HP Operations Orchestration

For Linux, Solaris ®, and Windows ® operating systems

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High Availability Guide

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Contents

Chapter 1

Overview

This chapter includes:

Best Practices for Setting up High Availability in HP Operations Orchestration

Note: This guide supports HP Operations Orchestration 9.00.01 and higher.

This guide contains a general overview of the High Availability solution, and describes the process of setting up your High Availability environment in Windows and Linux from different possible starting points.

You can:

- Deploy a fresh HP Operations Orchestration clustered environment. For details, see "Perform a Clean Installation" on page 14.

- Expand a standalone HP Operations Orchestration Central to a clustered environment. For details, see "Converting a Standalone Central to a Clustered Central" on page 16.

- Scale out a HP Operations Orchestration clustered environment to increase throughput capacity and high availability. For details, see "Adding a Node to an Existing Cluster" on page 21.

Introduction to High Availability in HP Operations Orchestration

If you run large volumes of flows, and if high availability is a requirement for your organization:

- An OO Central cluster can provide horizontal scalability, high availability of Central servers via failover protection, and automatic recovery of failed flows when a Central node fails.

- HP OO Load Balancer provides load balancing for requests to Central and RAS installations.

Clustering Service Overview

HP Operations Orchestration's clustering is based on a Clustering Service that controls all aspects related to clustered state and coordination. The Clustering Service is a separate entity from a clustered Central process. It is a server process that can co-exist with a Central process on the same node, or it can be hosted on a different machine.

The clustering support is based on a JVM level clustering solution called Terracotta (for details, see www.terracotta.org). The OO Clustering Service is a Terracotta server in either active or passive mode.

Note: Central processes themselves use active/active topology. Only the Clustering Services use an active/passive topology.

All that is required for the proper functioning of an HP OO cluster is the existence of the active Clustering Service. The additional passive service is recommended for achieving high availability in case the active service fails. Any clustered transaction must be acknowledged by all standby services before the active Clustering Service acknowledges it to the involved Central services. This means that a large number of passive Clustering Services will decrease throughput. For most deployments, one active and one passive Clustering Service are sufficient.

Tip: It is recommended that both the active and the passive Clustering Services run on identical hardware.

When the cluster starts, the Clustering Services go through an election process, and one of them becomes the active instance.

Horizontal Scalability of Central Servers

When you install the Clustering Service and create a cluster of OO Central installations, the clustering technology has the following features:

- Central cluster uses an active-active topology, thus maximizing the utilization of available hardware.

  Note: Clustering Services use active-passive topology.

- Horizontal scalability. The cluster can be horizontally scaled by adding more nodes. Routing all Studio and Central UI (browser) sessions, as well as headless requests through a load balancer is the recommended approach.

- The cluster uses one shared repository, and there is no need to manually synchronize the repository for each node. The shared Central repository requires a shared file system such as a Windows share (for Windows deployments) or a Network File System (NFS) share (for Linux deployments). If high availability of the repository is required, this shared file system should be implemented on top of your choice of HA file system technologies (for instance, SAN).

  Caution: Do not start Central services simultaneously. If you have more than one Central

service to restart, first restart the first one, and make sure it is up by logging in to its Web UI directly. Then, restart the second one, and so on.

Starting several Central services simultaneously might cause corruption in the shared repository.

Planning High Availability

When you are planning your high availability solution, you should consider the following:

- Should I cluster my Clustering Service installation for high availability?

  The deployment of a passive Terracotta Service is not strictly required but is strongly recommended, since if you do not provide high availability for the Clustering Service, you have simply moved your vulnerability to a single point of failure from the Central installation to the Clustering Service installation. The passive (standby) Terracotta service provides high availability in case of the active Terracotta service's failure.

  Be cautious, however, of deploying more passive Terracotta installations than are necessary for high availability. Each additional passive Terracotta installation comes with an operational cost. In a cluster, any clustered transaction must be acknowledged by all standby services before the active Clustering Service acknowledges it to the involved Central services. This means that each additional passive Clustering Service you install decreases throughput. For most deployments, one active and one passive (standby) Clustering Service are sufficient.

  Note: It is recommended that both the active and the passive (standby) Clustering Service instances run on identical hardware.

- Should I load balance my OO environment?

  For Central and standalone RAS servers, the OO Load Balancer provides Studio and Central UI balancing of sessions as well as balancing of headless flow invocations. The OO Load Balancer is based on the Apache Load Balancer. For more information on the Apache Load Balancer, see the Apache Software Foundation web site.

  Note: To achieve high availability, you must use a load -balancing solution between the Centrals. You have the option of using a load balancing solution other than the OO Load Balancer.

- Should I have high availability failover protection of the Central database?

  The Central database contains the Central nodes' run histories, schedules, and system configuration. If the database server fails without failover protection, Central and its users lose all of that information.

- Should I provide high availability failover protection of the load-balancer?

  It is recommended that you provide high availability for your load-balancing solution. If you do not, this component becomes a single point of failure.

When the Load Balancer and OO Clustering Service are installed in a development environment, multiple authors developing flows have the benefits both of load balancing for their requests to the Central cluster and failover protection for each author in case the Central server node to which you are connected fails.

> **Note:** When planning an OO deployment that avoids single points of failure, notice the underlying hardware as well. For example, if the OO servers are Virtual Machines, they should not be hosted on a single ESX.

Given the preceding recommendations, the "Recommended Deployment for the HP Operations Orchestration High Availability Solution" on page 13 is the recommended configuration for your OO deployment. See also the following sections for more considerations with which to design high availability and load balancing into your OO environment.

Considerations for Future Integrations with a Clustering Environment

In order to accomplish integration with OO in high availability, you must import the OO Load Balancer security certificate into the external application's keystore (or **cacerts** file).

The OO Load Balancer security certificate can be found at:

- Windows: `%ICONCLUDE_CLUSTER_HOME%\apache\conf\ras_keystore.crt`

- Linux: `$ICONCLUDE_CLUSTER_HOME/apache/conf/ras_keystore.crt`

There are two ways to import the OO Load Balancer security certificate.

Option 1: Export the Certificate to .X509 Format

1. Since **ras_keystore.crt** is not a supported format for keytool, you must first export the certificate from **%ICONCLUDE_CLUSTER_HOME%\apache\conf\ras_keystore.crt** to **.X509** format. In Windows, this can be done by double-clicking the **ras_keystore.crt** file and copying it to a **.X509** file.

   > **Note:** Keytool is a utility for generating and managing cryptographic keys and certificates. Keytool is a part of the Java installation, so you need to have Java on your computer to be able to use keytool.

2. Import the **.X509** certificate into the external application's keystore using keytool or a similar utility:

   ```
   keytool -import -alias <ALIAS> -file <X509_CERTIFICATE_PATH> -
   keystore <KEYSTORE_PATH>
   ```

3. Restart the external application that is integrated with OO.

Option 2: Manually Export the Certificate from the Browser

1. Manually export the OO Load Balancer certificate from the browser into an **.X509** format file, using the OO Load Balancer URL. For example, `https://<FQDN>:<PORT>/PAS.`

2. Import the **.X509** certificate into the integrating application keystore using keytool or a similar utility:

```
keytool -import -alias <ALIAS> -file <X509_CERTIFICATE_PATH> -
keystore <KEYSTORE_PATH>
```

3. Restart the external application that is integrated with OO.

OO Cluster Behavior in Node Failures

There are a few types of node failures that affect the cluster behavior:

- **The Central service.** If a node in the Central cluster fails:
  - The other Central continues functioning, and when the failed Central instance comes back up, it joins the cluster and is ready for work.

  - The load balancer identifies that the node is down, and no longer directs flow executions to the Central service.

  - The failed Central node's flow executions are automatically recovered on another node of the cluster and resumed at their last check-pointed step.

