changed later.

To enable network isolation for gears using the default range, run the following command on each node host:

```
# oo-gear-firewall -i enable -s enable
```

To specify the UID range:

```
# oo-gear-firewall -i enable -s enable -b District_Beginning_UID -e
District_Ending_UID
```

9.12. Configuring Node Hosts for xPaaS Cartridges

Most standard cartridges provided with the base OpenShift Enterprise entitlement can run effectively on node hosts using the default node configuration. However, some xPaaS cartridges, typically provided with premium add-on OpenShift Enterprise entitlements [7], have specific configuration requirements for node hosts where their gears are hosted.

This section is only relevant if you have installed or intend to install xPaaS cartridges on your node host, with each cartridge's general requirements and recommendations outlined below. If you have not installed any xPaaS cartridges and intend to only have standard cartridges installed on the node host, skip to Section 9.13, “Configuring Gear Profiles (Sizes)” and continue through to the end of the chapter for the remaining manual node host installation instructions.

Configuring Node Hosts for the JBoss Fuse and JBoss A-MQ Cartridges

The JBoss Fuse and JBoss A-MQ premium xPaaS cartridges have the following configuration requirements:

- All node and broker hosts must be updated to OpenShift Enterprise release 2.1.7 or later.
- Because the *openshift-origin-cartridge-fuse* and *openshift-origin-cartridge-amq* cartridge RPMs are each provided in separate channels, the node host must have the "JBoss Fuse for xPaaS" or "JBoss A-MQ for xPaaS" add-on subscription attached to enable the relevant channel(s) before installing either cartridge RPM. See Section 9.1, “Configuring Node Host Entitlements” for information on these subscriptions and using the **oo-admin-yum-validator** tool to automatically configure the correct repositories starting in releases 2.1.8 and 2.2.
- The configuration in the **/etc/openshift/resource_limits.conf.xpaas.m3.xlarge** example file must be used as the gear profile on the node host in place of the default **small** gear profile.
- The cartridges require 15 external ports per gear. All of these ports are not necessarily used at the same time, but each is intended for a different purpose.
- The cartridges require 10 ports on the SNI front-end server proxy.
- Due to the above gear profile requirement, a new district must be created for the gear profile. Further, due to the above 15 external ports per gear requirement, the new district's capacity must be set to a maximum of 2000 gears instead of the default 6000 gears.

- Starting in OpenShift Enterprise 2.2, restrict the xPaaS cartridges to the **xpaas** gear size by adding to the ***VALID_GEAR_SIZES_FOR_CARTRIDGE*** list in the **/etc/openshift/broker.conf** file on broker hosts. For example:

```
VALID_GEAR_SIZES_FOR_CARTRIDGE="fuse-cart-name|xpaas amq-cart-name|xpaas"
```

See the *JBoss Fuse Cloud Deployment Guide* for detailed instructions on configuring a node host for the JBoss Fuse cartridge. The guide provides the node and broker host configuration instructions to meet the above requirements, as well as instructions on ensuring user accounts have access to the cartridge. See the *JBoss A-MQ Cloud Deployment Guide* for the same instructions for the JBoss A-MQ cartridge. Because the JBoss Fuse cartridge and the JBoss A-MQ cartridge have the same configuration requirements, you can install both cartridges on the same node host.

The instructions in the above *Cloud Deployment Guides* cover similar tasks handled by Section 9.13, "Configuring Gear Profiles (Sizes)", Section 9.14, "Configuring Districts", and Section 9.15, "Importing Cartridges" of this guide for basic node host installations. After finishing the instructions in one or both of the above *Cloud Deployment Guides*, you can return to this guide starting in Chapter 10, *Continuing Node Host Installation for Enterprise* for instructions on further customizing your node host installation for enterprise use, if desired.

Configuring Node Hosts for the JBoss Fuse Builder Cartridge

The JBoss Fuse Builder premium xPaaS cartridge can run on a default node host configuration. However, because the *openshift-origin-cartridge-fuse-builder* cartridge RPM is provided in the same separate channels as the JBoss Fuse and JBoss A-MQ cartridges, the node host must have either the "JBoss Fuse for xPaaS" or "JBoss A-MQ for xPaaS" add-on subscription attached to enable either of the channels before installing the cartridge RPM. See Section 9.1, "Configuring Node Host Entitlements" for more information.

See the *JBoss Fuse Cloud Deployment Guide* or the *JBoss A-MQ Cloud Deployment Guide* for more information on the JBoss Fuse Builder cartridge.

Configuring Node Hosts for the JBoss EAP Cartridge

The JBoss EAP premium xPaaS cartridge has the following configuration requirement and recommendation:

- Because the *openshift-origin-cartridge-jbosseap* cartridge RPM is provided in a separate channel, the node host must have the "JBoss Enterprise Application Platform for OpenShift Enterprise" add-on subscription attached to enable the channel before installing the cartridge RPM. See Section 9.1, "Configuring Node Host Entitlements" for more information.
- Red Hat recommends setting the following values in the node host's **/etc/openshift/resource_limits.conf** file:

```
limits_nproc=500
memory_limit_in_bytes=5368709120 # 5G
memory_memsw_limit_in_bytes=5473566720 # 5G + 100M (100M swap)
```

  You can set these values while following the instructions in Section 9.13, "Configuring Gear Profiles (Sizes)" through to the end of the chapter.

9.13. Configuring Gear Profiles (Sizes)

A *gear profile*, or *gear size*, specifies the parameters of the gears provided by a node host. A single node host can only host gears of the same gear profile. The gear profile for a given node host is defined in the host's **/etc/openshift/resource_limits.conf** file.

Because all gears on a node host have the same gear profile, references to *node profiles* in this guide refer to the gear profile on that particular node host. From the client usage perspective, the configurable parameters of a gear profile, such as RAM, CPU, and disk quota, conceptually define the size of a gear. Gear profiles are therefore often referred to synonymously with *gear sizes*. However, you can specify an arbitrary name for the gear profile to distinguish node hosts for purposes that are not related to resource limits, such as ownership and location.

All gears on the node host follow the configured gear profile's specifications. To be consistent, all node hosts with the same gear profile name should specify the same configuration, although this is not currently a requirement.

Important

Due to a bug, users of the Jenkins cartridge must define a gear profile named **`small`**. See https://bugzilla.redhat.com/show_bug.cgi?id=1027390 for more details.

9.13.1. Adding or Modifying Gear Profiles

Adding or modifying gear profiles in your OpenShift Enterprise deployment requires three main tasks:

1. Define the new gear profile on the node host.
2. Update the list of valid gear sizes on the broker host.
3. Grant users access to the new gear size.

The following instructions detail how to perform these tasks.

Procedure 9.11. To Define a New Gear Profile:

The default node host installation configures a gear profile named **`small`**. Edit the **`/etc/openshift/resource_limits.conf`** file on the node host to define a new gear profile.

Note

Starting with OpenShift Enterprise 2.1.6, additional example **`resource_limits.conf`** files based on other gear profile and host type configurations are included in the **`/etc/openshift/`** directory on nodes. For example, files for **`medium`** and **`large`** example profiles are included, as well as an **`xpaas`** profile for use on nodes hosting xPaaS cartridges. These files are available as a reference or can be used to copy over the existing **`/etc/openshift/resource_limits.conf`** file.

1. Edit the **`/etc/openshift/resource_limits.conf`** file on the node host and modify its parameters to your desired specifications. See the file's commented lines for information on available parameters.
2. Modify the ***`node_profile`*** parameter to set a new name for the gear profile, if desired.
3. Restart the **`ruby193-mcollective`** service on the node host:

```
# service ruby193-mcollective restart
```

4. If Traffic Control is enabled in the **/etc/openshift/node.conf** file, run the following command to apply any bandwidth setting changes:

```
# oo-admin-ctl-tc restart
```

Procedure 9.12. To Update the List of Valid Gear Sizes:

If you defined a new gear profile or modified the name of an existing gear profile, you must update the broker host configuration to enable administrators to create districts for the profile and to enable developers to create gears of that size.

1. Edit the **/etc/openshift/broker.conf** file on the broker host and modify the comma-separated list in the ***VALID_GEAR_SIZES*** parameter to include the new gear profile.

2. Consider adding the new gear profile to the comma-separated list in the ***DEFAULT_GEAR_CAPABILITIES*** parameter as well, which determines the default available gear sizes for new users.

3. Restart the broker service:

```
# service openshift-broker restart
```

4. For existing users, you must grant their accounts access to the new gear size before they can create gears of that size. Run the following command on the broker host for the relevant user name and gear size:

```
# oo-admin-ctl-user -l Username --addgearsize Gear_Size
```

5. See Section 9.14, “Configuring Districts” for more information on how to create and populate a district, which are required for gear deployment, using the new gear profile.

6. If gears already exist on the node host and the **memory_limit_in_bytes** variable has been updated in the **resource_limits.conf**, run the following command to ensure the memory limit for the new gear profile is applied to the existing gears. Replace 512 with the new memory limit *in megabytes*:

```
# for i in /var/lib/openshift/*/.env/OPENSHIFT_GEAR_MEMORY_MB; do echo
512 > "$i"; done
```

   Note that the original variable from **resource_limits.conf** is in bytes, while the environment variable is actually in megabytes.

9.14. Configuring Districts

An OpenShift Enterprise district defines a set of node hosts and the resource definitions they must share to enable transparent migration of gears between hosts. Using districts, a gear can keep the same UUID (and related IP addresses, ports, etc.) when moved from one node host to another node host within the same district. This means that applications are not disrupted during a migration. This is true even if applications have specific values that are hard-coded, as many do, rather than sourcing environment variables.

Districts are enabled and required by default for deploying gears. Red Hat requires that you create at least one district before you deploy an OpenShift Enterprise installation to production. See the *OpenShift Enterprise Administration Guide* [8] for more information on resource management, including capacity planning and using districts.

9.14.1. Creating a District

All node hosts in a district must have the same gear profile, so at least one district is required for each gear profile that is defined. At least two or more node hosts are required in each district to move gears from one node host to another. When capacity planning, you must take into account that districts currently have a hard limit of 6000 gears.

Districts are defined by the broker host in the MongoDB datastore. The following instructions describe how to create a district and add a new node host to it.

Procedure 9.13. To Create a District and Add a Node Host:

1. Create an empty district and specify the gear profile with:

```
# oo-admin-ctl-district -c create -n district_name -p gear_profile
```

2. Add an empty node host to the district. Only node hosts that do not have any gears can be added to a district, and the node host must have the same gear profile as the district:

```
# oo-admin-ctl-district -c add-node -n district_name -i hostname
```

   The following example shows how to create an empty district, then add an empty node host to it.

