Installing and Configuring VMware vRealize Orchestrator

vRealize Orchestrator 7.1

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Installing and Configuring VMware vRealize Orchestrator

Installing and Configuring VMware vRealize Orchestrator provides information and instructions about installing, upgrading and configuring VMware® vRealize Orchestrator.

Intended Audience

This information is intended for advanced vSphere administrators and experienced system administrators who are familiar with virtual machine technology and datacenter operations.

Introduction to VMware vRealize Orchestrator 1

VMware vRealize Orchestrator is a development- and process-automation platform that provides a library of extensible workflows to allow you to create and run automated, configurable processes to manage VMware products as well as other third-party technologies.

vRealize Orchestrator automates management and operational tasks of both VMware and third-party applications such as service desks, change management systems, and IT asset management systems.

This chapter includes the following topics:

Key Features of the Orchestrator Platform

Orchestrator is composed of three distinct layers: an orchestration platform that provides the common features required for an orchestration tool, a plug-in architecture to integrate control of subsystems, and a library of workflows. Orchestrator is an open platform that can be extended with new plug-ins and libraries, and can be integrated into larger architectures through a REST API.

The following list presents the key Orchestrator features.

Persistence Production grade databases are used to store relevant information, such as processes, workflow states, and configuration information.

Central management Orchestrator provides a central way to manage your processes. The application server-based platform, with full version history, can store scripts and process-related primitives in the same storage location. . This way, you can avoid scripts without versioning and proper change control on your servers.

Check-pointing

Every step of a workflow is saved in the database, which prevents data-loss if you must restart the server. This feature is especially useful for long-running processes.

Control Center

The Control Center interface increases the administrative efficiency of vRealize Orchestrator instances by providing a centralized administrative interface for runtime operations, workflow monitoring, unified log access and configurations, and correlation between the workflow runs and system resources. The vRealize Orchestrator logging mechanism is optimized with an additional log file that gathers various performance metrics for vRealize Orchestrator engine throughput.

Versioning

All Orchestrator Platform objects have an associated version history. Version history is useful for basic change management when distributing processes to project stages or locations.

Scripting engine

The Mozilla Rhino JavaScript engine provides a way to create building blocks for Orchestrator Platform. The scripting engine is enhanced with basic version control, variable type checking, name space management, and exception handling. The engine can be used in the following building blocks:

- Actions
- Workflows
- Policies

Workflow engine

The workflow engine allows you to automate business processes. It uses the following objects to create a step-by-step process automation in workflows:

- Workflows and actions that Orchestrator provides
- Custom building blocks created by the customer
- Objects that plug-ins add to Orchestrator

Users, other workflows, schedules or policies can start workflows.

Policy engine

You can use the policy engine to monitor and generate events to react to changing conditions in the Orchestrator server or plugged-in technology. Policies can aggregate events from the platform or any of the plug-ins, which helps you to handle changing conditions on any of the integrated technologies.

Security

Orchestrator provides the following advanced security functions:

- Public Key Infrastructure (PKI) to sign and encrypt content imported and exported between servers.
- Digital Rights Management (DRM) to control how exported content can be viewed, edited, and redistributed.
- Secure Sockets Layer (SSL) to provide encrypted communications between the desktop client and the server and HTTPS access to the Web front end.

- Advanced access rights management to provide control over access to processes and the objects manipulated by these processes.

Encryption vRealize Orchestrator uses a FIPS-compliant Advanced Encryption Standard (AES) with a 256-bit cipher key for encryption of strings. The cipher key is randomly generated and is unique across appliances that are not part of a cluster. All nodes in a cluster share the same cipher key.

Orchestrator User Types and Related Responsibilities

Orchestrator provides different tools and interfaces based on the specific responsibilities of the global user roles. In Orchestrator, you can have users with full rights, that are a part of the administrator group (Administrators) and users with limited rights, that are not part of the administrator group (End Users).

Users with Full Rights

Orchestrator administrators and developers have equal administrative rights, but are divided in terms of responsibilities.