    > **Note:** This feature is not enabled by default. It can be enabled by an OO administrator in the **Administration** > **System Configuration** tab. Only unassisted (headless) flow runs can be recovered by this feature. For details see HP Operations Orchestration Central User Guide.

  - Any Central UI session connected to the failed node is closed and a new one has to be opened (if Central UI sessions always go through a load balancer (recommended), then only logging on again is required). Flows that were initiated through that session can be manually resumed from the Central Administration tab once a session to another node is established.

  - Any Studio connection to the Central public repository that had gone through the failed Central node is closed. Ongoing editing work is not lost, as it is stored in the shared repository, in a private workspace.

    > **Note:** The system maintains edited work that has been saved. When the connection to a Central node is lost, edited work done in Studio is not recovered if it was not saved.

- **The Clustering Service.** If the Clustering Service fails on one node:
  - If the failed Clustering Service was the active node, the passive (standby) node takes over and becomes active. The Central instances resume functionality after this failover is completed.

- If the failed Clustering Service was the passive node, the cluster continues functioning, without a passive standby. Further failure of the active instance results in cluster "death" and requires the restart of all nodes.

- **The Load Balancer.** Once the load balancer is down, the various OO cluster components cannot be accessed through it. In such a case, the OO cluster components can only be accessed directly.

Chapter 2

Recommended Deployment for the HP Operations Orchestration High Availability Solution

The recommended deployment configuration comprises the following:

- A two-node Central cluster, in which each node hosts one Central instance and one Clustering Service instance, on identical hardware

- Highly available shared file system, for hosting the shared repository.

- A two-node database cluster, for hosting the Central database

- A load-balancing solution, for load-balancing requests to Central and RAS instances

The diagram below describes the recommended configuration for a high availability solution.
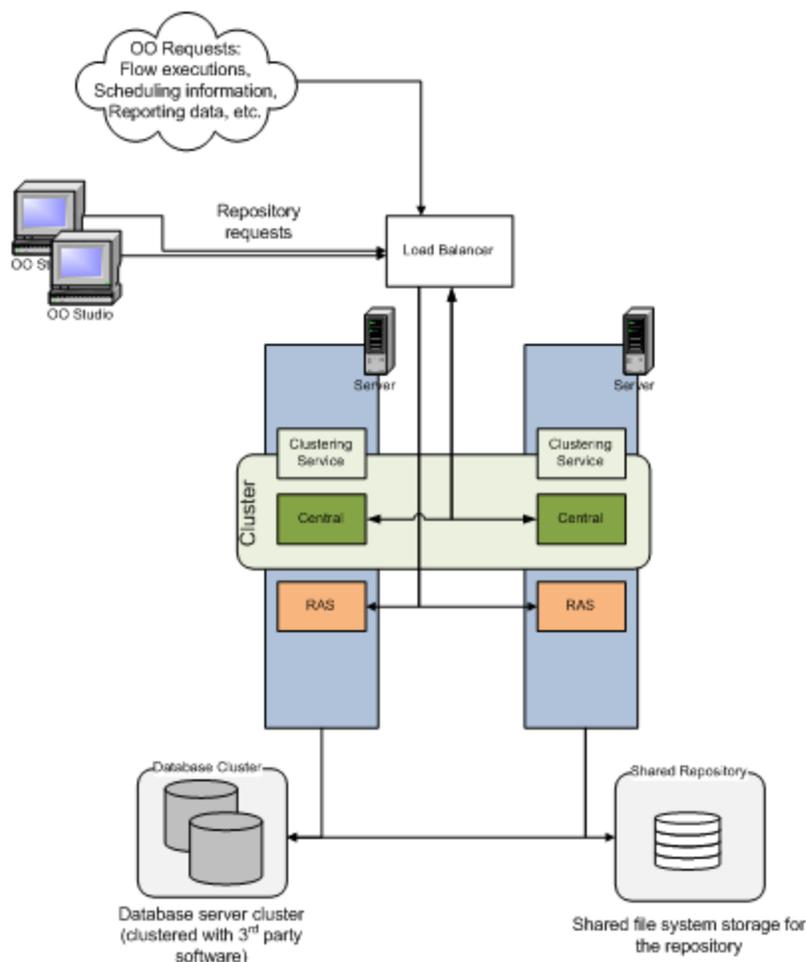
Chapter 3

Perform a Clean Installation

To create a Central cluster with the OO Load Balancer, perform the following steps:

1. Create the database cluster. How you create the database cluster depends on the third-party software that you use to create and support it.

2. Create a shared file system. For details, see .

   > **Tip:** It is recommended not to use any of the cluster nodes for hosting the shared file system.

3. Install two standalone Centrals on the desired nodes that point to the same database.

   > **Note:** These steps need to be done on one node at a time and not concurrently.

   This is done as follows:

   a. Install the first Central (using a clean database or pointing to an existing one).

      For details, see the *OO Installation and Upgrade Guide*.

   b. Install the second Central on the other node. During the installation, choose the option of using the database defined in the previous step.

      > **Note:**
      >
      > ○ Make sure that every Central instance is functional.
      >
      > ○ If you clustered your database servers with an Oracle Real Application Cluster, then be sure that you have installed OO Central according to the provisions described in the Installing Operations Orchestration with Oracle Real Application Clusters Guide.
      >
      > ○ When installing Central, you need to select the **Create or recreate (if it exists), the database schema** box only for the first Central installation.

4. Give Read/Write file-system level access to Central processes to the share. This step depends on the chosen type of the shared file system.

5. Create a Clustering Service on each Central node. For Windows, see . For Linux, see .

6. Install the OO Load Balancer. For information on installing the OO Load Balancer by itself, see .

7. Integrate a load balancer with node management from Central. For details, see the section

"Integrating a Load balancer with Node Management" in the HP Operations Orchestration
Central User Guide.

> **Note:** Modify the load balancer URL in Studio by adding the `lbUrl` as follows:
> `https://<LB_ip_address>:<LB_port>/balancer-manager.`

8. Open Central in a Web browser and check that both nodes are visible in the Nodes
    Administration page, to make sure that the cluster was correctly configured before running the
    upgrade.

9. Run the 9.06 patch installer on each node. Also, apply the patch on the Load Balancer if it is
    installed on a different machine.

10. Restart each Central Service, one at a time.

Chapter 4

Converting a Standalone Central to a Clustered Central

To convert an existing standalone Central to Clustered Central:

1. Create a new shared folder for the Shared repository. For details, see "Preparing the Shared File System" on page 33.

2. On the second node, install a Central (using the existing database and shared repository). For details, see the Installing or Upgrading HP Operations Orchestration Guide.

3. **For Windows only.** Configure the Central service to log on with credentials of a user which can access the Shared Repository.

   > **Tip:** Before adding a new node, it is recommended to back up the repository.

4. On both nodes, install a Clustering Service and configure OO Central in clustering mode.

   - For Windows, see "Add a Clustering Service to an Existing Central on Windows" below

   - For Linux, see "Add a Clustering Service to an Existing Central on Linux" on page 18

   > **Caution:** If version 9.06 was installed on Central before installing the Cluster service, you need to install the same patch again after cluster installation.

5. Restart each Central Service, one at a time.

6. **Important!** Verify that the cluster of Centrals is correctly configured. For details, see "Verify That the Central Cluster is Correctly Configured" on page 34.

7. Configure the Load Balancer.

   - For Windows, see "Installing the HP OO Load Balancer on a Windows Platform" on page 27.

   - For Linux, see "Installing the HP OO Load Balancer on a Linux Platform" on page 28.

Add a Clustering Service to an Existing Central on Windows

> **Note:** The installation path for the Clustering Services must not contain non-English language characters.

1. On the HP OO Installation CD, navigate to and double-click the **ClusterInstaller-9.00.exe**. file.

2. On the **Welcome** page of the Setup wizard, click **Next**.

3. On the **License Agreement** page, accept the terms of the license agreement, and click **Next.**

    The **Installation Type** page appears, presenting the various types of installation and configuration options that you will use to create a Central cluster.