Example 9.8. Creating an Empty District and Adding a Node Host

```
# oo-admin-ctl-district -c create -n small_district -p small

Successfully created district: 7521a7801686477f8409e74f67b693f4

{"active_server_identities_size"=>0,
"node_profile"=>"small",
"creation_time"=>"2012-10-24T02:14:48-04:00",
"name"=>"small_district",
"externally_reserved_uids_size"=>0,
"uuid"=>"7521a7801686477f8409e74f67b693f4",
"max_capacity"=>6000,
"available_uids"=>"<6000 uids hidden>",
"max_uid"=>6999,
"available_capacity"=>6000,
"server_identities"=>{}}
```

```
# oo-admin-ctl-district -c add-node -n small_district -i
node1.example.com

Success!
{...
"server_identities"=>{"node1.example.com"=>{"active"=>true}},
"uuid"=>"7521a7801686477f8409e74f67b693f4",
"name"=>"small_district",
...}
```

Note

The command outputs in the previous example show the JSON object representing the district in the MongoDB.

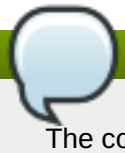
9.14.2. Viewing a District

View a list of all available districts:

```
# oo-admin-ctl-district
```

View one district:

```
# oo-admin-ctl-district -n district_name -c list-available
```



Note

The command outputs above show the JSON object representing the district in the MongoDB.

9.15. Importing Cartridges

Cartridges that are installed on node hosts are available for gears to use without having to download those cartridges. This applies to cartridges that are available with OpenShift Enterprise, and unsupported custom cartridges.

Important

With the current release of OpenShift Enterprise, all node hosts must have the same cartridges installed. With different cartridges installed on some node hosts, developers creating gears or adding cartridges may experience failures in certain scenarios.

Cartridge manifests must be initially imported into the broker host database from node hosts so that they can be managed by the broker host. Import the cartridge manifests on one broker host from a node host with the following command:

```
# oo-admin-ctl-cartridge -c import-profile --activate
```

[7] See Section 9.1, “Configuring Node Host Entitlements” for a table that notes the subscriptions that provide xPaaS cartridges.

[8] https://access.redhat.com/documentation/en-US/OpenShift_Enterprise/2/html-single/Administration_Guide/index.html#chap-Resource_Management

Chapter 10. Continuing Node Host Installation for Enterprise

This section describes how to customize your node host installation for enterprise use, and provides information beyond the basic installation of an OpenShift Enterprise node host.

10.1. Front-End Server Proxies

The front-end servers of OpenShift Enterprise are a collection of services that proxy external connections to OpenShift Enterprise applications. These control the public-facing application web servers, and allow access to node host management routines through a standardized API, and provide a standard interface to manage application web front ends. Several server plug-ins can be bound to different ports to provide different features. For example, on OpenShift Enterprise an **Apache** server runs on ports 80 and 443 to provide standard HTTP proxy services to applications, while a **Node.js** server runs on ports 8000 and 8443 and provides WebSocket services.

Starting with OpenShift Enterprise 2.2, the **Apache `Virtual Hosts`** front-end is the default for deployments. However, alternate front-end servers can be installed and configured and are available as a set of plug-ins. When multiple plug-ins are used at one time, every method call for a front-end event, such as creating or deleting a gear, becomes a method call in each loaded plug-in. The results are merged in a contextually sensitive manner. For example, each plug-in typically only records and returns the specific connection options that it parses. In OpenShift Enterprise, connection options for all loaded plug-ins are merged and reported as one connection with all set options from all plug-ins.

The port proxy uses **`iptables`** to listen on external-facing ports and forwards incoming requests to the appropriate application. High-range ports are reserved on node hosts for scaled applications to allow inter-node connections. See Section 9.10.7, “Configuring the Port Proxy” for information on **`iptables`** port proxy.

The HTTP proxy, SNI proxy, and Websocket proxy are plug-ins that listen on standard ports, and are shared by the gears on a node, while the **`iptables`** proxy listens on ports that are unique to each gear.

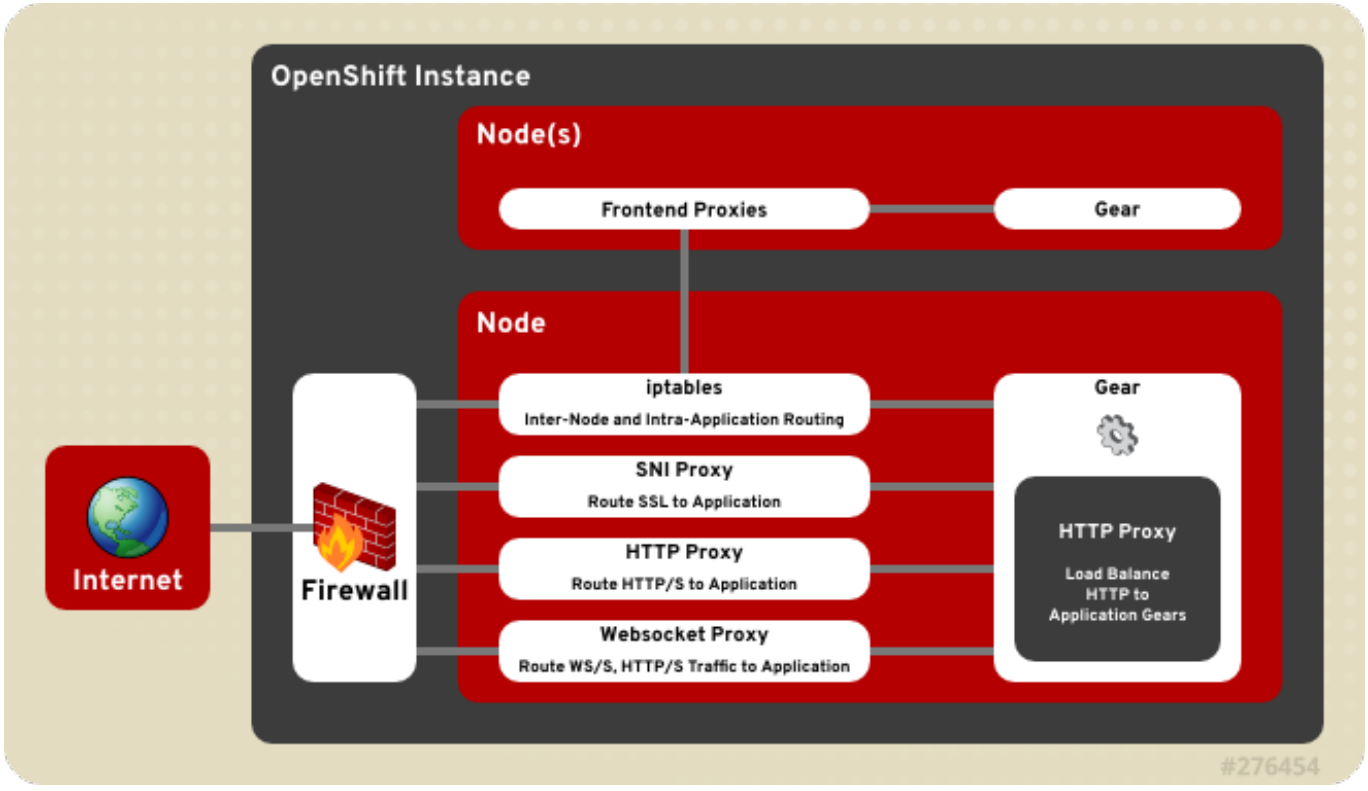


Figure 10.1. OpenShift Enterprise Front-End Server Proxies

This section provides administrators, service operators, and developers information to understand how these proxies work and the options available for OpenShift Enterprise deployments.

10.1.1. Configuring Front-end Server Plug-ins

The set of front-end plug-ins installed on the node host must be configured by installing the appropriate RPM packages and configuring the ***OPENSHIFT_FRONTEND_HTTP_PLUGINS*** parameter in the **/etc/openshift/node.conf** file. The value of this parameter is a comma-separated list of names of the Ruby gems that must be loaded for each plug-in. The gem name of a plug-in is found after the **rubygem-** in its RPM package name.

In addition to the plug-ins listed in the **/etc/openshift/node.conf** file, any plug-ins which are loaded into the running environment as a dependency of those explicitly listed are also used.

Example 10.1. Front-end Server Plug-in Configuration

```
# Gems for managing the frontend http server
# NOTE: Steps must be taken both before and after these values are
changed.
#       Run "oo-frontend-plugin-modify  --help" for more information.
OPENSHIFT_FRONTEND_HTTP_PLUGINS=openshift-origin-frontend-apache-
vhost,openshift-origin-frontend-nodejs-websocket,openshift-origin-
frontend-haproxy-sni-proxy
```

10.1.2. Installing and Configuring the HTTP Proxy Plug-in

Note

With the release of OpenShift Enterprise 2.1, both the single-threaded **prefork** module and the multi-threaded **worker** module in **Apache** are supported. The **prefork** module is used by default, but for better performance you can change to the **worker** module. This can be changed in the **/etc/sysconfig/httpd** file:

```
HTTPD=/usr/sbin/httpd.worker
```

By default, OpenShift Enterprise uses a configured front-end HTTP service. HTTP and HTTPS connections are routed from the node's external interface to the application's IP address and port using the application's fully-qualified domain name. Available **Apache** plug-ins include **apache-vhost** and **apache-mod-rewrite**, and both have a dependency, the **apachedb** plug-in, which is installed when using either.

Starting with OpenShift Enterprise 2.2, the default front-end HTTP proxy is **apache-vhost**, which is based on **Apache Virtual Hosts**. The **apache-vhost** plug-in is provided by the *rubygem-openshift-origin-frontend-apache-vhost* RPM package. The virtual host configurations are written to **.conf** files in the **/etc/httpd/conf.d/openshift** directory, which is a symbolic link to the **/var/lib/openshift/.httpd.d** directory.

Alternatively, the **apache-mod-rewrite** plug-in provides a front end based on **Apache**'s **mod_rewrite** module, but configured by a set of **Berkley DB** files to route application web requests to their respective gears. The **mod_rewrite** front end owns the default **Apache Virtual Hosts** with limited flexibility.

However, it can scale high-density deployments with thousands of gears on a node host and maintain optimum performance. The **apache-mod-rewrite** plug-in is provided by the *rubygem-openshift-origin-frontend-apache-mod-rewrite* RPM package, and the mappings for each application are persisted in the **/var/lib/openshift/.httpd.d/*.txt** file.