Administrators This role has full access to all of the Orchestrator platform capabilities. Basic administrative responsibilities include the following items:

- Installing and configuring Orchestrator
- Managing access rights for Orchestrator and applications
- Importing and exporting packages
- Running workflows and scheduling tasks
- Managing version control of imported elements
- Creating new workflows and plug-ins

Developers This user type has full access to all of the Orchestrator platform capabilities. Developers are granted access to the Orchestrator client interface and have the following responsibilities:

- Creating applications to extend the Orchestrator platform functionality
- Automating processes by customizing existing workflows and creating new workflows and plug-ins

Users with Limited Rights

End Users End users can run and schedule workflows and policies that the administrators or developers make available in the Orchestrator client.

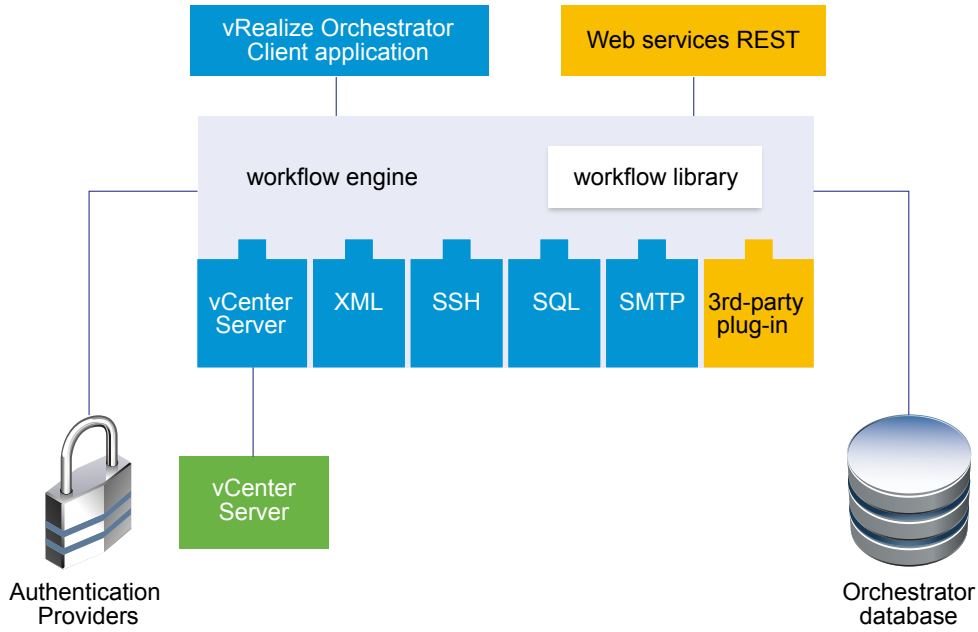
Orchestrator Architecture

Orchestrator contains a workflow library and a workflow engine to allow you to create and run workflows that automate orchestration processes. You run workflows on the objects of different technologies that Orchestrator accesses through a series of plug-ins.

Orchestrator provides a standard set of plug-ins, including a plug-in for vCenter Server, to allow you to orchestrate tasks in the different environments that the plug-ins expose.

Orchestrator also presents an open architecture to allow you to plug in external third-party applications to the orchestration platform. You can run workflows on the objects of the plugged-in technologies that you define yourself. Orchestrator connects to an authentication provider to manage user accounts, and to a database to store information from the workflows that it runs. You can access Orchestrator, the Orchestrator workflows, and the objects it exposes through the Orchestrator client interface, or through Web services.

Figure 1-1. VMware vRealize Orchestrator Architecture



Orchestrator Plug-Ins

Plug-ins allow you to use Orchestrator to access and control external technologies and applications. Exposing an external technology in an Orchestrator plug-in allows you to incorporate objects and functions in workflows that access the objects and functions of that external technology.

The external technologies that you can access by using plug-ins can include virtualization management tools, email systems, databases, directory services, and remote control interfaces.

Orchestrator provides a set of standard plug-ins that you can use to incorporate into workflows such technologies as the VMware vCenter Server API and email capabilities. By using the plug-ins, you can automate the delivery of new IT services or adapt the capabilities of existing vRealize Automation infrastructure and application services. In addition, you can use the Orchestrator open plug-in architecture to develop plug-ins to access other applications.