4. Select **Install Clustering Service AND Configure OO Central in Clustering Mode,** and then click **Next.**

    The **Shared Repository Path** page appears.

5. In the **Shared Repository Path** page's text box, type the location of the shared folder, and click **Next**.

    Or

    Click **Browse**, navigate to the shared folder, and click **Next**.

    For example, **\\my-server\shared_repo**.

    The **Clustering Service High Availability Information** page appears.

6. To specify additional Clustering Service nodes (that is, the other machines that will host Clustering Services), select the **Configure Additional Clustering Services for High Availability** box.

7. In the **List of comma-delimited Clustering Service machine addresses** box, type a comma-delimited list of the machine names of the other Clustering Service nodes in the cluster, including those that will be part of the cluster but that have not had the Clustering Service installed yet.

    For example, **abvc01.dev.com**,**abvc02.dev.com**,**abvc10.dev.com.**

    > **Note:**
    >
    > ■ You can use either IP addresses or full computer names.
    >
    > ■ If you use full computer names, make sure that the case is identical for all added nodes of the cluster.

8. Click **Next**. The **Ready to Install** page appears.

    > **Important**: If the data summary includes a notice that "There is already a shared repository at…" see the Important note at the end of the section "Preparing the Shared File System" on page 33.

9. On the **Ready to Install** page, click **Install**.

    > **Note:** At this stage, the contents of the current repository of the standalone Central are copied to the shared repository.

10. When the installation has finished, on the **Completing** page, click **Finish**.

    > **Caution:** If version 9.06 was installed on Central before installing the Cluster service, you need to install the same patch again after cluster installation.

11. Execute the 9.06 patch installer to upgrade the Clustering Service to version 9.06.

Add a Clustering Service to an Existing Central on Linux

> **Note:** The installation path for the Clustering Services must not contain non-English language characters.

To install the Clustering Service and configure the Central node to run in cluster mode:

1. On the installation CD, in the Clustering subdirectory, locate and copy the Cluster-9.00.zip file and extract it to the machine on which you are going to install the Clustering Service.

    Extracting the .zip file creates the **Cluster-9.00** directory.

    > **Note:** The following steps create the information in **INSTALL.txt** (contained in the **Cluster-9.00.zip** file).

2. In the **Cluster-9.00** directory, open the **install.config** file for editing.

    Modify it to specify the following.

To specify this	In this line of install.config	Type this between the quotation marks ("")
Central home directory	`ICONCLUDE_ HOME=""`	The location of the HP OO home directory (the location to which Central-9.00.zip was extracted).
Clustering Service home directory	`ICONCLUDE_ CLUSTER_ HOME=""`	The location of the Clustering Service home directory (the location to which Cluster-9.00.zip was extracted).
Installation of the Clustering Service and configuration of the server as a Clustering Service node	`INSTALL_ TYPE=""`	`terracotta_server`
Clustering Service server	`TS_ SERVER=""`	The machine name (on which you are installing the Clustering Service). The fully qualified machine name should be used, and should not be localhost.
The location of the shared Central repository	`SHARED_ REPO_ PATH=""`	Location of the shared Central repository, as referenced by the mount point. This location is the shared directory on the shared storage device.

Any additional Clustering Service servers	`ADDITIONAL_ TERRACOTTA_ SERVERS_ LIST=""`	Comma-separated list of additional machine names hosting Clustering Service instances (for Clustering Service high availability).

For example, suppose that:

- You are installing Clustering Service on and configuring vancouver.mydomain.com as a Clustering Service node (TS_SERVER="vancouver.mydomain.com")

- You are clustering the Clustering Service with two other cluster nodes, tacoma.mydomain.com and portland.mydomain.com.

When you have configured the **install.config** file properly on vancouver.mydomain.com, it will look like the following:

```
ICONCLUDE_HOME="Central-9.00"

# the location where OO Cluster is installed. Make sure that you points to the C
lustering's home folder
ICONCLUDE_CLUSTER_HOME="Cluster-9.00"

# Installation types:
# "terracotta_central" --> Configure OO node in Clustering Mode
# "terracotta_server" --> Install Clustering Service
# "load_balancer" --> Install Cluster Load Balancer

INSTALL_TYPE="terracotta_server"

#Terracotta server host name or IP address (do not use localhost, 127.0.0.1, etc
)
TS_SERVER="vancouver.mydomain.com"

# The path for the clustered Repository
SHARED_REPO_PATH="/opt/sharedRepo"

# List of comma-delimited Clustering Service machine addresses if exist
ADDITIONAL_TERRACOTTA_SERVERS_LIST="tacoma.mydomain.com
```

3. Run the **configure.sh** script.

   The **configure.sh** script creates **CLUSTER.sh** in the **/bin** folder.

4. Edit the **install.config** file as follows: **INSTALL_TYPE=**"terracotta_central".

5. Run the **configure.sh** script again.

   At this stage, the contents of the current repository of the standalone Central is copied to the shared repository.

Note: For each Clustering Service node that you create:

- The machine name in the `TS_SERVER=""` line will be that machine's name.

- The list of machines in the `ADDITIONAL_TERRACOTTA_SERVERS_LIST=""` line will differ, each time including only the nodes other than the one on which you are working.

   For instance, when you configure **install.config** on vancouver.mydomain.com:

- The line `TS_SERVER=""` should specify "vancouver.mydomain.com"

- The list in the `ADDITIONAL_TERRACOTTA_SERVERS_LIST=""` line should be: "tacoma.mydomain.com,portland.mydomain.com"

6. Run the 9.06 patch installer to upgrade the cluster to version 9.06.

7. To start Central, run the following command: `./bin/Central.sh start`

8. To start the Clustering Service, run the command: `./bin/CLUSTER.sh start`.

9. Repeat this procedure on each of the other nodes hosting Clustering Services.

Caution: If a patch was installed on Central before installing the Cluster service, you need to install the same patch again after cluster installation.

Chapter 5

Adding a Node to an Existing Cluster

This chapter includes:

Adding a Node to an Existing Cluster Overview

The best practices deployment for the HP Operations Orchestration HA solution (for details, see "Recommended Deployment for the HP Operations Orchestration High Availability Solution" on page 13 achieves high availability from the perspective of Central and the Clustering Service. Also, because clustered Central instances always work in an active-active mode, it maximizes the usage of the hardware necessary to achieve HA.

When two Central nodes cannot cover the capacity requirements, you scale out the cluster by adding additional Central instances. This is achieved by installing additional Centrals and then switching them to clustering mode (see the installation procedures in subsequent sections). If more redundancy is desired for the Clustering Services themselves, some of the added nodes can also host Clustering Service instances (one per node). A large number of standby Clustering Service instances would decrease the throughput, so in general, we recommend that the added nodes just host clustered Central instances.

> **Caution:** Multiple clustered Central processes running on the same node is not supported in all platforms. While in Linux it is technically possible to run multiple Central instances on the same node (physical machine or VM), if those Central processes are also clustered, the run recovery will not function properly due to the fact that they will all share the same node ID.

To add a node to an existing cluster, you install a Central, configure it to run in cluster mode, and connect the load balancer to it. For details, see "Installing Additional Central Instances in Windows" on next page and "Installing Additional Central Instances in Linux" on page 23.