Previous versions of OpenShift Enterprise used the **apache-mod-rewrite** plug-in as the default. However, this has been deprecated, making the **apache-vhost** plug-in the new default for OpenShift Enterprise 2.2. The **Apache mod_rewrite** front end plug-in is best suited for deployments with thousands of gears per node host, and where gears are frequently created and destroyed. However, the default **Apache Virtual Hosts** plug-in is best suited for more stable deployments with hundreds of gears per node host, and where gears are infrequently created and destroyed. See Section 10.1.2.1, "Changing the Front-end HTTP Configuration for Existing Deployments" for information on how to change the HTTP front-end proxy of an already existing deployment to the new default.

Table 10.1. Apache Virtual Hosts Front-end Plug-in Information

Plug-in Name	openshift-origin-frontend-apache-vhost
RPM	*rubygem-openshift-origin-frontend-apache-vhost*
Service	httpd
Ports	80, 443
Configuration Files	**/etc/httpd/conf.d/000001_openshift_origin_frontend_vhost.conf**
	/var/lib/openshift/.httpd.d/frontend-vhost-http-template.erb, the configurable template for HTTP vhosts
	/var/lib/openshift/.httpd.d/frontend-vhost-https-template.erb, the configurable template for HTTPS vhosts
	/etc/httpd/conf.d/openshift-http-vhost.include, optional, included by each HTTP vhost if present
	/etc/httpd/conf.d/openshift-https-vhost.include, optional, included by each HTTPS vhost if present

Table 10.2. Apache mod_rewrite Front-end Plug-in Information

Plug-in Name	openshift-origin-frontend-apache-mod-rewrite
RPM	*rubygem-openshift-origin-frontend-apache-mod-rewrite*
Service	httpd
Ports	80, 443
Configuration Files	**/etc/httpd/conf.d/000001_openshift_origin_node.conf**
	/var/lib/openshift/.httpd.d/frontend-mod-rewrite-https-template.erb, configurable template for alias-with-custom-cert HTTPS vhosts

Important

Because the **apache-mod-rewrite** plug-in is not compatible with the **apache-vhost** plug-in, ensure your HTTP front-end proxy is consistent across your deployment. Installing both of their RPMs on the same node host will cause conflicts at the host level. Whichever HTTP front-end you use must be consistent across the node hosts of your deployment. If your node hosts have a mix of HTTP front-ends, moving gears between them will cause conflicts at the deployment level. This is important to note if you change from the default front-end.

apachedb

The **apachedb** plug-in is a dependency of the **apache-mod-rewrite**, **apache-vhost**, and **nodejs-websocket** plug-ins and provides base functionality. The **GearDBPlugin** plug-in provides common bookkeeping operations and is automatically included in plug-ins that require **apachedb**. The **apachedb** plug-in is provided by the *rubygem-openshift-origin-frontend-apachedb* RPM package.

Note

If you are using the kickstart or bash script, the ***CONF_NODE_APACHE_FRONTEND*** parameter can be specified to override the default HTTP front-end server configuration.

10.1.2.1. Changing the Front-end HTTP Configuration for Existing Deployments

Starting with OpenShift Enterprise 2.2, the **Apache Virtual Hosts** front-end HTTP proxy is the default for new deployments. If your nodes are currently using the previous default, the **Apache mod_rewrite** plug-in, you can use the following procedure to change the front-end configuration of your existing deployment.

Configuring the HTTP front-end for an already-deployed OpenShift Enterprise instance after it has been configured is possible, but Red Hat recommends caution when doing so. You must first prevent any front-end changes made by the broker, such as creating or deleting application gears, on the node host containing the applications during this configuration change. Performing a verified backup of the node host before commencing configuration is highly recommended.

Procedure 10.1. To Change the Front-end HTTP Configuration on an Existing Deployment:

1. To prevent the broker from making any changes to the front-end during this procedure, stop the ruby193-mcollective service on the node host:

   ```
   # service ruby193-mcollective stop
   ```

   Then set the following environment variable to prevent each front-end change from restarting the httpd service:

   ```
   # export APACHE_HTTPD_DO_NOT_RELOAD=1
   ```

2. Back up the existing front-end configuration. You will use this backup to restore the complete state of the front end after the process is complete. Replace *filename* with your desired backup storage location:

   ```
   # oo-frontend-plugin-modify --save > filename
   ```

3. Delete the existing front-end configuration:

   ```
   # oo-frontend-plugin-modify --delete
   ```

4. Remove and install the front-end plug-in packages as necessary:

   ```
   # yum remove rubygem-openshift-origin-frontend-apache-mod-rewrite
   # yum -y install rubygem-openshift-origin-frontend-apache-vhost
   ```

5. Replicate any Apache customizations reliant on the old plug-in onto the new plug-in, then restart the httpd service:

```
# service httpd restart
```

6. Change the **OPENSHIFT_FRONTEND_HTTP_PLUGINS** value in the **/etc/openshift/node.conf** file from **openshift-origin-frontend-apache-mod-rewrite** to **openshift-origin-frontend-apache-vhost**:

```
OPENSHIFT_FRONTEND_HTTP_PLUGINS="openshift-origin-frontend-apache-
vhost"
```

7. Un-set the previous environment variable to restarting the httpd service as normal after any front-end changes:

```
# export APACHE_HTTPD_DO_NOT_RELOAD=""
```

8. Restart the MCollective service:

```
# service ruby193-mcollective restart
```

9. Restore the HTTP front-end configuration from the backup you created in step one:

```
# oo-frontend-plugin-modify --restore < filename
```

10.1.3. Installing and Configuring the SNI Proxy Plug-in

The SNI proxy plug-in allows applications to provide services that communicate directly over a TLS connection, but might not be HTTP-based. For example, a service can use AMQP over TLS as opposed to HTTP over SSL/TLS (HTTPS).

The SNI proxy plug-in is not installed or configured by default, but is instead supplied with the *rubygem-openshift-origin-frontend-haproxy-sni-proxy* RPM package. This plug-in requires **HAProxy** 1.5 for SNI support. Red Hat Enterprise Linux 6 provides **HAProxy** version 1.4 by default, which is used by the cartridge. **HAProxy** version 1.5 is provided for OpenShift by the separate *haproxy15side* RPM package as a dependency of the SNI proxy plug-in.

By default, the SNI proxy runs on external ports 2303 to 2308, which can be configured with the ***PROXY_PORTS*** parameter in the **/etc/openshift/node-plugins.d/openshift-origin-frontend-haproxy-sni-proxy.conf** file. The configured ports must be exposed externally by adding a rule in iptables so that they are accessible on all node hosts where the SNI proxy is running. These ports must be available to all application end users. The SNI proxy also requires that a client uses TLS with the SNI extension and a URL containing either the fully-qualified domain name or OpenShift Enterprise alias of the application. See the *OpenShift Enterprise User Guide* [9] for more information on setting application aliases.

The SNI mapping for each application persists in the **/var/lib/openshift/.httpd.d/sniproxy.json** file. These mappings must be entered during gear creation, so the SNI proxy must be enabled prior to deploying any applications that require the proxy.

Table 10.3. SNI Proxy Plug-in Information

Plug-in Name	openshift-origin-frontend-haproxy-sni-proxy
RPM	*rubygem-openshift-origin-frontend-haproxy-sni-proxy*
Service	openshift-sni-proxy
Ports	2303-2308 (configurable)

Configuration Files	**/etc/openshift/node-plugins.d/openshift-origin-frontend-haproxy-sni-proxy.conf**

Important

Scaled applications are not compatible with the OpenShift Enterprise SNI proxy, because all traffic is routed to the first gear of an application.

Procedure 10.2. To Enable the SNI Front-end Plug-in:

1. Install the required RPM package:

```
# yum install rubygem-openshift-origin-frontend-haproxy-sni-proxy
```

2. Open the necessary ports in the firewall. Add the following to the **/etc/sysconfig/iptables** file just before the **-A INPUT -j REJECT** rule:

```
-A INPUT -m state --state NEW -m tcp -p tcp --dport 2303:2308 -j
ACCEPT
```

3. Restart the **iptables** service:

```
# service iptables restart
```

   If gears have already been deployed on the node, you might need to also restart the port proxy to enable connections to the gears of scaled applications:

```
# service node-iptables-port-proxy restart
```

4. Enable and start the SNI proxy service:

```
# chkconfig openshift-sni-proxy on
# service openshift-sni-proxy start
```

5. Add **openshift-origin-frontend-haproxy-sni-proxy** to the **OPENSHIFT_FRONTEND_HTTP_PLUGINS** parameter in the **/etc/openshift/node.conf** file:

   Example 10.2. Adding the SNI Plug-in to the /etc/openshift/node.conf File

```
OPENSHIFT_FRONTEND_HTTP_PLUGINS=openshift-origin-frontend-apache-
vhost,openshift-origin-frontend-nodejs-websocket,openshift-origin-
frontend-haproxy-sni-proxy
```

6. Restart the MCollective service:

```
# service ruby193-mcollective restart
```

Note

If you are using the kickstart or bash script, the SNI proxy is installed automatically if the ***CONF_ENABLE_SNI_PROXY*** parameter is set to "true", which is the default if the ***CONF_NODE_PROFILE*** parameter is set to "xpaas".

10.1.4. Installing and Configuring the Websocket Proxy Plug-in

The **nodejs-websocket** plug-in manages the **Node.js** proxy with Websocket support at ports 8000 and 8443 by default. Requests are routed to the application according to the application's fully qualified domain name or alias. It can be installed with either of the HTTP plug-ins outlined in Section 10.1.2, “Installing and Configuring the HTTP Proxy Plug-in”.

The **nodejs-websocket** plug-in is provided by the *rubygem-openshift-origin-frontend-nodejs-websocket* RPM package. The mapping rules of the external node address to the cartridge's listening ports are persisted in the **/var/lib/openshift/.httpd.d/routes.json** file. The configuration of the default ports and SSL certificates can be found in the **/etc/openshift/web-proxy-config.json** file.

Important

Scalable applications are not compatible with the **nodejs-websocket** plug-in, because all traffic is routed to the first gear of an application.

Table 10.4. Websocket Front-end Plug-in Information

Plug-in Name	nodejs-websocket
RPM	*rubygem-openshift-origin-frontend-nodejs-websocket* (required and configured by the *rubygem-openshift-origin-node* RPM)
Service	openshift-node-web-proxy
Ports	8000, 8443
Configuration Files	**/etc/openshift/web-proxy-config.json**

Note that this plug-in is automatically installed and configured when the *rubygem-openshift-origin-node* RPM is installed. To disable it, remove it from the list set in ***OPENSHIFT_FRONTEND_HTTP_PLUGINS*** parameter in the **node.conf** file, stop and disable the service, and close the firewall ports. Any of these would disable the plug-ins, but to be consistent perform all.