The Orchestrator plug-ins that VMware develops are distributed as `.vmoapp` files. For more information about the Orchestrator plug-ins that VMware develops and distributes, see http://www.vmware.com/support/pubs/vco_plugins_pubs.html. For more information about third-party Orchestrator plug-ins, see https://solutionexchange.vmware.com/store/vco.

Orchestrator System Requirements 2

Your system must meet the technical requirements that are necessary for Orchestrator to work properly.

For a list of the supported versions of vCenter Server, the vSphere Web Client, vRealize Automation, and other VMware solutions, as well as compatible database versions, see VMware Product Interoperability Matrix.

This chapter includes the following topics:

Hardware Requirements for the Orchestrator Appliance

The Orchestrator Appliance is a preconfigured Linux-based virtual machine. Before you deploy the appliance, verify that your system meets the minimum hardware requirements.

The Orchestrator Appliance has the following hardware configuration:

- 2 CPUs
- 6 GB of memory
- 17 GB hard disk

Do not reduce the default memory size, because the Orchestrator server requires at least 2 GB of free memory.

Supported Directory Services

If you plan to use an LDAP server for authentication, ensure that you set up and configure a working LDAP server.

Note LDAP authentication is deprecated and will not be supported in future versions.

Orchestrator supports these directory service types.

- Windows Server Active Directory

- OpenLDAP

Important Multiple domains that have a two-way trust, but are not in the same tree, are not supported and do not work with Orchestrator. The only configuration supported for multi-domain Active Directory is domain tree. Forest and external trusts are not supported.

Browsers Supported by Orchestrator

Control Center requires a Web browser.

You must use one of the following browsers to connect to Control Center.

- Microsoft Internet Explorer 10 or later
- Mozilla Firefox
- Google Chrome

Orchestrator Database Requirements

The Orchestrator server requires a database. The preconfigured in Orchestrator PostgreSQL database is production ready. You can also use an external database, depending on your environment.

For a list of the supported database versions, see VMware Product Interoperability Matrix.

Software Included in the Orchestrator Appliance

The Orchestrator Appliance is a preconfigured virtual machine optimized for running Orchestrator. The appliance is distributed with preinstalled software.

The Orchestrator Appliance package contains the following software:

- SUSE Linux Enterprise Server 11 Update 3 for VMware, 64-bit edition
- PostgreSQL
- Orchestrator

The default Orchestrator Appliance database configuration is production ready.

The default in-process LDAP configuration is suitable only for experimental and testing purposes. To use the Orchestrator Appliance in a production environment, you must set up a new directory service, and configure the Orchestrator server to work with it. You can also configure the Orchestrator server to authenticate through vRealize Automation, vSphere, or vCenter Single Sign-On. For more information about configuring external LDAP or Single Sign-On, see "Selecting the Authentication Type," on page 29.

For information about configuring a database for production environments, see "Setting Up the Orchestrator Database," on page 18.

Note LDAP authentication is deprecated and will not be supported in future versions.

Password Requirements

When you configure the root password of the Orchestrator Appliance, you must comply with the predefined password requirements.

The root password that you define when you deploy the Orchestrator Appliance from an OVF template must contain at least eight characters.

When you change a local user password from Control Center, the new password is not accepted, unless it meets all requirements.

- The password must be at least eight characters long.
- The password must contain at least one digit.
- The password must contain at least one uppercase letter.
- The password must contain at least one lowercase letter.
- The password must contain at least one special character.

Note Non-ASCII or extended ASCII characters are not supported. Such characters might be accepted when you define the password, but cause failures during save operations and when joining an Orchestrator node to a cluster.

Level of Internationalization Support

Orchestrator supports internationalization level 1.

Non-ASCII Character Support in Orchestrator

Although Orchestrator is not localized, it can run on a non-English operating system and support non-ASCII text.

Table 2-1. Non-ASCII Character Support in Orchestrator GUI

	Support for Non-ASCII Characters			
Orchestrator Item	**Description Field**	**Name Field**	**Input and Output Parameters**	**Attributes**
Action	Yes	No	No	No
Folder	Yes	Yes	-	-
Configuration element	Yes	Yes	-	No
Package	Yes	Yes	-	-
Policy	Yes	Yes	-	-
Policy template	Yes	Yes	-	-
Resource element	Yes	Yes	-	-
Workflow	Yes	Yes	No	No
Workflow presentation display group and input step	Yes	Yes	-	-

Non-ASCII Character Support for Oracle Databases

To store characters in the correct format in an Oracle database, set the `NLS_CHARACTER_SET` parameter to `AL32UTF8` before configuring the database connection and building the table structure for Orchestrator. This setting is crucial for an internationalized environment.