The following diagram shows a three-node Central cluster with two Clustering Services.
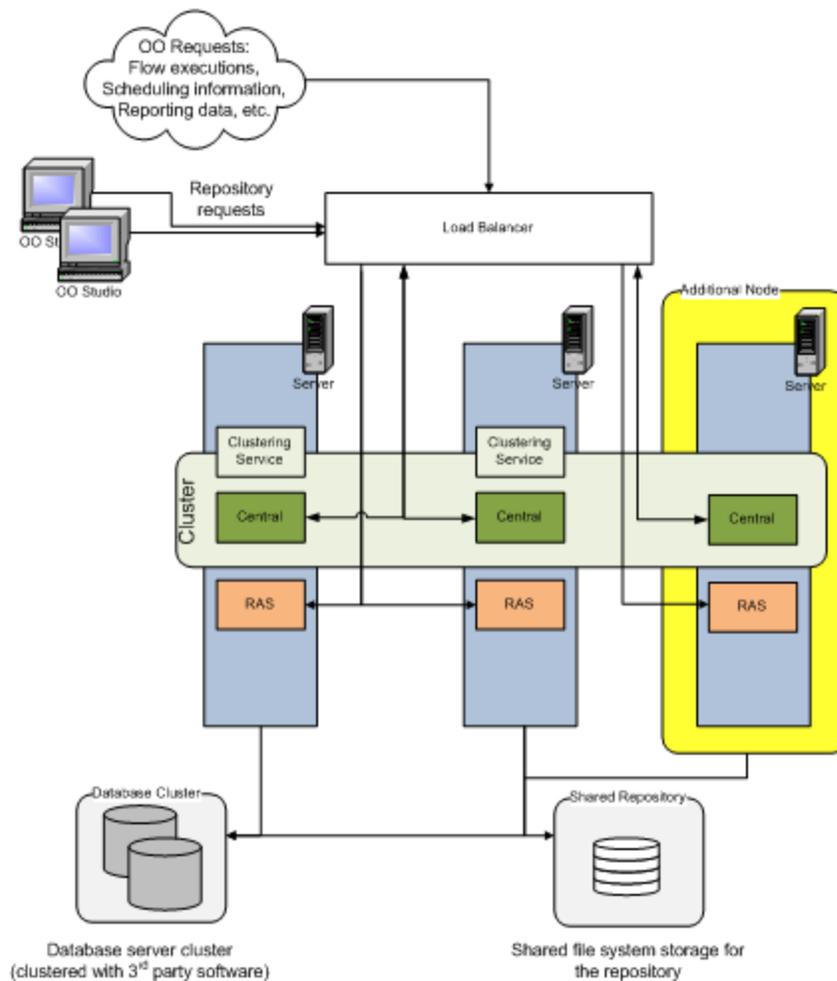
Installing Additional Central Instances in Windows

This task describes how to add additional Central instances to the cluster without installing a Clustering service on it.

1. Install Central on the node to be added to the cluster. For details, see the Installing or Upgrading HP Operations Orchestration Guide.

   Note: Verify that the installed Central has the same version as the other Centrals in the cluster. If the cluster you are adding nodes to are installed with patches, make sure the Central you add is installed with the same patch.

2. Navigate to and double-click the file **ClusterInstaller-9.00.exe**.

3. In the **Welcome** page of the Setup wizard, click **Next**.

4. In the **License Agreement** page, accept the terms of the license agreement, and click **Next**. The **Installation Type** page appears, presenting the various types of installation and configuration options that you will use to create a Central cluster.

5. Select **Configure OO Central in Clustering Mode,** and then click **Next.** The **Shared Repository Path** page appears.

6. In the text box, type the location of the shared folder, and click **Next.**

    Or

    Click **Browse,** navigate to the shared folder, click **OK,** and then click **Next.**

    The **Clustering Service Settings** page appears.

7. In the text box, type the comma-delimited list of machine hostnames that are hosting Clustering Services, and then click **Next.**

    > **Note:**
    >
    > - You can use either IP addresses or full computer names.
    >
    > - If you use full computer names, make sure that the case is identical for all added nodes of the cluster.

8. On the **Ready to Install** page, click **Install.**

9. When the installation has completed, on the **Completing** page, click **Finish.**

10. Run the 9.06 patch installer to upgrade the OO node to version 9.06.

11. **Important!** Verify that the Central cluster and Clustering Service cluster are correctly configured. For details, see "Verify That the Central Cluster is Correctly Configured" on page 34

12. Verify that the **RSCentral** service is up. If it is down, restart the service.

13. Connect the load balancer to Central. For details, see "Configuring a Load Balancing Cluster" on page 29.

Installing Additional Central Instances in Linux

This task describes how to add additional Central instances to the cluster without installing a Clustering service on it.

1. Install Central on the node to be added to the cluster. For details, see the Installing or Upgrading HP Operations Orchestration Guide.

2. Configure the shared file system. For details, see "Preparing the Shared File System" on page 33.

3. On the installation CD, in the Clustering subdirectory, locate and copy the **Cluster-9.00.zip** file and extract it to the machine that hosts the Central Service that is being configured in clustering mode.

Extracting the .zip file creates the Cluster-9.00 directory.

> **Note:** The following steps create the information in **INSTALL.txt** (contained in the **Cluster-9.00.zip** file).

4. In the Cluster-9.00 directory, open the **install.config** file for editing and modify it to specify the following.

To specify this	In this line of install.config	Type this between the quotation marks ("")
OO Central home directory	`ICONCLUDE_ HOME=""`	The location of the Central home directory.
Clustering Service home directory	`ICONCLUDE_ CLUSTER_ HOME=""`	The location of the Clustering Service home directory (the location OS where Cluster-9.00.zip was extracted).
Configuration of the Central server as a Central node	`INSTALL_ TYPE=""`	`terracotta_central`
Clustering Service server	`TS_SERVER=""`	Machine name of Clustering Service host server (first Clustering Service node if more are configured for HS).
Repository shared by Central nodes	`SHARED_REPO_ PATH=""`	Location of the shared Central repository, as referenced by the mount point. This location is the shared directory on the shared storage device.
Any additional Clustering Service servers	`ADDITIONAL_ TERRACOTTA_ SERVERS_ LIST=""`	Comma-separated list of additional machine names hosting Clustering Service instances (for Clustering Service high availability).

> **Note:** All the settings that you specify are the same for each Central node.

The following is an example of providing HA for the Clustering Service with one active node and two passive nodes. Note that each node that you add to the Clustering Service cluster slows system throughput, so that you need to keep system performance when deciding how many nodes to add. For more information on the impact of increasing the number of stand-by nodes, see "Clustering Service Overview" on page 8.

The following is a sample of a Central server node installation

```
ICONCLUDE_HOME="Central-9.00"

# the location where OO Cluster is installed. Make sure that you points to the C
lustering's home folder
ICONCLUDE_CLUSTER_HOME="Cluster-9.00"

# Installation types:
# "terracotta_central" --> Configure OO node in Clustering Mode
# "terracotta_server" --> Install Clustering Service
# "load_balancer" --> Install Cluster Load Balancer

INSTALL_TYPE="terracotta_central"

#Terracotta server host name or IP address (do not use localhost, 127.0.0.1, etc
)
TS_SERVER="vancouver.mydomain.com"

# The path for the clustered Repository
SHARED_REPO_PATH="/opt/sharedRepo"

# List of comma-delimited Clustering Service machine addresses if exist
ADDITIONAL_TERRACOTTA_SERVERS_LIST="tacoma.mydomain.com
```

5. Save your changes and close the **install.config** file.

6. Run the **configure.sh** script.

7. Run the 9.06 patch installer to upgrade to version 9.06.

8. To restart the Central Service, run the following commands:

    ```
    ./bin/Central.sh stop
    ```

    ```
    ./bin/Central.sh start
    ```

9. **Important!** Verify that the Central and Clustering Service clusters are correctly configured. For details, see "Verify That the Central Cluster is Correctly Configured" on page 34.

10. Connect the load balancer to the Central. For details, see "Configuring a Load Balancing Cluster" on page 29.

Chapter 6

Load Balancer Configuration

This chapter includes:

Providing Load Balancing for OO Components

You can provide load-balancing for Central by installing the HP OO Load Balancer and then running the **cluster-config.jar** file (a Java command-line utility) to add Central and RAS, instances to the Load Balancer configuration.