10.1.5. Installing and Configuring the `iptables` Proxy Plug-in

The **iptables** port proxy is essential for scalable applications. While not exactly a plug-in like the others outlined above, it is a required functionality of any scalable application, and does not need to be listed in the ***OPENSHIFT_FRONTEND_HTTP_PLUGINS*** parameter in the **node.conf** file. The configuration steps for this plug-in were performed earlier in Section 9.10.7, “Configuring the Port Proxy”. The **iptables** rules generated for the port proxy are stored in the **/etc/openshift/iptables.filter.rules** and **/etc/openshift/iptables.nat.rules** files and are applied each time the service is restarted.

The **iptables** plug-in is intended to provide external ports that bypass the other front-end proxies. These ports have two main uses:

- Direct HTTP requests from load-balancer gears or the routing layer.

- Exposing services (such as a database service) on one gear to the other gears in the application.

The port proxy supplies **iptables** rules to route a single external port to a single internal port belonging to the corresponding gear.

Important

The ***PORTS_PER_USER*** and ***PORT_BEGIN*** parameters in the **/etc/openshift/node.conf** file allow for carefully configuring the number of external ports allocated to each gear and the range of ports used by the proxy. Ensure these are consistent across all nodes in order to enable gear movement between them.

Table 10.5. iptables Front-end Plug-in Information

RPM	*rubygem-openshift-origin-node*
Service	openshift-iptables-port-proxy
Ports	35531 - 65535
Configuration Files	The ***PORTS_PER_USER*** and ***PORT_BEGIN*** parameters in the **/etc/openshift/node.conf** file

10.2. Enabling Seamless Gear Migration with Node Host SSH Keys

There may be situations where OpenShift Enterprise administrators may wish to move an application gear to another node host. This section addresses some concerns to make that possible.

10.2.1. rsync Keys

Gear migration on OpenShift Enterprise uses rsync from a broker host. Migrating gears requires SSH access from the broker host to both the origin node host and the destination node host. If available, the **/etc/openshift/rsync_id_rsa** key is used for authentication, so the corresponding public key must be added to the **/root/.ssh/authorized_keys** file of each node host. If you have multiple broker hosts, you can either copy the private key to each broker host, or add the public key of every broker host to every node host. This enables migration without having to specify node host root passwords during the process.

10.2.2. SSH Host Keys

Another concern with gear migration is that it results in a change of the host with which developers interact for the application. Under standard security practices, every host should generate unique host keys for SSH authentication. This enables SSH verification of the host ID to prevent man-in-the-middle or other attacks before the connection is made. If the host ID changes between sessions, by default SSH generates a warning and refuses the connection.

Developers may experience issues when an application changes hosts. The following sequence of events demonstrate this problem:

1. Administrator deploys OpenShift Enterprise.
2. Developer creates an OpenShift Enterprise account.
3. Developer creates an application that is deployed to node1.

- When an application is created, the application's Git repository is cloned using SSH. The host name of the application is used in this case, which is a cname to the node host where it resides.
- Developer verifies the host key, either manually or as defined in the SSH configuration, which is then added to the developer's local **~/.ssh/known_hosts** file for verification during future attempts to access the application gear.

4. Administrator moves the gear to node2, which causes the application cname to change to node2.
5. Developer attempts to connect to the application gear again, either with a Git operation or directly using SSH. However, this time SSH generates a warning message and refuses the connection, as shown in the following example:

Example 10.3. SSH Warning Message After an Application Gear Moves

```
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@    WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!     @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY!
Someone could be eavesdropping on you right now (man-in-the-middle
attack)!
It is also possible that the RSA host key has just been changed.
The fingerprint for the RSA key sent by the remote host is
ab:cd:ef:12:34:cd:11:10:3a:cd:1b:a2:91:cd:e5:1c.
Please contact your system administrator.
Add correct host key in /home/user/.ssh/known_hosts to get rid of
this message.
Offending key in /home/user/.ssh/known_hosts:1
RSA host key for app-domain.example.com has changed and you have
requested strict checking.
Host key verification failed.
```

This is because the host ID of the application has changed, and it no longer matches what is stored in the developer's **known_hosts** file.

The SSH warning message shows that the host the developer is attempting to connect to has indeed changed, and SSH has no way of distinguishing whether the new host is the correct host, or if there is an attack in progress. However, because all node hosts are presented as part of the same cloud, developers should be shielded from needing to understand resource allocation details, such as gear migrations. The SSH behavior in this particular case serves only to alarm and annoy developers unnecessarily, as there is no present security problem. In the worst case, these false alarms can teach developers to ignore the symptoms of a real attack.

Manage this situation by ensuring that all node hosts have the same SSH host keys. You can either deploy all node hosts using the same base image that includes host keys, or duplicate the SSH host keys on a node host to all other node hosts. The following instructions describe how to duplicate SSH host keys.

Procedure 10.3. To Duplicate SSH Host Keys:

1. On each node host, back up all **/etc/ssh/ssh_host_*** files:

```
# cd /etc/ssh/
# mkdir hostkeybackup
# cp ssh_host_* hostkeybackup/.
```

2. From the first node, copy the **/etc/ssh/ssh_host_*** files to the other nodes:

```
# scp /etc/ssh/ssh_host_* node2:/etc/ssh/.
# scp /etc/ssh/ssh_host_* node3:/etc/ssh/.
...
```

   You can also manage this with a configuration management system.

3. Restart the SSH service on each node host:

```
# service sshd restart
```

If the host keys have been changed after connecting with SSH as an administrator, the same man-in-the-middle warning message shown in the previous example appears again when you attempt to SSH to a node host. This is because the host ID has changed. You can remove the host keys for all node hosts from your **.ssh/known_hosts** file as a workaround for this problem. Because all nodes have the same fingerprint now, verifying the correct fingerprint at the next attempt to connect should be relatively easy. In fact, you may wish to publish the node host fingerprint prominently so that developers creating applications on your OpenShift Enterprise installation can do the same.

Duplicating host keys is not essential and can be skipped if your IT policy mandates unique host keys. However, you will either need to educate developers on how to work around this problem, or avoid migrating application gears.

10.3. SSL Certificates

There is a single SSL certificate on each node host that is used for every application host name served by the host **httpd** proxy. OpenShift Enterprise supports associating a certificate with a specific application alias, distinguishing them by way of the SNI extension to the SSL protocol. However, the host-wide wildcard certificate should still be configured for use with default host names.

The certificate created by default can be used to provide an encrypted connection to applications. However, it is not properly secure and results in the following warning messages from your browser:

1. The certificate common name (CN) does not match the application URL.
2. The certificate is self-signed.
3. Assuming the end-user accepts the certificate anyway, if the application gear is migrated between node hosts, the new host will present a different certificate from the one the browser has accepted previously.

Create a proper certificate so that application users do not receive some or all of the warning messages described above when attempting to access an application.

10.3.1. Creating a Matching Certificate

Create, or recreate, the certificate as a wildcard for the application domain so that it matches the published OpenShift Enterprise applications. Also create a new key because the default key is only 1024 bits in size, and a minimum size of 2048 bits is required by most certificate authorities. Use the following instructions to create a matching certificate.

Note

If you use the kickstart script, the **configure_wildcard_ssl_cert_on_node** function performs this step.

Procedure 10.4. To Create a Matching Certificate:

1. Configure the **$domain** environment variable to simplify the process with the following command, replacing **example.com** with the domain name to suit your environment:

```
# domain=example.com
```

2. Create the matching certificate using the following commands:

```
# cat << EOF | openssl req -new -rand /dev/urandom \
-newkey rsa:2048 -nodes -keyout /etc/pki/tls/private/localhost.key \
-x509 -days 3650 \
-out /etc/pki/tls/certs/localhost.crt 2> /dev/null
XX
SomeState
SomeCity
SomeOrganization
SomeOrganizationalUnit
*.$domain
root@$domain
EOF
```

   The self-signed wildcard certificate created expires after 3650 days, or approximately 10 years.

3. Restart the **httpd** service:

```
# service httpd restart
```

10.3.2. Creating a Properly Signed Certificate

Although the certificate created in the previous section matches the applications it is used for, it is not properly signed by a trusted authority. You can prevent warning messages from the browser about this by requesting a wildcard certificate signed by a Certificate Authority (CA). The CA must be authoritative for the browsers used by the application users.

Create a certificate signing request (CSR) by using the following command:

```
# openssl req -new \
-key /etc/pki/tls/private/localhost.key \
-out /etc/pki/tls/certs/localhost.csr
```

Enter the appropriate values as prompted to suit your installation. This creates a CSR in the **/etc/pki/tls/certs/localhost.csr** file.

You must then have your certificate authority sign the request. If all application users are internal to your organization, it may be possible to use an internal CA; otherwise, an external trusted authority must be used. The authority should supply a properly signed certificate, which you can place in the **/etc/pki/tls/certs/localhost.crt** file.

Next, restart the **httpd** service:

```
# restart service httpd
```

10.3.3. Reusing the Certificate

Whether the certificate is properly signed or not, the certificate and the key must be the same on all node hosts. When the key and the certificate to use have been created, copy the key to **/etc/pki/tls/private/localhost.key** and copy the certificate to **/etc/pki/tls/certs/localhost.crt** on all node hosts.

Next, configure the correct permissions and context with the following commands:

```
# chmod 400 /etc/pki/tls/private/localhost.key
/etc/pki/tls/certs/localhost.crt
# chown root:root /etc/pki/tls/private/localhost.key
/etc/pki/tls/certs/localhost.crt
# restorecon /etc/pki/tls/private/localhost.key
/etc/pki/tls/certs/localhost.crt
```

Restart the **httpd** service on each node host after modifying the key and the certificate.

10.4. Idling and Overcommitment

Most applications are not used at all times in a production environment. Therefore, administrators can manage a host's resources efficiently by idling unused application gears, which means that you shut down inactive gears. In OpenShift Enterprise, inactive gears can be idled either manually or automatically. Gears are restored automatically when they become active again.

The instructions in this section provide basic information on how to enable gear idling. See the *OpenShift Enterprise Administration Guide* at https://access.redhat.com/site/documentation for more information.

10.4.1. Manually Idling a Gear

Use the **oo-admin-ctl-gears** command with the **idlegear** option and the specific gear ID to manually idle a gear:

```
# oo-admin-ctl-gears idlegear gear_ID
```

To manually reactivate an idle gear, use the **unidlegear** option:

```
# oo-admin-ctl-gears unidlegear gear_ID
```

Listing Idled Gears

List any idled gears with the **listidle** option. The output will give the gear ID of any idled gears:

```
# oo-admin-ctl-gears listidle
```

10.4.2. Automated Gear Idling

Combine the **oo-last-access** and **oo-auto-idler** commands in a cron job to automatically idle inactive gears. The **oo-last-access** command compiles the last time each gear was accessed from the web front-end logs, excluding any access originating from the same node on which the gear is located. The **oo-auto-idler** command idles any gears when the associated URL has not been accessed, or the associated Git repository has not been updated, in the specified number of hours.