Setting Up Orchestrator Components 3

When you download, and deploy the Orchestrator Appliance, the Orchestrator server is preconfigured. After deployment, the service starts automatically.

To enhance the availability and scalability of your Orchestrator setup, follow these guidelines:

- Install and configure a database and configure Orchestrator to connect to it.
- Install and configure an authentication provider and configure Orchestrator to work with it.

This chapter includes the following topics:

vCenter Server Setup

Increasing the number of vCenter Server instances in your Orchestrator setup causes Orchestrator to manage more sessions. Each active session results in activity on the corresponding vCenter Server, and too many active sessions can cause Orchestrator to experience timeouts when more than 10 vCenter Server connections occur.

For a list of the supported versions of vCenter Server, see VMware Product Interoperability Matrix.

Note You can run multiple vCenter Server instances on different virtual machines in your Orchestrator setup if your network has sufficient bandwidth and latency. If you are using LAN to improve the communication between Orchestrator and vCenter Server, a 100 Mb line is mandatory.

Authentication Methods

To authenticate and manage user permissions, Orchestrator requires a connection to an LDAP server, a connection to a Single Sign-On server, or a connection to vRealize Automation.

Note LDAP authentication is deprecated and will not be supported in future versions.

When you download, and deploy the Orchestrator Appliance, the Orchestrator server is preconfigured to work with the in-process ApacheDS LDAP server distributed with the appliance. The default in-process LDAP configuration is suitable testing purposes only. To use Orchestrator in a production environment, you must set up either an LDAP server, a vCenter Single Sign-On server, or set up a connection with vRealize Automation and configure Orchestrator to work with it.

Connect to the LDAP server that is physically closest to your Orchestrator server to avoid long response times for LDAP queries that slow down system performance. Orchestrator supports the Active Directory and OpenLDAP service types.

To improve the performance of the LDAP queries, keep the user and group lookup base as narrow as possible. Limit the users to targeted groups that need access, rather than including whole organizations with many users who do not need access. The resources that you need depend on the combination of database and directory service you choose. For recommendations, see the documentation for your LDAP server.

To use the vCenter Single Sign-On authentication method, you must first install vCenter Single Sign-On. You must configure the Orchestrator server to use the vCenter Single Sign-On server that you installed and configured.

You can use Single Sign-On authentication through vRealize Automation and vSphere from the authentication settings in Control Center.

Setting Up the Orchestrator Database

Orchestrator requires a database to store workflows and actions.

When you download, and deploy the Orchestrator Appliance, the Orchestrator server is preconfigured to work with the PostgreSQL database distributed with the appliance. The default Orchestrator Appliance database configuration is production ready. However, to use Orchestrator in a high-load production environment, you must set up a separate database and configure Orchestrator to work with it from Control Center.

Orchestrator server supports Oracle, Microsoft SQL Server, and PostgreSQL databases.

The common workflow for setting up the Orchestrator database consists of the following steps:

1 Create a database. For more information about creating a database, see the documentation of your database provider.

2 Enable remote connection for the database.

3 Configure the database connection parameters. For more information, see "Configuring the Orchestrator Database Connection," on page 36.

If you plan to set up an Orchestrator cluster, you must configure the database to accept multiple connections so that it can accept connections from the different Orchestrator server instances in the cluster.

The database setup can affect Orchestrator performance. Install the database on a machine other than the one on which the Orchestrator server is installed. This approach ensures that the JVM and database server do not share CPU, RAM, and I/O.

The location of the database is important because almost every activity on the Orchestrator server triggers operations on the database. To avoid latency in the database connection, connect to the database server that is geographically closest to your Orchestrator server and that is on the network with the highest available bandwidth.

The size of the Orchestrator database varies depending on the setup and how workflow tokens are handled. Allocate approximately 50 KB for each vCenter Server object and 4 KB for each workflow run.