> **Note:** When using a load balancer, make sure that any interaction that had originally pointed to the Central now points to the load balancer. It can be a patch installation, flow execution, the DynamicallyLaunchFlow step, and so forth.

The OO Load Balancer is based on the Apache Load Balancer, version 2.2.11 The default configuration of the Apache load balancer that comes with OO is to spread the flows evenly between the various centrals based on the number of currently running requests. This is called **Pending Request Counting** (see Apache documentation). In addition, subsequent requests coming from the same web client are directed to the same Central using sticky sessions based on cookies.

This default OO behavior can be adjusted using the Apache load balancer configuration files. In addition, the customer can use a different load balancer with a different request spreading behavior.

For more information about the Apache Load Balancer, see the Apache Web site.

Load balancing is created by installing a load balancer, pointing it to the OO components, and integrating it with the Node Management in the Central. For information on creating the load-balancer-managing flow and enabling load-balancing management, see the HP Operations Orchestration Central User Guide.

1. Install the HP OO Load Balancer, using one of the two following procedures:

   - "Installing the HP OO Load Balancer on a Windows Platform" on next page

   - "Installing the HP OO Load Balancer on a Linux Platform" on page 28

2. Configure the load balancer cluster. For details, see "Configuring a Load Balancing Cluster" on page 29.

3. In Studio, create a flow that synchronizes the load balancer to the online/offline state changes of each node of OO Central.

   For more information about building your own operations and flows, see the Guide to Authoring Operations Orchestration Flows and the Operations Orchestration Software Development Kit Guide.

   > **Note:** Operations and steps that point to the Central hostname should point to the load-balancing cluster's IP address.

4. In Central, enable load-balancer management for the Central cluster.

   > **Note:** When creating a load balancer management flow to manage the Apache load balancer's state (for details, see the section "Integrating a Load Balancer with Node Management" in HP Operations Orchestration Central User Guide), notice that the default value for the Apache load balancer management URL is **https://<lb-host>:<lb-port>/balancer-manager**.

   If you use a software load balancer other than the OO Load Balancer, be sure that for the Central web client, the load balancer should be configured as a **sticky session**.

   > **Note:** Be sure to distinguish between creating a load-balancing cluster for RAS and Central instances. When you create a Central load-balancing cluster, add only Central servers. When you create a RAS load-balancing cluster, add only RAS instances.

Providing High Availability to the Load Balancer

To prevent the load balancer from becoming another "Single Point Of Failure", you must provide high availability for the load balancer. The load balancer can consist of two or more load balancer nodes that monitor each other using heartbeat. If one load balancer fails, the other takes over silently.

The common configuration for the load balancer is to have a virtual IP address that will be shared by the load balancer nodes and used for incoming HTTP requests.

Synchronizing between load balancer nodes can be configured using various 3rd party solutions. The relevant solution setup is out of this document's scope.

Installing the HP OO Load Balancer on a Windows Platform

> **Note:** Before you perform the following steps, make sure that jre 1.6 bin folder is in the PATH environment variable.

1. On the machine on which you are installing the Load Balancer, locate the **ClusterInstaller-9.00.exe** file on the HP OO Installation CD.

2. Double-click the file to open **Welcome** page of the Setup wizard.

3. On the **Welcome** page, click **Next**.

4. On the **License Agreement** page, accept the terms of the license agreement, and then click **Next**.

   The **Installation Type** page appears.

5. To install the Load Balancer, select **Install Cluster Load Balancer,** and click **Next**.

6. On the **Select Destination Location** page, do one of the following, and click **Next**:

   The option you should choose here varies, depending on whether the Load Balancer is installed standalone or on one of the Central nodes

   - Accept the default location. This option should be selected if the Load Balancer is installed on one of the Central nodes.

   - Type the location where you want the OO Load Balancer to be installed. This option can be selected if the Load Balancer is installed standalone.

   - Click **Browse** and specify the required location. This option can be selected if the Load Balancer is installed standalone.

   The **Ready to Install** page appears, displaying the information that you specified.

7. To proceed, click **Install**. The Setup Wizard tracks progress on the **Installing** page.

8. When the installation is completed, click **Finish**.

9. Run the 9.06 patch installer to upgrade the OO Load Balancer to version 9.06.

Installing the HP OO Load Balancer on a Linux Platform

1. On the installation CD, in the Clustering subdirectory, locate and copy the **Cluster-9.00.zip** file and extract it to the location where you are going to perform the installation.

   > **Note:** The following steps create the information in the **INSTALL.txt** file (contained in the **Cluster-9.00.zip** file).

2. Open the **install.config** file for editing.

3. To specify installation of the Load Balancer as the install type, find the line that begins with INSTALL_TYPE= and make sure that the installation type is "load_balancer".

4. Run the **configure.sh** script. The installation creates a service, **PASLB.sh**, in the /apache subdirectory of the Load Balancer home directory (which is, by default, /Cluster-9.00).

5. Using **configure.sh**, create or view the cluster and add or remove its nodes.

For information on adding or removing nodes, see "Configuring a Load Balancing Cluster" below.

6. Run the 9.06 patch installer to upgrade the OO Load Balancer to version 9.06.

7. To start the Load Balancer service, run the following command:
   ```
   ./apache/PASLB.sh start
   ```

Configuring a Load Balancing Cluster

Use the following procedure in both Windows and Linux environments.

> **Note:**
>
> - Be sure to distinguish between creating a load-balancing cluster for Central instances and RAS instances. When you create a Central load-balancing cluster (PAS), add only Central servers. When you create a load-balancing cluster for RAS installations, add only RAS instances.
>
> - If you have multiple load balancers, make sure to perform the following procedure for each of them.
>
> - The load balancer is already configured with a default entry called **Test Cluster** using port 8444. If you want to use this port, you must manually delete this entry before creating another one. If you are planning to use a port other than this one, you can ignore this entry.

To specify which OO components are load-balanced:

1. If you are using Windows:
   a. Open a command window and Navigate to the location where you installed the HP OO Load Balancer and locate **cluster-config.jar**.

      If you accepted the default locations when installing the Load Balancer, cluster-config.jar is in the OO home directory, in the \Clustering subdirectory.

   b. **Important! Before performing this step, make sure that Java 6 is installed.**

      Run **cluster-config.jar**, using the following command:

      ```
      java -jar cluster-config.jar
      ```

> **Note:** To find the command help for **cluster-config.jar**, type **help.**

```
Enter a Command: help
Command Description
------- -----------
rm       removes a node from the cluster (eg. rm <index> )
view     views cluster details (eg. view <index> )
restart  saves config file and restarts apache
save     saves config file
help     this current view of all commands
ls       lists all clusters and their index
del      deletes a cluster (eg. del <index> )
add      adds node to cluster
edit     edits cluster (eg. edit 1)
create   creates cluster
exit     exits this tool
```

2. If you are using Linux:
   a. Navigate to the location where you installed the HP OO Load Balancer and locate the extracted folder of the **Cluster-9.00.zip** file.

   b. Run **configure.sh**.

   > **Note:** To find the command help for **configure.sh**, type **help.**

```
Enter a Command: help    this current view of all commands
Command Description
------- -----------
help     this current view of all commands
restart  saves config file and restarts apache
save     saves config file
create   creates cluster
view     views cluster details (eg. view <index> )
edit     edits cluster (eg. edit 1)
del      deletes a cluster (eg. del <index> )
ls       lists all clusters and their index
rm       removes a node from the cluster (eg. rm <index> )
add      adds node to cluster
exit     exits this toolrestart saves config file and restarts apache
```

3. To create a cluster, type `create` and then press ENTER.

4. At the prompt **Enter the cluster name,** type the cluster name, and press ENTER.

   > **Note:** There should be two clusters – one for the Central instances and one for the RAS instances.