As root user, create a cron job, for example **/etc/cron.hourly/auto-idler**, containing the following contents, specifying the desired hourly interval:

```
(
/usr/sbin/oo-last-access
/usr/sbin/oo-auto-idler idle --interval 24
) >> /var/log/openshift/node/auto-idler.log 2>&1
```

Then, make the file executable:

```
# chmod +x /etc/cron.hourly/auto-idler
```

The created job will run hourly to idle any gears that have been inactive for the designated amount of hours. However, the following exceptions apply:

- Gears that have no web end point. For example, a custom message bus cartridge.
- Non-primary gears in a scaled application.
- Any gear with a UUID listed in **/etc/openshift/node/idler_ignorelist.conf**

Note

If you use the kickstart or bash script, the **configure_idler_on_node** function performs this step.

10.4.3. Automatically Restoring Idled Gears

The **oddjobd** service, a local message bus, automatically activates an idle gear that is accessed from the web. When idling a gear, first ensure the **oddjobd** service is available and is running so that the gear is restored when a web request is made:

```
# chkconfig messagebus on
# service messagebus start
# chkconfig oddjobd on
# service oddjobd start
```

10.5. Backing Up Node Host Files

Backing up certain node host files can help prevent data loss. You can use standard Red Hat Enterprise Linux software, such as **tar** or **cpio**, to perform this backup. Red Hat recommends backing up the following node host files and directories:

- **/opt/rh/ruby193/root/etc/mcollective**
- **/etc/passwd**
- **/var/lib/openshift**
- **/etc/openshift**

Important

Backing up the **/var/lib/openshift** directory is paramount to recovering a node host, including head gears of scaled applications, which contain data that cannot be recreated. If the file is recoverable, then it is possible to recreate a node from the existing data. Red Hat recommends this directory be backed up on a separate volume from the root file system, preferably on a Storage Area Network.

If the data from these files is lost, see *OpenShift Enterprise Administration Guide* for instructions on how to recover a failed node host.

Stateless and Stateful Applications

Even though applications on OpenShift Enterprise are stateless by default, developers can also use persistent storage for stateful applications by placing files in their **$OPENSHIFT_DATA_DIR** directory. See the *OpenShift Enterprise User Guide* for more information.

Stateless applications are more easily recovered; if an application is treated as stateless, then node hosts can easily be added to and destroyed in your deployment and you can create **cron** scripts to clean up these hosts. For stateful applications, Red Hat recommends keeping the state on a separate shared storage volume. This ensures the quick recovery of a node host in the event of a failure.

Note

Developers can also take snapshots of their applications as another way to back up and restore their application data. See the *OpenShift Enterprise User Guide* for more information.

[9] https://access.redhat.com/documentation/en-US/OpenShift_Enterprise/2/html/User_Guide/sect-Custom_Domains_and_SSL_Certificates.html

Chapter 11. Testing an OpenShift Enterprise Deployment

This chapter provides information on how to test an OpenShift Enterprise deployment, and information on how to diagnose some problems.

11.1. Testing the MCollective Configuration

Important

Do not run the **ruby193-mcollective** daemon on the broker. The **ruby193-mcollective** daemon runs on node hosts and the broker runs the **ruby193-mcollective** client to contact node hosts. If the **ruby193-mcollective** daemon is run on the broker, the broker will respond to the **oo-mco ping** command and behave as both a broker and a node. This results in problems when creating applications, unless you have also run the node configuration on the broker host.

Run the following command on each node host to verify that the **ruby193-mcollective** service is running:

```
# service ruby193-mcollective status
```

If the service is not running, use the following command to start it:

```
# service ruby193-mcollective start
```

The command-line interface to MCollective is provided by the **oo-mco** command. This command can be used to perform diagnostics concerning communication between the broker and node hosts. Get a list of available commands with the following command:

```
# oo-mco help
```

Use the **oo-mco ping** command to display all node hosts the current broker is aware of. An output similar to the following example is displayed:

```
node.example.com                          time=100.02 ms

---- ping statistics ----
1 replies max: 100.02 min: 100.02 avg: 100.02
```

Use the **oo-mco help** command to see the full list of MCollective command line options.

11.2. Testing Clock Skew

A frequently encountered problem is clock skew. Every MCollective request includes a time stamp, provided by the clock on the sending host. If the clock of a sender is substantially behind that of a recipient, the recipient drops the message. Consequently, a host will not appear in the output from the **oo-mco ping** command if its clock is substantially behind.

Inspect the **/var/log/openshift/node/ruby193-mcollective.log** file on node hosts to verify:

```
W, [2012-09-28T11:32:26.249636 #11711]  WARN -- : runner.rb:62:in `run'
Message 236aed5ad9e9967eb1447d49392e76d8 from uid=0@broker.example.com
created at 1348845978 is 368 seconds old, TTL is 60
```

The above message indicates that the current host received a message that was 368 seconds old, and it was discarded because its time-to-live (TTL), which is the duration for which it is considered relevant, is only 60 seconds. You can also run the **date** command on the different hosts and compare the output across those hosts to verify that the clocks are synchronized.

The recommended solution is to configure **NTP**, as described in a previous section. Alternatively, see Section 5.3, "Configuring Time Synchronization" for information on how to set the time manually.

11.3. Testing the BIND and DNS Configuration

Verify that the broker and node hosts have network connectivity with one another. This is done with either the **host** or **ping** commands.

Procedure 11.1. To Test the BIND and DNS Configuration:

1. On all node hosts, run the following command, substituting your broker host name for the example shown here:

   ```
   # host broker.example.com
   ```

2. On the broker, run the following command, substituting your node host's name for the example shown here:

   ```
   # host node.example.com
   ```

3. If the host names are not resolved, verify that your DNS configuration is correct in the **/etc/resolv.conf** file and the **named** configuration files. Inspect the **/var/named/dynamic/$*domain*.db** file and check that the domain names of nodes and applications have been added to the BIND database. See Section 7.3.2, "Configuring BIND and DNS" for more information.

Note

BIND might maintain a journal under **/var/named/dynamic/$*domain*.db.jnl**. If the **$*domain*.db** file is out of date, check the **$*domain*.db.jnl** file for any recent changes.

11.4. Testing the MongoDB Configuration

If MongoDB is not configured correctly, the client tools fail with unhelpful error messages. The following instructions describe how to test the MongoDB configuration.

On the broker, verify that MongoDB is running with the following command:

```
# service mongod status
```

If MongoDB is not running, inspect the **/var/log/mongodb/mongodb.log** file and look for any "multiple_occurrences" error messages. If you see this error, inspect **/etc/mongodb.conf** for duplicate configuration lines, as any duplicates may cause the startup to fail.

If the **mongod** service is running, try to connect to the database:

```
# mongo openshift_broker
```

This returns a command line from MongoDB.

Chapter 12. Configuring a Developer Workstation

This chapter explains the operation of a new OpenShift Enterprise deployment, and provides information on how to prepare a developer workstation to create applications and domains.

12.1. Configuring Workstation Entitlements

OpenShift Enterprise requires several packages that are not available in the standard Red Hat Enterprise Linux channels. A subscription to the appropriate OpenShift Enterprise channels is required to receive these extra packages. For developer workstations, typically only the Red Hat OpenShift Enterprise Client Tools channel is required.

12.2. Creating a User Account

A suitable user account is required before domains and applications can be created. The following instructions describe how to create a user account.

Procedure 12.1. To Create a User Account:

1. Run the following command on the broker to create a user account:

   ```
   # htpasswd -c /etc/openshift/htpasswd username
   ```

   This command prompts for a password for the new user account, and then creates a new **/etc/openshift/htpasswd** file and adds the user to that file.

2. Use the same command *without* the **-c** option when creating additional user accounts:

   ```
   # htpasswd /etc/openshift/htpasswd newuser
   ```

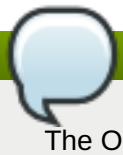
3. Inspect the **/etc/openshift/htpasswd** file to verify that the accounts have been created:

   ```
   # cat /etc/openshift/htpasswd
   ```

A one line entry for each user is displayed.

12.3. Installing and Configuring the Client Tools

Application developers use the client tools to create domains and applications on OpenShift Enterprise. The instructions for installing these client tools vary according to the operating system you are using. See the *OpenShift Enterprise Client Tools Installation Guide* at https://access.redhat.com/site/documentation for instructions on how to install the client tools on supported operating systems.



Note

The OpenShift Enterprise client tools require a server entitlement in order to be used. However, the OpenShift Online client tools can be used by each application developer without using a server entitlement. OpenShift Online features are available in the OpenShift Enterprise client tools upon each major release.

12.4. Configuring DNS on the Workstation

You must configure developer workstations to resolve the host names used in your OpenShift Enterprise deployment. There are two ways to do this, but both are intended for testing purposes only:

- Edit the **/etc/resolv.conf** file on the client host, and add the DNS server from your OpenShift Enterprise deployment to the top of the list.
- Install and use the OpenShift Enterprise client tools on a host within your OpenShift Enterprise deployment. For convenience, the kickstart script installs the client tools when installing the broker host. Otherwise, see Section 12.3, “Installing and Configuring the Client Tools” for more information.

12.5. Configuring the Client Tools on a Workstation

By default, the client tools connect to Red Hat's OpenShift Online service. Use the **--server** option to override the default server. Use the **rhc setup** command with the **--server** option to configure the default server. Replace the example host name with the host name of your broker.

Note that running this command overwrites any existing configuration in the **~/.openshift/express.conf** file:

```
# rhc setup --server=broker.example.com
```

12.6. Using Multiple OpenShift Configuration Files

The OpenShift Enterprise interactive setup wizard creates a new **express.conf** configuration file in the **~/.openshift** directory with the specified user and server settings. Multiple configuration files can be created, but you must then use the ***--config*** option with the client tools to select the appropriate configuration file.

Procedure 12.2. To Create a New Configuration File:

1. Run **rhc setup** with the **--config** command to create a new configuration file:

   ```
   # rhc setup --config=~/.openshift/bob.conf
   ```

2. Verify that you can connect to OpenShift using different configuration files. Run an **rhc** command without specifying the configuration file. In this example, the domain for the account configured in the **express.conf** file is displayed.

   ```
   # rhc domain show
   ```

3. Run the **rhc** command with **--config** option. In this example, the domain for the account configured in the **bob.conf** file is displayed.