Caution Verify that at least 1 GB of disk space is available on the machine where the Orchestrator database is installed.

Insufficient hard disk space might cause the Orchestrator server and client not to function correctly.

Installing and Upgrading Orchestrator

4

Orchestrator consists of a server component and a client component.

The Orchestrator installable client can run on 64-bit Windows, Linux, and Mac machines.

To use Orchestrator, you must start the Orchestrator Server service and then start the Orchestrator client.

You can change the default Orchestrator configuration settings by using the Orchestrator Control Center.

This chapter includes the following topics:

Download and Deploy the Orchestrator Appliance

Download and install an Orchestrator Appliance by deploying it from a template.

Prerequisites

- Verify that vCenter Server is installed and running.
- Verify that the host on which you are deploying the appliance meets the minimum hardware requirements. For more information, see "Hardware Requirements for the Orchestrator Appliance," on page 13.
- If your system is isolated and without Internet access, you must download the `.ova` file for the appliance from the VMware Web site.

Procedure

1 Log in to the vSphere Web Client as an administrator.

2 In the vSphere Web Client, select an inventory object that is a valid parent object of a virtual machine, such as a data center, folder, cluster, resource pool, or host.

3 Select **Actions > Deploy OVF Template**.

4 Enter the path or the URL to the `.ova` file and click **Next**.

5 Review the OVF template details and click **Next**.

6 Accept the terms in the license agreement and click **Next**.

7 Enter a name and location for the deployed appliance, and click **Next**.

8 Select a host, cluster, resource pool, or vApp as a destination on which you want the appliance to run, and click **Next**.

9 Select a format in which you want to save the virtual disk and the storage of the appliance.

Format	Description
Thick Provisioned Lazy Zeroed	Creates a virtual disk in a default thick format. The space required for the virtual disk is allocated when the virtual disk is created. If any data remains on the physical device, it is not erased during creation, but is zeroed out on demand later on first write from the virtual machine.
Thick Provisioned Eager Zeroed	Supports clustering features such as Fault Tolerance. The space required for the virtual disk is allocated when the virtual disk is created. If any data remains on the physical device, it is zeroed out when the virtual disk is created. It might take much longer to create disks in this format than to create disks in other formats.
Thin Provisioned Format	Saves hard disk space. For the thin disk, you provision as much datastore space as the disk requires based on the value that you select for the disk size. The thin disk starts small and, at first, uses only as much datastore space as the disk needs for its initial operations.

10 Select the options that you want to enable and set the initial password for the root user account.

Your initial password must be at least eight characters long.

Important The password for the root account of the Orchestrator Appliance expires after 365 days. You can increase the expiry time for an account by logging in to the Orchestrator Appliance as root, and running `passwd –x number_of_days name_of_account`. If you want to increase the Orchestrator Appliance root password to infinity, run `passwd –x 99999 root`.

11 (Optional) Configure the network settings, and click **Next**.

By default, the Orchestrator Appliance uses DHCP. You can change this setting and assign a fixed IP address from the appliance Web console.

12 Review the Ready to Complete page and click **Finish**.

The Orchestrator Appliance is successfully deployed.

Power On the Orchestrator Appliance and Open the Home Page

To use the Orchestrator Appliance, you must first power it on and get an IP address for the virtual appliance.

Procedure

1 Log in to the vSphere Web Client as an administrator.

2 Right-click the Orchestrator Appliance and select **Power > Power On**.

3 On the **Summary** tab, view the Orchestrator Appliance IP address.

4 In a Web browser, go to the IP address of your Orchestrator Appliance virtual machine.

http://*orchestrator_appliance_ip*

Change the Root Password

For security reasons, you can change the root password of the Orchestrator Appliance.

Important The password for the root account of the Orchestrator Appliance expires after 365 days. You can increase the expiry time for an account by logging in to the Orchestrator Appliance as root, and running `passwd –x number_of_days name_of_account`. If you want to increase the Orchestrator Appliance root password to infinity, run the `passwd –x 99999 root` command.

Prerequisites

- Download and deploy the Orchestrator Appliance.
- Verify that the appliance is up and running.