5. At the prompt **Enter the cluster type,** among the cluster types, do one of the following:

   ■ To add a Central node, type **PAS**

   ■ To add a RAS node, type **RAS**

   Do not specify either JRAS or NRAS.

6. At the prompt **Enter the cluster port,** type an *unused* port for the cluster to use, and press

ENTER.

The following message appears: **Cluster <clustername> successfully added!**

```
Enter a Command: create
Enter the cluster name: OO-PAS-Cluster
Enter the cluster type (PAS, RAS): PAS
Enter the cluster port: 8444
Cluster OO-PAS-Cluster successfully added!
Name:   OO-PAS-Cluster
Host:   PAS
Port:   8444
Nodes:
        Port    Host
        _____  _____

(view) View Cluster, (edit) Edit Cluster, (add) Add Node, (rm #) Remove Node
```

7. To add a node to the cluster, type `add` and then press ENTER.

8. At the prompt **Enter the node host,** type the machine name of the node to add.

9. At the prompt **Enter the node port,** type the port that the node will use to communicate with the other nodes. The PAS default port is 8443 and the RAS default is 9004.

    Each time you successfully add a node, the current state of the cluster, including its nodes, is displayed.

```
Enter a Command: add
Enter the node host: Central_1
Enter the node port: 8443
Node Central_1 successfully added!
Name:   OO-PAS-Cluster
Host:   PAS
Port:   8444
Nodes:
        Port    Host
        _____  _____
1       8443    Central_1

(view) View Cluster, (edit) Edit Cluster, (add) Add Node, (rm #) Remove Node

Enter a Command: add
Enter the node host: Central_2
Enter the node port: 8443
Node Central_2 successfully added!
Name:   OO-PAS-Cluster
Host:   PAS
Port:   8444
Nodes:
        Port    Host
        _____  _____
1       8443    Central_1
2       8443    Central_2

(view) View Cluster, (edit) Edit Cluster, (add) Add Node, (rm #) Remove Node
```

10. To save the configuration file, at the prompt, type `save` and press ENTER.

11. To view the cluster details, type `view <index>`.

```
Enter a Command: view 1
Name:   OO-PAS-Cluster
Host:   PAS
Port:   8444
Nodes:
        Port    Host
        _____  _____
1       8443    Central_1
2       8443    Central_2
```

12. To list all clusters and their index, press `ls`.

```
Enter a Command: ls
        Type    Port    Name
        ----    ----    -------------------------
1       PAS     8444    OO-PAS-Cluster
2       RAS     9005    OO-RAS-Cluster

<view #> View Cluster, <create> Create Cluster, <del #> Delete Cluster
```

13. Type `exit`, press y and then press ENTER.

14. Restart the load balancer service (**RSCluster**).

15. To access RAS through the load balancer, RAS configuration needs to point to the RAS load balancer.

    a. Open Studio.

    b. Go to **Configuration > Remote Action Services**.

    c. Edit the RAS_Operator_Path URL as follows: **https://<load balancer host name>:<load balancer RAS port number>/RAS/services/RCAgentService**.
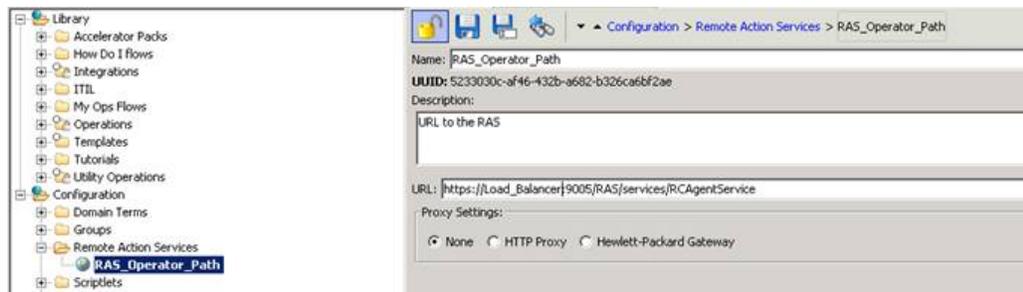
Connecting Studio to the Load Balancer

In a clustered environment, it is recommended to connect the Studio to the load balancer. This provides failover and load balancing capabilities to the Studio users when they access the Shared Repository.

Chapter 7

Common Tasks

This chapter includes:

Preparing the Shared File System

All the nodes in a Central cluster share the repository. The repository is stored as a set of folders and files. This requires that the shared repository reside on a shared file system/shared folder, using the technology of your choice.

The Central cluster must be able to access this shared file system over the network.

- For a Windows-based Central cluster, you can create a regular Windows share and restrict access to it by using standard Windows file system security (using domain accounts).

- For a Linux-based Central cluster, you can use NFS, with proper access control.

Caution: If you use NFS for the shared repository, it is strongly recommended that you use NFS version 4 and turn off NFS caching.

Important: If you are installing the Clustering Service on a server running on Windows and there is already a shared repository present on the server, you will have to:

1. Delete the existing shared repository or create the new shared repository for the cluster at another location.

   If you start the installation without having performed this step, you will have to exit the installation without completing it, and then perform this step.

2. Stop the Clustering Service service.

3. In the OO home directory, remove the **\Clustering\terracotta\terracotta-data** folder.

The accounts under which Central will run must have full Read and Write permissions to the shared network directory (Windows or Linux).

- For a Windows-based Central cluster using a regular Windows share, switch the Central service to a domain account that has full permissions for the shared network directory.

- For a Linux-based Central cluster using NFS, assure regular Linux access control for the Central processes.

To achieve high availability for the HP OO cluster, the shared file system should be highly available as well. HP OO does not depend on a particular technology, because the repository is accessed through standard file IO.

The following procedure describes how to accomplish this on a Linux operating system.

To create and assign rights to a shared folder using the NFS Server on Linux:

> **Caution:** The NFS Server must be reside at the same location as the shared repository.

1. Log on as the root user.

2. Check that NFS service is installed in each of the nodes and NFS server.

3. Make sure the NFS service is started by running the command: `service NFS status`. In case the service is down, run the command: `service NFS start`.

4. On each of the nodes, insert an NFS configuration such as the following in the file /etc/fstab.
   `<hostname>:/Linux_share1    /Linux_share2    nfs    rsize=8192, wsize=8192,timeo=14,intr`

   where

   `<hostname>` is the NFS server where the shared repository resides.

   `Linux_share1` is the shared repository folder name that resides on the NFS server.

   `Linux_share2` is the folder on the local node on which it is running.

5. To give the mounted folder direct communication, insert the following line in the **/etc/exports** file:

   On the NFS server: `/Linux_share1 16.0.0.0/8(rw)`

   On the nodes: `/Linux_share2 16.0.0.0/8(rw)`

6. Mount the NFS folder in each of the nodes, using a command such as the following.

   `mount -t nfs <hostname>:/Linux_share1 /Linux_share2`

Verify That the Central Cluster is Correctly Configured

> **Note:** Before starting Central, verify that the shared repository is accessible. Central does not start if the shared repository is down.

To verify that the high-availability Central cluster setup is correct, check the following on each Central node:

- In the Central home directory's \conf subdirectory, in the **Central.properties** file, find the line beginning with:

  `dharma.repository=`

- The `location=` setting must point to the shared repository.

  The reference to the shared repository can be either a UNC or a shared-directory reference. Whichever method of reference this setting uses, the reference must be consistent across the nodes of the Central. That is, the shared-repository reference must be identical in the Central.properties file on each node of the Central cluster. If the reference to the shared repository is not consistent across the Central cluster, the repository will be corrupted.

- The line should include the setting

  ```
  shared=true;
  ```

- Make sure you can access the shared file system from each node. To ensure this, you need to configure the Central service to log on with credentials of a user that can access the Shared Repository. Verify that the **Log On** user of the Central service to a local user account has permissions to the shared folder. Then confirm that the user that is used for Central service has permissions to that folder.