   ```
   # rhc domain show --config=~/.openshift/bob.conf
   ```

Note

To switch between different OpenShift environments frequently, see Section 12.7, “Switching Between Multiple OpenShift Environments”.

12.7. Switching Between Multiple OpenShift Environments

The client tools now support the environment variable **OPENSHIFT_CONFIG**, which overrides the default configuration file that the client tools will read from. This enables specifying only once the configuration file rather than having to specify it every time using the **--config** option. See Section 12.6, “Using Multiple OpenShift Configuration Files”. When you define the **OPENSHIFT_CONFIG** setting in your environment, the client tool will read the defined configuration file.

Procedure 12.3. To Switch Between OpenShift Environments

1. Set the **OPENSHIFT_CONFIG** environment variable under a bash shell using the following command:

```
# export OPENSHIFT_CONFIG=bob
```

2. Run **rhc setup** to create the new configuration file: *~/.openshift/bob.conf*. Specify which broker server you want to connect to using the **--server** option:

```
# rhc setup --server broker.example.com
```

3. Verify that you are connected to the defined environment by running an **rhc** command:

```
# rhc domain show
```

4. Restore to default configuration by removing the value in **OPENSHIFT_CONFIG** with the following command:

```
# export OPENSHIFT_CONFIG=
```

Note

Authentication tokens are stored locally based on the broker server and the *username*, so you do not need to sign in again as you switch between servers.

To check which broker server you are currently configured to use, run the following command:

```
# rhc account
```

12.8. Creating a Domain and Application

Verify that you can create a new domain and a new application with the following commands on the developer's workstation:

```
# rhc domain create testdom
# rhc app create testapp php
```

These commands create a test domain called **testdom** and a test PHP application called **testapp** respectively.

If you receive any error messages, use the ***-d*** option to provide additional debugging output, and then inspect the broker's log files for hints. If you still cannot find the source of the errors, see the *OpenShift Enterprise Troubleshooting Guide* at https://access.redhat.com/site/documentation for further information, or visit the website at https://openshift.redhat.com.

Chapter 13. OpenShift Enterprise by Red Hat Offline Developer Virtual Machine Image

OpenShift Enterprise helps datacenters transform the relationships between developers and operations to allow a better continuous integration and delivery experience through a DevOps methodology. However, not all developers are connected to their datacenter at all times. For these developers, the OpenShift Enterprise by Red Hat Offline Developer Virtual Machine Image provides a full version of OpenShift Enterprise on a laptop or spare server. The image is fully supported by Red Hat and allows developers to experience all of the features of OpenShift Enterprise. Using this image, a mobile developer can still be productive on the platform when they are disconnected from the datacenter.

13.1. Downloading the Image

The OpenShift Enterprise by Red Hat Offline Developer Virtual Machine Image is available in **vmdk** and **qcow2** file formats on the Red Hat Customer Portal at https://access.redhat.com/. The image is accessible using a Red Hat account with an active OpenShift Enterprise subscription.

Download the image from the Red Hat Customer Portal using the following instructions:

Procedure 13.1. To Download the Image:

1. Go to https://access.redhat.com/ and log into the Red Hat Customer Portal using your Red Hat account credentials.
2. Go to the downloads page for the OpenShift Enterprise minor version you require:
   - OpenShift Enterprise 2.2: https://rhn.redhat.com/rhn/software/channel/downloads/Download.do?cid=23917
   - OpenShift Enterprise 2.1: https://rhn.redhat.com/rhn/software/channel/downloads/Download.do?cid=21355

   These pages provide the latest available images within a minor version. Images for older releases within a minor version are also provided, if available.
3. Click the download link for the image in your desired file format:
   - OSEoD Virtual Machine (**OSEoD-*Release*_*Version*.x86_64.vmdk**)
   - OSEoD OpenStack Virtual Machine (**OSEoD-*Release*_*Version*.x86_64.qcow2**)

13.2. Using the Image

Owners of OpenShift Enterprise may, as part of their subscription, use as many copies of the image as desired. The purpose of the image is focused on demonstrations and developer enablement. The image is built from the following products:

- OpenShift Enterprise
- Red Hat Enterprise Linux
- Red Hat Software Collections
- JBoss Enterprise Application Platform (EAP)
- JBoss Enterprise Web Server (EWS)

- JBoss Developer Studio

However, this image is not designed to be part of a deployment of OpenShift Enterprise PaaS within the datacenter, and does not have a separate subscription for updating it. If you choose to update the image with security, enhancement, or bug fix errata using Red Hat Network subscriptions, the image requires the use of a regular OpenShift Enterprise Infrastructure, Node, and JBoss EAP add-on subscriptions.

The **`vmdk`** image can be used on such hypervisors as VirtualBox or VMware Player. The **`qcow2`** image can be used on Red Hat Enterprise Linux, CentOS, and Fedora servers and workstations that leverage KVM, as well as on OpenStack. If you need a different file format, you can use the hypervisor utility of your choice to convert the images. Red Hat recommends running the image with at least 2 vCPUs and 2GB RAM.

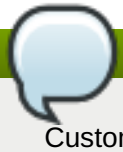
When the image starts, an informative web page displays the user accounts and passwords for the image. The image defaults to leveraging a DNS configuration that is self-contained to the Red Hat Enterprise Linux image in the virtual machine. Instructions are also displayed on how to contact it from your host laptop, if desired, using a remote desktop client or SSH. Because the image starts a full desktop session with X server, you can work completely from the image in terms of browser URLs and JBoss Developer Studio, which are also pre-installed.

Chapter 14. Customizing OpenShift Enterprise

With the release of OpenShift Enterprise 2.1, the Management Console and default application settings are customizable to suit organizational branding.

14.1. Creating Custom Application Templates

When an application is created, the default application content and Git repository is created from a template supplied by the application's web cartridge. You can customize these templates without creating an entirely custom cartridge. For example, you can modify the initial content with organizational branding.



Note

Customizations only apply to newly created applications and do not apply to existing applications. You can also use the **`--from-code`** option when creating an application to specify a different application template.

Procedure 14.1. To Create an Application Template:

1. Create an application using the desired cartridge, then change into the Git directory:

```
$ rhc app create App_Name Cart_Name
$ cd App_Name
```

2. Make any desired changes to the default cartridge template. Templates can include more than application content, such as application server configuration files.

   If you are creating an application template from a JBoss EAP or JBoss EWS cartridge, you may want to modify settings such as **`groupId`** and **`artifactId`** in the **`pom.xml`** file, as these settings are equal to the **`App_Name`** value used above. It is possible to use environment variables, such as **`${env.OPENSHIFT_APP_DNS}`**, however it is not recommended by Red Hat because Maven will issue warnings on each subsequent build, and the ability to use environment variables might be removed in future versions of Maven.

3. Commit the changes to the local Git repository:

```
$ git add .
$ git commit -am "Template Customization"
```

   You can now use this repository as an application template.

4. Place the template into a shared space that is readable by each node host. This could be on Github, an internal Git server, or a directory on each node host. Red Hat recommends creating a local directory named **`templates`**, then cloning the template into the new directory:

```
$ mkdir -p /etc/openshift/templates
$ git clone --bare App_Name /etc/openshift/templates/Cart_Name.git
```

5. Next, edit the **`/etc/openshift/broker.conf`** file on the broker host, specifying the new template repository as the default location to pull from each time an application is created:

```
DEFAULT_APP_TEMPLATES=Cart_Name|file:///etc/openshift/templates/Cart_Name.git
```

Note

The broker provides the same cartridge template location to all nodes, so the template location must be available on all node hosts or application creation will fail.

6. Restart the broker for the changes to take effect:

```
$ service openshift-broker restart
```

Any applications created using the specified cartridge will now draw from the customized template.

14.2. Customizing the Management Console

Starting in OpenShift Enterprise 2.2, you can customize the product logo and instance name of your OpenShift Enterprise deployment by configuring the **/etc/openshift/console.conf** file on the broker host. This allows you to add organizational branding to your deployment.

To change the image used in the masthead of the Management Console, modify the **PRODUCT_LOGO** parameter to the local or remote path of your choice.

Example 14.1. Default PRODUCT_LOGO Setting

```
PRODUCT_LOGO=logo-enterprise-horizontal.svg
```

To change the instance name that appears in the browser title for the Management Console, modify the **PRODUCT_TITLE** to a custom name.

Example 14.2. Default PRODUCT_TITLE Setting

```
PRODUCT_TITLE=OpenShift Enterprise
```

You must restart the Management Console service to load any configuration changes:

```
# service openshift-console restart
```

Further customization is possible with custom CSS. See the Knowledgebase solution at https://access.redhat.com/solutions/762023 on the Red Hat Customer Portal for more information.

14.3. Configuring the Logout Destination

You can enable a **Sign Off** link that allows application developers to log out of the Management Console by uncommenting and setting the ***LOGOUT_LINK*** parameter in the **/etc/openshift/console.conf** file on the broker host:

```
LOGOUT_LINK="LOGOUT_DESTINATION_URL"
```

If a value is set, then the **Sign Off** link is visible from the Management Console. When the developer clicks it, they are logged out of the Management Console and directed to the specified URL. If no value is set, then the link is not visible.

You must restart the console service to load any configuration changes:

```
# service openshift-console restart
```

Chapter 15. Asynchronous Errata Updates

Security, bug fix, and enhancement updates for minor versions of OpenShift Enterprise are released as asynchronous errata through the Red Hat Network. All OpenShift Enterprise 2 errata are available on the Red Hat Customer Portal at https://rhn.redhat.com/errata/rhel6-rhose2-errata.html. Red Hat recommends applying the latest errata updates.

Cartridge Upgrades

When Red Hat releases asynchronous errata updates within a minor release, the errata can include upgrades to shipped cartridges. After installing the updated cartridge packages using the **yum** command, further steps are often necessary to upgrade cartridges on existing gears to the latest available version and to apply gear-level changes that affect cartridges. The OpenShift Enterprise runtime contains a system for accomplishing these tasks.

The **oo-admin-upgrade** command provides the command line interface for the upgrade system and can upgrade all gears in an OpenShift Enterprise environment, all gears on a single node, or a single gear. This command queries the OpenShift Enterprise broker to determine the locations of the gears to migrate and uses MCollective calls to trigger the upgrade for a gear. While the **ose-upgrade** command, outlined in Chapter 4, *Upgrading from Previous Versions*, handles running the **oo-admin-upgrade** command during major platform upgrades, **oo-admin-upgrade** must be run by an administrator when applying asynchronous errata updates that require cartridge upgrades.