Procedure

1. In a Web browser, go to https://*orchestrator_appliance_ip*:5480.
2. Type the appliance user name and password.
3. Click the **Admin** tab.
4. In the **Current administrator password** text box, type the current root password.
5. Type the new password in the **New administrator password** and **Retype new administrator password** text boxes.
6. Click **Change password**.

You successfully changed the password of the root Linux user of the Orchestrator Appliance.

Enable or Disable SSH Administrator Login on the vRealize Orchestrator Appliance

You can enable or disable the ability to log in as root to the Orchestrator Appliance using SSH.

Prerequisites

- Download and deploy the Orchestrator Appliance.
- Verify that the appliance is up and running.

Procedure

1. In a Web browser, go to https://*orchestrator_appliance_ip*:5480.
2. Log in as root.
3. On the **Admin** tab, select **SSH service enabled** to enable the Orchestrator SSH service.
4. (Optional) Click **Administrator SSH login enabled** to allow log in as root to the Orchestrator Appliance using SSH.
5. Click **Save Settings**.

SSH Status appears as *Running*.

Configure Network Settings for the Orchestrator Appliance

Configure network settings for the Orchestrator Appliance to assign a static IP address and define the proxy settings.

Prerequisites

- Download and deploy the Orchestrator Appliance.
- Verify that the appliance is up and running.

Procedure

1 In a Web browser, go to https://*orchestrator_appliance_ip*:5480.

2 Log in as root.

3 On the **Network** tab, click **Address**.

4 Select the method by which the appliance obtains IP address settings.

Option	Description
DHCP	Obtains IP settings from a DHCP server. This is the default setting.
Static	Uses static IP settings. Type the IP address, netmask, and gateway.

Depending on your network settings, you might have to select IPv4 and IPv6 address types.

5 (Optional) Type the necessary network configuration information.

6 Click **Save Settings**.

7 (Optional) Set the proxy settings and click **Save Settings**.

Upgrade Orchestrator Appliance 5.5.x and Later to 7.x

vRealize Orchestrator 7.x supports in-place upgrade from version 5.5.x and 6.0.x.

You can upgrade your existing Orchestrator Appliance through the virtual appliance management interface (VAMI).

Upgrade Orchestrator Appliance by Using the Default VMware Repository

You can configure Orchestrator to download the upgrade package from the default VMWare repository.

Prerequisites

- Unmount all network file systems. For more information, see the *vSphere Virtual Machine Administration* documentation.
- Increase the memory of the Orchestrator Appliance to at least 6 GB. For more information, see the *vSphere Virtual Machine Administration* documentation.
- Take a snapshot of the Orchestrator virtual machine. For more information, see the *vSphere Virtual Machine Administration* documentation.
- If you use an external database, back up the database.
- If you use the preconfigured in Orchestrator PostgreSQL database, back up the database by using the **Export Database** menu in Control Center.

Procedure

1 Go to the VAMI at https://*orchestrator_server*:5480 and log in as **`root`**.

2 On the **Update** tab, click **Settings**.

The radio button next to the **Use Default Repository** option is selected.

3 On the **Status** page, click **Check Updates**.

The system checks for available updates.

4 If any updates are available, click **Install Updates**.

5 Accept the VMware End-User License Agreement to proceed with the upgrade.

6 To complete the update, restart the Orchestrator Appliance.

7 (Optional) On the **Update** tab, verify that the latest version of the Orchestrator Appliance is successfully installed.

You have successfully upgraded the Orchestrator Appliance.

What to do next

Verify that Orchestrator is configured properly at the **Validate Configuration** page in Control Center.

Upgrade Orchestrator Appliance by Using an ISO Image

You can configure Orchestrator to download the upgrade package from an ISO image file mounted to the CD-ROM drive of the appliance.

Prerequisites

- Unmount all network file systems. For more information, see the *vSphere Virtual Machine Administration* documentation.
- Increase the memory of the Orchestrator Appliance to at least 6 GB. For more information, see the *vSphere Virtual Machine Administration* documentation.
- Take a snapshot of the Orchestrator virtual machine. For more information, see the *vSphere Virtual Machine Administration* documentation.
- If you use an external database, back up the database.
- If you use the preconfigured in Orchestrator PostgreSQL database, back up the database by using the **Export Database** menu in Control Center.