- In the **<OO Cluster installation directory>\Cluster-9.00\tc-config.xml** file, confirm the Terracotta server settings and ports. The full computer names must be identical, including case identical on both nodes.

  > **Caution:** Before running **dev-console** in the next step, make sure that the JAVA_HOME variable is set.

- In the **Clustering/terracotta/bin** folder, execute **dev-console** on Windows or **dev-console.sh** on Linux, and connect to the cluster. An example of the minimal, highly available cluster is displayed below:
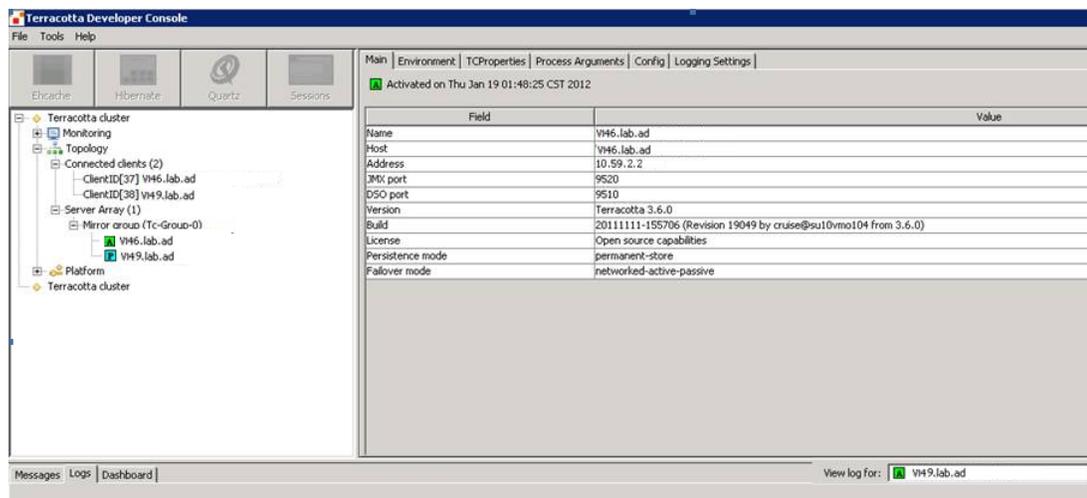
In the above example, two physical computers host both the Central Services (listed under **Clients (2)**) and the Clustering Service (listed under **Servers (2)**).

Under Clustering Services, make certain that one of the servers is green (green denotes an active server) and the other is blue (blue denotes a passive server).

- **If both servers are active, then do the following:**
  - In the **<OO installation directory>\Clustering\terracotta\tc-config.xml** file, verify that you used the full computer names rather than the IP addresses. The full computer names

must be identical, including case identical on both nodes.

- ○ If the file needs to be edited, restart the **RSGridserver services** after modifying the file, **one by one**.

- ○ Run the **<OO installation directory>\Operations Orchestration\Clustering\terracotta\bin\dev-console** script and look for error messages in the Terracotta Administrator Console.

- ○ Look for error messages under: **<OO installation directory>\Operations Orchestration\Clustering\terracotta\logs\Terracotta_wrapper**.

- ▪ **If less than two Centrals appear under clients, then do the following:**
  - ○ Check whether the repository is accessible. Central does not start if the shared repository is down.

  - ○ Restart **Central Services**, **one by one**.

  - ○ Verify that there is one active and one passive server under the **Server** section in the Terracotta Administrator Console. If there is more than one active server, then follow the instructions in the section above explaining what to do if both servers are active.

  - ○ Check the logs at the following locations:

    - ○ **%ICONCLUDE_HOME%\Central\logs\Central_wrapper.log**

    - ○ **%ICONCLUDE_HOME%\Clustering\terracotta\logs\Terracotta_wrapper.log**

Using this Terracotta Administrator Console is the most reliable way of visualizing the health of the cluster. Depending on your deployment topology, the number of services listed under both the **Servers** and **Clients** nodes may differ from the example above.

> **Note:** In the Terracotta Administrator Console, the tree view with the servers can be sometimes hidden under the left edge of the window.
>
> To make the tree view frame visible again, try minimizing and maximizing the window. If this does not work, select the left edge of the window and drag it to the right, in order to expose the frame with the tree view.

Recommended Order for Starting and Stopping HP OO Services

> **Note:** There is no specific order in which you need to start and stop HP OO services, as long as you apply the following dependencies:
>
> - RSGridserver needs to be restarted before RSCentral.
>
> - In a clustered environment, make sure to start Central services one by one, that is, do not start more than one Central service at the same time.

The recommended order in which to start HP OO services is:

1. RSGridserver

2. RSJRAS

3. RSCentral

> **Note:** In a clustered environment, make sure to start Central services one by one, that is, do not start more than one clustered Central service at the same time.

4. RSCluster

The recommended order in which to stop HP OO services is:

1. RSCluster

2. RSCentral

3. RSJRAS

4. RSGridserver

Chapter 8

Advanced Clustering Configuration

Removing a Node from an OO Cluster

This section describes how to remove a third Central node from an OO cluster, and uninstall its components in Windows and Linux.

The steps include removing the node from the load balancer, and removing the following node components — Clustering installation, Central and RAS services.

> **Note:** Once the node has been disconnected from the cluster, it is in an invalid state and should not be used to execute or schedule flows.

This chapter includes:

Remove a Node from a Windows Cluster Installation

1. Remove the node from the load balancer.
   a. Connect to the host on which the load balancer is installed.

   b. From the **<Operations Orchestration Installation directory>\Clustering** folder, run the following script in a command prompt window: **java -jar cluster-config.jar.**

   c. Type `ls` to view the list of clusters.

   d. Type `view <cluster number>` to view the nodes of the selected cluster.

   e. Type `rm <node number>` to remove the required node.

   f. Type `exit`. When asked, **Save your changes**?, press **Y** and then ENTER.

2. **Important! If you are using Windows Server 2003, make sure that the Services window is closed before performing this step.**

---

    a. Access the Windows Programs and Features window.

    b. Locate **HP Operations Orchestration Cluster**.

    c. Click **Uninstall**.

3. Stop the HP Operations Orchestration Central Service.
    a. Access the Windows Services window.

    b. Locate the **RSCentral** service.

    c. Click **Stop Service**.

4. Uninstall Central, and the RAS. For details, see the section "Uninstalling OO Programs" in the Installing or Upgrading HP Operations Orchestration Guide.

> **Caution:** After uninstalling the Clustering Service, the **RSGridServer** service, may not be removed. For details about how to uninstall the **RSGridServer** service, see "Troubleshooting" on page 43.

> **Note:** Uninstalling the clustering service invalidates HP-OO Central. To have a standalone Central installation, the Central service must be reinstalled. To reinstall Central, see the section "Installing or Upgrading Central" in the Installing or Upgrading HP Operations Orchestration Guide.

Remove a Node from a Linux Cluster Installation

> **Note:** The commands in this section assume that OO is installed on the default path, that is, **/opt/hp**. If OO is installed elsewhere, substitute that path for **/opt/hp**.

1. Remove the node from the Load Balancer.
    a. Connect to the host on which the load balancer is installed.

    b. In shell, run the following command: **/opt/hp/<Operations Orchestration Installation directory>/Cluster-9.00/bin/configure.sh**.

    c. Type `ls` to view the list of clusters and press ENTER.

    d. Type `view <cluster number>` to view the nodes of the selected cluster and press ENTER.

    e. Type `rm <node number>` to remove the required node and press ENTER.

    f. Type **exit**. When asked, **Save your changes**?, press **Y.**and then ENTER.