Determining Application Downtime During Cartridge Upgrades

During a cartridge upgrade, the upgrade process can be classified as either *compatible* or *incompatible*. As mentioned in the *OpenShift Enterprise Cartridge Specification Guide*, to be compatible with a previous cartridge version, the code changes to be made during the cartridge upgrade must not require a restart of the cartridge or of an application using the cartridge. If the previous cartridge version is not in the **Compatible-Versions** list of the updated cartridge's **manifest.yml** file, the upgrade is handled as an incompatible upgrade.

Incompatible upgrades must stop the gear before the upgrade begins, complete the upgrade, and then restart the gear. This process can cause a short amount of downtime for the application. For instructions on how to determine upgrade compatibility for all cartridges in a directory, and therefore whether any application downtime would be required during an upgrade, see the Knowledgebase solution at https://access.redhat.com/solutions/1186183 on the Red Hat Customer Portal.

Example oo-admin-upgrade Usage

Instructions for applying asynchronous errata updates are provided in Section 15.1, “Applying Asynchronous Errata Updates”; in the event that cartridge upgrades are required after installing the updated packages, the **oo-admin-upgrade** command syntax as provided in those instructions upgrades all gears on all nodes by default. Alternatively, to only upgrade a single node or gear, the following **oo-admin-upgrade** command examples are provided. Replace **2.y.z** in any of the following examples with the target version.

Important

To prevent previously cached node data from interfering with the current upgrade, archive existing upgrade data with the **oo-admin-upgrade archive** command.

The following commands upgrade all gears on all nodes:

```
# oo-admin-upgrade archive
# oo-admin-upgrade upgrade-node --version=2.y.z
```

The following commands upgrade all gears on a single node:

```
# oo-admin-upgrade archive
# oo-admin-upgrade upgrade-node --upgrade-node=node1.example.com --
version=2.y.z
```

The following commands upgrade a single gear:

```
# oo-admin-upgrade archive
# oo-admin-upgrade upgrade-gear --app-name=testapp --login=demo --upgrade-
gear=gear-UUID --version=2.y.z
```

15.1. Applying Asynchronous Errata Updates

The following instructions provide a general overview on how to apply asynchronous errata updates within a minor release to previously installed OpenShift Enterprise systems.

Procedure 15.1. To Apply Asynchronous Errata Updates:

1. On each host, run the following command to ensure that the **yum** configuration is still appropriate for the type of host and its OpenShift Enterprise version:

   ```
   # oo-admin-yum-validator
   ```

   If run without any options, this command attempts to determine the type of host and its version, and report any problems that are found. See Section 7.2, “Configuring Yum on Broker Hosts” or Section 9.2, “Configuring Yum on Node Hosts” for more information on how to use the **oo-admin-yum-validator** command when required.

2. Ensure all previously released errata relevant to your systems have been fully applied, including errata from required Red Hat Enterprise Linux channels and, if applicable, JBoss channels.

3. On each host, install the updated packages. Note that running the **yum update** command on a host installs packages for all pending updates at once:

   ```
   # yum update
   ```

4. After the **yum update** command is completed, verify whether there are any additional update instructions that apply to the releases you have just installed. These instructions are provided in the "Asynchronous Errata Updates" chapter of the *OpenShift Enterprise Release Notes* at https://access.redhat.com/documentation relevant to your installed minor version.

   For example, if you have OpenShift Enterprise 2.1.3 installed and are updating to release 2.1.5, you must check for additional instructions for releases 2.1.4 and 2.1.5 in the *OpenShift Enterprise 2.1 Release Notes* at:

   https://access.redhat.com/documentation/en-US/OpenShift_Enterprise/2/html-single/2.1_Release_Notes/index.html#chap-Asynchronous_Errata_Updates

Guidance on aggregating steps when applying multiple updates is provided as well. Additional steps can include restarting certain services, or using the **`oo-admin-upgrade`** command to apply certain cartridge changes. The update is complete after you have performed any additional steps that are required as described in the relevant *OpenShift Enterprise Release Notes*.

Appendix A. Revision History

Revision 2.2-11	Wed Nov 23 2016	Ashley Hardin

BZ 1394396: Updated Section 9.8.1, “Installing Web Cartridges” to add an Important box about a *tomcat7* known issue.

Revision 2.2-10	Thu Sep 08 2016	Ashley Hardin

BZ 1212040, BZ 1354609, BZ 1294966: Bug Fixes

Revision 2.2-8	Thurs Aug 20 2015	Brice Fallon-Freeman

OpenShift Enterprise 2.2.7 release.
BZ 1197116: Updated Section 9.10.3, “Configuring Disk Quotas” with Important box.
BZ 1190885: Updated Section 7.7.2, “Configuring MCollective Client”.
BZ 1210052: Update Section 8.6.1, “Selecting an External Routing Solution” with link to LTM® documentation.

Revision 2.2-7	Mon Jul 20 2015	Alex Dellapenta

OpenShift Enterprise 2.2.6 release.
BZ 1200123: Added Section 8.7, “Integrating with External Single Sign-on (SSO) Providers”.

Revision 2.2-6	Fri Apr 10 2015	Brice Fallon-Freeman

OpenShift Enterprise 2.2.5 release.
BZ 1159978, BZ 1157855, BZ 1051228: Rearranged and updated Section 6.1, “Using the Installation Utility” with more information.
BZ 1180532: Updated Section 8.2.2, “Authenticating Using LDAP” with Important box.
BZ 1173720: Added missing step to Section 8.6.2, “Configuring the Sample Routing Plug-In”.
BZ 1208556: Updated Section 8.6.3, “Configuring a Routing Daemon or Listener” to note the **`ACTIVEMQ_HOST`** setting can take an array of hosts.
BZ 1124840: Updated Section 10.5, “Backing Up Node Host Files” with more detail.
BZ 1118927: Updated Section 14.1, “Creating Custom Application Templates” with information on modifying **`pom.xml`** for JBoss EAP or JBoss EWS application templates.

Revision 2.2-5	Thu Feb 12 2015	Alex Dellapenta

OpenShift Enterprise 2.2.4 release.
Updated Section 8.6, “Using an External Routing Layer for High-Availability Applications”, Section 8.6.1, “Selecting an External Routing Solution”, and Section 8.6.3, “Configuring a Routing Daemon or Listener” to add details on **F5 BIG-IP LTM®** integration.

Revision 2.2-3	Wed Dec 10 2014	Timothy Poitras

OpenShift Enterprise 2.2.2 release.
BZ 1150426: Updated Section 8.4.4.1, “Configuring a Network of ActiveMQ Brokers” and Section 8.4.4.2, “Verifying a Network of ActiveMQ Brokers Using the ActiveMQ Console” with information on disabling Jetty.
Added Section 9.11, “Enabling Network Isolation for Gears”.
BZ 1165606: Updated Section 8.6.2, “Configuring the Sample Routing Plug-In” and Section 8.6.3, “Configuring a Routing Daemon or Listener” with information on enabling SSL connections per ActiveMQ host.
BZ 1159182: Updated Section 8.6.3, “Configuring a Routing Daemon or Listener” and Section 8.6.4, “Enabling Support for High-Availability Applications” with information on setting **HA_DNS_PREFIX** parameter consistently.
Updated Section 13.1, “Downloading the Image” to note the downloads page for the OpenShift Enterprise 2 version images.
Updated Section 14.2, “Customizing the Management Console” for the addition of the **PRODUCT_LOGO** and **PRODUCT_TITLE** parameters.
Updated Chapter 15, *Asynchronous Errata Updates* with details on incompatible cartridge upgrades.

Revision 2.2-2 **Thu Nov 6 2014** **Alex Dellapenta**

Updated Section 4.5, “Upgrading from OpenShift Enterprise 2.1 to OpenShift Enterprise 2.2” to clarify **OSE_UPGRADE_MIGRATE_VHOST** usage.
Fixed minor publication issue.

Revision 2.2-1 **Tue Nov 4 2014** **Alex Dellapenta**

Updated Section 8.6, “Using an External Routing Layer for High-Availability Applications” and subsections regarding routing solutions supported by the sample routing daemon.
Updated Section 9.12, “Configuring Node Hosts for xPaaS Cartridges” per OpenShift Enterprise 2.1.8 release.

Revision 2.2-0 **Tue Nov 4 2014** **Alex Dellapenta**

OpenShift Enterprise 2.2 release.
Added Section 4.5, “Upgrading from OpenShift Enterprise 2.1 to OpenShift Enterprise 2.2”.
Added Section 5.2.3, “IPv6 Tolerance”.
Replaced the "Dynamic DNS with Non-BIND Name Servers" section with the new Section 8.1, “Installing and Configuring DNS Plug-ins” and subsections.
Added Section 8.2.4, “Authenticating Using Mutual SSL”.
Added Section 8.2.5, “Integrating Active Directory Authentication with Identity Management”.
Added Section 8.5, “Installing and Configuring the Gear Placement Plug-in” and subsections.
Updated Section 8.6, “Using an External Routing Layer for High-Availability Applications” and all subsection to include information on the new sample routing daemon, and added Section 8.6.1, “Selecting an External Routing Solution”.
Updated Section 8.10.2, “Accessing the Administration Console” to remove the unsupported "Configuring Hosts with Collocated Broker and Node Components" procedure.
Added Section 8.10.3, “Configuring Authentication for the Administration Console”.
Added Section 14.3, “Configuring the Logout Destination”.

Revision 2.1-7 **Thu Oct 23 2014** **Brice Fallon-Freeman**

Updated **oo-admin-ctl-cartridge** commands to use **import-profile**.
BZ 1001833: Added Section 5.1, “Default umask Setting”.
BZ 1006040: Edited Section 5.2.1, “Custom and External Firewalls” and added Section 5.2.2, “Manually Configuring an iptables Firewall”.
BZ 1145762: Removed mention of installing using https://install.openshift.com with the **-e** option from Section 6.1, “Using the Installation Utility”.
BZ 1118766: Updated Section 8.6, “Using an External Routing Layer for High-Availability Applications” and subsections with edits to wording and procedure order.
Added Section 9.12, “Configuring Node Hosts for xPaaS Cartridges” and updated Section 9.1, “Configuring Node Host Entitlements” and Section 9.8.1, “Installing Web Cartridges” for the new JBoss A-MQ, JBoss Fuse, and JBoss Fuse Builder cartridges.
BZ 1146706: Updated "SNI Proxy" to clarify that SNI proxy ports must be opened in the firewall.