Procedure

1 Download the `VMware vRealize Orchestrator Appliance` *`version`* `.iso Update Repository Archive` from the official VMware download site.

2 Connect the CD-ROM drive of the Orchestrator Appliance virtual machine. For more information, see the *vSphere Virtual Machine Administration* documentation.

3 Mount the ISO image file to the CD-ROM drive of the appliance. For more information, see the *vSphere Virtual Machine Administration* documentation.

4 Go to the VAMI at https://*orchestrator_server*:5480 and log in as **`root`**.

5 On the **Update** tab, click **Settings**.

6 Select the radio button next to the **Use CD-ROM updates** option.

7 Return to the **Status** page.

The version of the available upgrade is displayed.

8 Click **Install Updates**.

9 Accept the VMware End-User License Agreement to proceed with the upgrade.

10 To complete the update, restart the Orchestrator Appliance.

11 (Optional) On the **Update** tab, verify that the latest version of the Orchestrator Appliance is successfully installed.

You have successfully upgraded the Orchestrator Appliance.

What to do next

Verify that Orchestrator is configured properly at the **Validate Configuration** page in Control Center.

Upgrade Orchestrator Appliance by Using a Specified Repository

You can configure Orchestrator to use a local repository, on which you have uploaded the upgrade archive.

Prerequisites

- Unmount all network file systems. For more information, see the *vSphere Virtual Machine Administration* documentation.
- Increase the memory of the Orchestrator Appliance to at least 6 GB. For more information, see the *vSphere Virtual Machine Administration* documentation.
- Take a snapshot of the Orchestrator virtual machine. For more information, see the *vSphere Virtual Machine Administration* documentation.
- If you use an external database, back up the database.
- If you use the preconfigured in Orchestrator PostgreSQL database, back up the database by using the **Export Database** menu in Control Center.

Procedure

1 Prepare the local repository for upgrades.

   a Install and configure a local Web server.

   b Download the `VMware-vRO-Appliance-`*`version-build_number`*`-updaterepo.zip` from the official VMware download site.

   c Extract the `.ZIP` archive to the local repository.

2 Go to the VAMI at https://*orchestrator_server*:5480 and log in as **`root`**.

3 On the **Update** tab, click **Settings**.

4 Select the radio button next to the **Use Specified Repository** option.

5 Enter the URL address of the local repository by pointing to the `Update_Repo` directory.

   `http://`*`local_web_server`*`:`*`port`*`/build/mts/release/bora-`*`build_number`*`/publish/exports/Update_Repo`

6 If the local repository requires authentication, enter user name and password.

7 Click **Save Settings**.

8 On the **Status** page, click **Check Updates**.

   The system checks for available updates.

9 If any updates are available, click **Install Updates**.

10 Accept the VMware End-User License Agreement to proceed with the upgrade.

11 To complete the update, restart the Orchestrator Appliance.

12 (Optional) On the **Update** tab, verify that the latest version of the Orchestrator Appliance is successfully installed.

You have successfully upgraded the Orchestrator Appliance.

What to do next

Verify that Orchestrator is configured properly at the **Validate Configuration** page in Control Center.

Upgrade an Orchestrator Cluster 5.5.x and Later to 7.x

You can upgrade an Orchestrator cluster to version 7.x by upgrading a single instance and joining nodes that are freshly installed on version 7.x.

Prerequisites

- Take a snapshot of all vRealize Orchestrator server nodes.
- Back up the Orchestrator shared database.

Procedure

1 Stop the Orchestrator services `vco-server`, `vco-configurator`, and `vco-proxy` on all cluster nodes.

2 Upgrade only one of the Orchestrator server instances in your cluster.

See "Upgrade Orchestrator Appliance by Using the Default VMware Repository," on page 22.

3 Start the configuration service of the Orchestrator server that you upgraded and log in to Control Center as **`root`**.

4 Go to the **Validate Configuration** page to check the state of the system components.

5 Deploy a new Orchestrator appliance on the upgraded version.

6 Configure the new node with the network settings of an existing instance.

7 From the **Orchestrator Cluster Management** page in Control Center, join the new node to the upgraded node of your cluster.

8 Restart the Orchestrator servers from the **Startup Options** page in Control Center to match the configuration fingerprints between the nodes.