2. Stop the HP Operations Orchestration Central Service. In shell,run the following commands:
    a. **/opt/hp/<Operations Orchestration Installation directory>/Cluster-9.00/bin/Central.sh stop**.

    b. **/opt/hp/<Operations Orchestration Installation directory>/Cluster-9.00/bin/JRAS.sh stop.**

3. In shell, run the following command: **rm /opt/hp/<HP Operations Orchestration Installation directory>**.

Install a Standalone Clustering Service

This procedure should be used when the Clustering Service instances are hosted on separate nodes from the Central instances.

Perform the following procedure on the machine that hosts the installed Clustering Service.

> **Caution:** The installation path for the Clustering Service must not contain non-English language characters.

To install the Clustering Service separate from a Central server in Windows:

1. Locate the following executable file: **ClusterInstaller-9.00.exe**.

2. Double-click the file to open the Setup wizard.

3. On the **Welcome** page of the Setup wizard, click **Next**.

4. On the **License Agreement** page, accept the terms of the license agreement, and then click **Next**.

   The **Installation Type** page appears, presenting the various types of installation and configuration options that you will use to create a Central cluster.

5. Select **Install Clustering Service,** and then click **Next**.

6. On the **Select Destination Location** page, type the location at which you want to install the Clustering Service files, and then click **Next**.

   Or

   Click the **Browse** button, navigate to the desired location, click **OK**, and then **Next**.

   The **Clustering Service High Availability Information** page appears. This is the page on which you identify the other nodes that host Clustering Service instances.

7. Select the **Configure additional Clustering Services for High Availability box**.

8. In the text box, type a comma-delimited list of the machine names of the other Clustering Service nodes, and click **Next.**

   > **Note:**
   >
   > - You can use either IP addresses or full computer names.
   >
   > - If you use full computer names, make sure that the case is identical for all added nodes of the cluster.

9. On the **Ready to Install** page, click **Install**.

10. When the installation has completed, on the **Completing** page, click **Finish**.

11. Upgrade to Clustering Service 9.06.

12. **Recommended!** Review the troubleshooting issue regarding an active-active cluster.

To install the Clustering Service separate from a Central server in Linux:

1. On the installation CD, in the Clustering subdirectory, locate and copy the Cluster-9.00.zip file and extract it to the machine on which you are going to install the Clustering Service.

   Extracting the .zip file creates the **Cluster-9.00** directory.

   > **Note:** The following steps create the information in **INSTALL.txt** (contained in the **Cluster-9.00.zip** file).

2. In the **Cluster-9.00** directory, open the **install.config** file for editing.

   Modify it to specify the following.

To specify this	In this line of install.config	Type this between the quotation marks ("")
Central home directory	`ICONCLUDE_ HOME=""`	The location of the HP OO home directory (the location to which Central-9.00.zip was extracted).
Clustering Service home directory	`ICONCLUDE_ CLUSTER_ HOME=""`	The location of the Clustering Service home directory (the location to which Cluster-9.00.zip was extracted).
Installation of the Clustering Service and configuration of the server as a Clustering Service node	`INSTALL_ TYPE=""`	`terracotta_server`
Clustering Service server	`TS_ SERVER=""`	The machine name (on which you are installing the Clustering Service). The fully qualified machine name should be used, and should not be localhost.
The location of the shared Central repository	`SHARED_ REPO_ PATH=""`	Location of the shared Central repository, as referenced by the mount point. This location is the shared directory on the shared storage device.
Any additional Clustering Service servers	`ADDITIONAL_ TERRACOTTA_ SERVERS_ LIST=""`	Comma-separated list of additional machine names hosting Clustering Service instances (for Clustering Service high availability).

For example, suppose that:

- You are installing Clustering Service on and configuring vancouver.mydomain.com as a Clustering Service node (TS_SERVER="vancouver.mydomain.com")

- You are clustering the Clustering Service with two other cluster nodes, tacoma.mydomain.com and portland.mydomain.com.

When you have configured the **install.config** file properly on vancouver.mydomain.com, it will look like the following:

```
ICONCLUDE_HOME="Central-9.00"

# the location where OO Cluster is installed. Make sure that you points to the C
lustering's home folder
ICONCLUDE_CLUSTER_HOME="Cluster-9.00"

# Installation types:
# "terracotta_central" --> Configure OO node in Clustering Mode
# "terracotta_server" --> Install Clustering Service
# "load_balancer" --> Install Cluster Load Balancer

INSTALL_TYPE="terracotta_server"

#Terracotta server host name or IP address (do not use localhost, 127.0.0.1, etc
)
TS_SERVER="vancouver.mydomain.com"

# The path for the clustered Repository
SHARED_REPO_PATH="/opt/sharedRepo"

# List of comma-delimited Clustering Service machine addresses if exist
ADDITIONAL_TERRACOTTA_SERVERS_LIST="tacoma.mydomain.com
```

3. Run the **configure.sh** script.

    The **configure.sh** script creates **CLUSTER.sh** in the **/bin** folder.

4. To start the Clustering Service, run the command: `./bin/CLUSTER.sh start`.

5. Repeat this procedure on each of the other nodes hosting Clustering Services.

    Note: If a patch was installed on Central before installing the Cluster service, you need to install the same patch again after cluster installation.

Chapter 9

Troubleshooting

This section describes the troubleshooting issues for HP Operations Orchestration High Availability.

Clustering Service Problems

> **Note:** For details on how to start and stop HP OO services, see "Recommended Order for Starting and Stopping HP OO Services" on page 36.

Problem: The Clustering Service does not start.

Solution: Check if the installation path of the Clustering Service contains non-English characters. The installation path for the Clustering Services must not contain non-English language characters. If the installation path contains non-English character, you need to reinstall the Clustering Service in a path containing English characters only.

Problem: The **RSGridServer** service is not removed after uninstalling the Clustering Service.

Solution: If the **RSGridServer** service is not removed after uninstalling the Clustering Service, do the following:

1. Access the Registry Editor (**Start** > **Run** > type `regedit`).

2. Locate then delete the **RSGridServer** folder at:

   HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\Services

3. Restart the machine

Problem: When adding additional Central instances to the cluster (for details, see "Installing Additional Central Instances in Windows" on page 22 you cannot use the IP address of the machines you want to use to host Clustering Services.

Solution: If you need to replace occurrences of IP addresses for the machines you want to use to host Clustering Services, perform the following steps:

1. Edit the **<HP Operations Orchestration installation directory>\Clustering\terracotta\tc-config.xml** file on all cluster machines.

2. Replace all the occurrences of IP addresses with their respective hostnames.

3. Save the file.

4. Access the Windows Services window and, one by one, restart the **RSGridServer** service on all cluster machines.

Problem: When attempting to restart OO processes on one node, you start the cluster first, and then Central, Central fails to restart. The following exception is seen in **Central_wrapper.log**:

```
Failed To Modify Field:
com.iconclude.dharma.commons.repo.DharmaPathReference.path in
com.iconclude.dharma.commons.repo.DharmaPathReference
```

Solution:

1. Edit **<OO installation directory>/Cluster-9.00/terracotta/tc-config.xml.**

2. Locate the **locks** section.

3. After the first **<autolock>** block, append these lines:

```
<autolock auto-synchronized="true">

 <method-expression>*
com.iconclude.dharma.commons.repo.DharmaPathReference.*(..)</method-
expression>

 <lock-level>write</lock-level>

</autolock>
```

Corrupted Repository Problem

Problem: The Central Service fails due to a corrupted repository.

Solution:

1. Verify that the problem has been caused by a corrupted repository by locating an error in the **Central_wrapper.log** file that indicates a repository exception.

2. Replace the corrupted repository files with the an uncorrupted backup version from the **backups** folder:
   a. In the **<main repository>** folder, delete all the folders except the **backups** folder.

   b. From the **backups** folder, extract the latest, uncorrupted .zip file to the **<main repository>** folder.