Revision 2.1-6 **Thu Sep 11 2014** **Brice Fallon-Freeman**

OpenShift Enterprise 2.1.6 release.
BZ 1135480: Updated Section 2.1, “Supported Operating Systems” with Important box.
BZ 1133958: Updated Section 7.7.2, “Configuring MCollective Client” and Section 9.7, “Installing and Configuring MCollective on Node Hosts” with ActiveMQ configuration changes.
BZ 1124579: Updated Section 9.9, “Configuring SSH Keys on the Node Host” and Section 8.4, “Configuring Redundancy” with information on having multiple brokers.
BZ 1133936: Updated Section 9.13.1, “Adding or Modifying Gear Profiles” to note new, additional example **resource_limits.conf** files.
BZ 1133628: Updated Section 15.1, “Applying Asynchronous Errata Updates” with information on applying multiple updates at once.

Revision 2.1-5 **Tue Aug 26 2014** **Timothy Poitras**

OpenShift Enterprise 2.1.5 release.
Updated Section 2.1, “Supported Operating Systems” and Section 2.3, “Red Hat Subscription Requirements” to note the inclusion of Red Hat Enterprise Linux 6 with OpenShift Enterprise subscriptions.
Updated Section 6.1, “Using the Installation Utility”, Section 7.1.2, “Using Red Hat Network Classic on Brok Hosts”, and Section 9.1.2, “Using Red Hat Network Classic on Node Hosts” with details regarding migrating from RHN to RHSM.

Revision 2.1-4 **Thu Aug 7 2014** **Alex Dellapenta**

BZ 1060871: Updated "HTTP Proxies" with a note.
BZ 1084617: Updated Section 10.1.2.1, “Changing the Front-end HTTP Configuration for Existing Deployments” with correct Apache plug-in information.
BZ 1119795: Fixed typo in Section 9.10.3, “Configuring Disk Quotas”.
BZ 1114162: Updated steps in Section 4.3, “Upgrading from OpenShift Enterprise 1.2 to OpenShift Enterprise 2.0” and Section 4.4, “Upgrading from OpenShift Enterprise 2.0 to OpenShift Enterprise 2.1”.

Revision 2.1-3 **Tue Jun 24 2014** **Alex Dellapenta**

OpenShift Enterprise 2.1.2 release.
Updated various sections to highlight OpenShift Enterprise 2.1 features.
Updated Section 13.1, “Downloading the Image” to note the 2.1.1 version image and latest Red Hat Custom Portal site navigation.
BZ 1102430: Updated Section 8.6.2, “Configuring the Sample Routing Plug-In” to note the **ACTIVEMQ_HOST** setting can now take an array of hosts.
BZ 1102131: Updated note in Section 7.8.9, “Configuring OpenShift Enterprise Authentication” for clarification between different OpenShift Enterprise releases.
BZ 1108950: Updated the procedure in Section 9.9, “Configuring SSH Keys on the Node Host”.
BZ 1111452: Updated Section 9.10.3, “Configuring Disk Quotas” with an example **/etc/fstab** file entry.

Revision 2.1-2 **Mon Jun 9 2014** **Alex Dellapenta**

Added Chapter 13, *OpenShift Enterprise by Red Hat Offline Developer Virtual Machine Image*.
Various enhancements to Section 6.2, “Using the Installation Scripts” and subsections.
BZ 1105155: Updated Section 6.1, “Using the Installation Utility” to show **`tar`** usage instead of **`zip`**, and added an Important admonition on using the **none** subscription type.

Revision 2.1-1	Wed Jun 4 2014	Alex Dellapenta

OpenShift Enterprise 2.1.1 release.
Restructured and added sections for new Chapter 6, *Deployment Methods*, including more detailed information and examples regarding the installation scripts.
Restructured sections for new Chapter 5, *Host Preparation*.
Added Warning admonitions to note that running a broker and node on the same host is not supported.
Updated Section 9.8.2, “Installing Add-on Cartridges” for addition of MongoDB cartridge.
Updated Section 7.6.2, “Configuring ActiveMQ” for changes to default Jetty configuration.
Updated Section 8.4.5, “Broker Web Application”.
BZ 1098544: Updated Section 6.2.7, “Performing Required Post-Deployment Tasks” with required post-deployment tasks.
BZ 1100859: Updated Section 8.9.1, “Installing the Management Console” and Section 8.2, “Configuring Us Authentication for the Broker”.
BZ 1080163: Updated Section 8.6.4, “Enabling Support for High-Availability Applications” with a note.
BZ 1099672: Updated Section 7.8.8, “Configuring the Broker Plug-ins”.

Revision 2.1-0	Fri May 16 2014	Bilhar Aulakh

OpenShift Enterprise 2.1 release.
Added Section 4.4, “Upgrading from OpenShift Enterprise 2.0 to OpenShift Enterprise 2.1”.
Added Section 7.8.2, “Setting Ownership and Permissions for MCollective Client Configuration File”.
Added Section 8.11, “Clearing Broker and Management Console Application Cache”.
Added Section 9.8.3, “Installing Cartridge Dependency Metapackages”.
Added Chapter 14, *Customizing OpenShift Enterprise* and subsections.
Updated default DNS key algorithm in various sections from HMAC-MD5 to HMAC-SHA256.
Updated Section 6.2, “Using the Installation Scripts” and Section 6.1, “Using the Installation Utility” to includ latest installation script and utility changes.
Updated Section 7.7.2, “Configuring MCollective Client” and Section 9.7, “Installing and Configuring MCollective on Node Hosts” to include heartbeat parameters in the sample file configuration.
Updated Section 8.6.4, “Enabling Support for High-Availability Applications” with additional configuration settings.
Updated Section 9.14, “Configuring Districts”.
BZ 1063859: Updated log file locations to **`/var/log/openshift/node/ruby193-mcollective.log`**
BZ 1081654: Updated Chapter 15, *Asynchronous Errata Updates* with archiving instructions.
BZ 1071375: Updated Section 7.1, “Configuring Broker Host Entitlements” and Section 9.1, “Configuring Node Host Entitlements” to remove deprecated subscription-manager commands.
BZ 963332: Updated Section 7.7.2, “Configuring MCollective Client” with modified logging options.
BZ 1079365: Updated Section 7.7.2, “Configuring MCollective Client” and Section 9.7, “Installing and Configuring MCollective on Node Hosts” for upgrade to MCollective 2.4.
BZ 1063439: Added Important box to Section 7.8.9, “Configuring OpenShift Enterprise Authentication”.
BZ 1066729: Updated sample configuration in Section 8.4.4.1, “Configuring a Network of ActiveMQ Brokers
BZ 1074826: Fixed command error in Section 9.9, “Configuring SSH Keys on the Node Host”.

Revision 2.0-4	Fri Apr 11 2014	Brice Fallon-Freeman

BZ 1076233: Fixed faulty images in Chapter 3.

Revision 2.0-3	Mon Feb 10 2014	Julie Wu

OpenShift Enterprise 2.0.3 release.
BZ 1063577: Edited command in Section 6.1, “Using the Installation Utility”.
BZ 1066025: Added info to Section 9.10.7, “Configuring the Port Proxy”.
BZ 1009869: Added Section 12.7, “Switching Between Multiple OpenShift Environments”.
BZ 1051799 and BZ 1078325: Edited Section 7.8.7, “Configuring the Broker Datastore”.
BZ 1057190: Updated Section 7.6.2, “Configuring ActiveMQ”.
BZ 1064417: Updated Section 9.10.2, “Configuring Cgroups”

Revision 2.0-2 Tue Jan 28 2014 Alex Dellapenta

OpenShift Enterprise 2.0.2 release.
BZ 929182: Updated Section 8.2.2, “Authenticating Using LDAP”.
BZ 1051960: Updated commands in Section 7.8.4, “Configuring the Required Services”, Section 7.8.6, “Configuring the Broker Domain”, Section 8.3.2, “MongoDB”, Section 9.10.8, “Configuring Node Settings”, Section 4.2, “Preparing for an Upgrade”, and Section 9.10.1, “Configuring PAM”.
BZ 1051804: Updated Section 8.9.1, “Installing the Management Console”.
Added Chapter 15, *Asynchronous Errata Updates*.
Updated Chapter 4, *Upgrading from Previous Versions*.
BZ 1049566: Updated Section 8.6.3, “Configuring a Routing Daemon or Listener”.

Revision 2.0-1 Tue Jan 14 2014 Bilhar Aulakh

OpenShift Enterprise 2.0.1 release.
BZ 1043394: Updated contents of listener.rb file.
BZ 1051960: Fixed various shell commands with problematic quoting.
BZ 1051946: Removed problematic less-than signs in some shell commands.
BZ 1042903: Removed MONGO_REPLICA_SETS from configuration file screen output.
BZ 1042887: Updated suggestions for redundant topologies in Section 8.4, “Configuring Redundancy” for clarification.
BZ 1043073: Updated Section 9.4, “Configuring Node Host Name Resolution” and Section 9.5, “Configuring the Node Host DHCP and Host Name”.
BZ 1042997: Updated URL to configuration template and added note for kickstart script.
BZ 1042999: Added note about kickstart script for procedures.
BZ 1041545 and BZ 1039744: Updated Section 6.1, “Using the Installation Utility”.
BZ 1044224: Fixed and Updated Section 10.4, “Idling and Overcommitment”.
BZ 1043678: Updated Section 9.15, “Importing Cartridges”.
BZ 1022195: Fixed Section 9.10.8, “Configuring Node Settings”.
BZ 1014294: Fixed Section 8.4.4.1, “Configuring a Network of ActiveMQ Brokers”.
Added Section 4.3, “Upgrading from OpenShift Enterprise 1.2 to OpenShift Enterprise 2.0”.
BZ 1040150: Fixed and updated Section 7.1, “Configuring Broker Host Entitlements”, Section 7.2, “Configuring Yum on Broker Hosts”, Section 9.1, “Configuring Node Host Entitlements”, and Section 9.2, “Configuring Yum on Node Hosts”.
BZ 1039746: Fixed Section 5.4, “Enabling Remote Administration”.
BZ 1040199: Fixed Section 7.4.1, “Configuring the DHCP Client on the Broker Host”.
BZ 1040179: Fixed Section 7.3.2, “Configuring BIND and DNS”.

Revision 2.0-0 Tue Dec 10 2013 Alex Dellapenta

OpenShift Enterprise 2.0 release.
BZ 1000595: Added "Security" section.
BZ 921793: Added "Network Access" section.
Added "Installation Utility" section.
Added "External Load Balancing" sections.
Added "Administration Console" sections.
Added "Front-end Server Plug-ins" sections.
BZ 991607: Added "Adding New Gear Profiles" section.
BZ 1030645: Updated installation script function names.
BZ 990327: Updated "BIND and DNS" section with correct DNS configuration file.
BZ 1006451: Updated "Installing Cartridges" section.
BZ 1017839: Updated "Storage and Backup for Fault Tolerance" section for node hosts.
BZ 998699: Typo fixes in "Creating an SSL Certificate" section.