9 Verify that the vRealize Orchestrator cluster is configured properly by opening the **Validate Configuration** page in Control Center.

10 (Optional) Repeat Step 5 to Step 9 for each node in the cluster.

You have successfully upgraded the Orchestrator cluster.

Upgrade an Orchestrator Cluster 7.0 to 7.1

In the cluster, multiple Orchestrator server instances work together. If you have already set up a cluster of Orchestrator server instances, you can upgrade the cluster to the latest Orchestrator version by upgrading its nodes.

Procedure

1 Stop the Orchestrator services `vco-server`, `vco-configurator`, and `vco-proxy` on all cluster nodes.

2 Upgrade one of the Orchestrator server instances in the cluster.

See "Upgrade Orchestrator Appliance by Using the Default VMware Repository," on page 22.

3 Start the configuration service of the Orchestrator server that you upgraded and log in to Control Center as **root**.

4 Go to the **Validate Configuration** page and check the state of the system components.

5 Upgrade all other Orchestrator server instances in the cluster.

6 Restart the Orchestrator servers from the **Startup Options** page in Control Center to match the configuration fingerprints between the nodes.

7 Verify that the vRealize Orchestrator cluster is configured properly by opening the **Validate Configuration** page in Control Center.

You have successfully upgraded the Orchestrator cluster.

Configuring vRealize Orchestrator in the Orchestrator Appliance 5

Although the Orchestrator Appliance is a preconfigured Linux-based virtual machine, you must configure the default vCenter Server plug-in and the other default Orchestrator plug-ins. You might also want to change the Orchestrator settings.

If you want to use the Orchestrator Appliance in a medium or large-scale environment, change the authentication provider to ensure optimal performance.

Note LDAP authentication is deprecated and will not be supported in future versions.

The Orchestrator Appliance contains a preconfigured PostgreSQL database and an in-process ApacheDS LDAP server. The PostgreSQL database and ApacheDS LDAP server are accessible only locally from the virtual appliance Linux console.

Preconfigured Software	Default User Group Or User	Password
Embedded PostgreSQL	User: vmware	vmware
In-Process ApacheDS LDAP	User group: vcoadmins User: vcoadmin By default, the admin user is set up as an Orchestrator administrator.	vcoadmin
In-Process ApacheDS LDAP	User group: vcousers User: vcouser	vcouser

The preconfigured PostgreSQL database is production ready. To use the Orchestrator appliance in a high-load production environment, replace the preconfigured PostgreSQL with an external database instance. For more information about setting up an external database, see "Configuring the Orchestrator Database Connection," on page 36.

In-Process ApacheDS LDAP is suitable for testing purposes only. To use the Orchestrator appliance in a production environment, configure a directory service with external support or use vRealize Automation, vSphere, and vCenter Single Sign-On authentication. For information about setting up an external directory service or vRealize Automation, vSphere, and vCenter Single Sign-On authentication providers, see "Selecting the Authentication Type," on page 29.

This chapter includes the following topics:

- "Configure the Orchestrator Plug-Ins," on page 40
- "Start the Orchestrator Server," on page 44
- "Orchestrator Availability and Scalability," on page 44
- "Configuring the Customer Experience Improvement Program," on page 48

Log In to Control Center

To start the configuration process, you must access the Control Center.

Procedure

1 Access Control Center by going to https://*your_orchestrator_server_IP_or_DNS_name*:8281 in a Web browser and clicking **Orchestrator Control Center** or navigating directly to https://*your_orchestrator_server_IP_or_DNS_name*:8283/vco-controlcenter.

2 Log in with the default user name and the password that you initially set up.

- User name: **`root`**

  You cannot change the default user name.

- Password: *your_password*

Important The password for the root account of the Orchestrator Appliance expires after 365 days. You can increase the expiry time for an account by logging in to the Orchestrator Appliance as root, and running `passwd -x number_of_days name_of_account`. If you want to increase the Orchestrator Appliance root password to infinity, run `passwd -x 99999 root`.

You successfully logged in to Control Center.

Orchestrator Network Ports

Orchestrator uses specific ports to communicate with the other systems. The ports are set with a default value that cannot be changed.

Default Configuration Ports

To provide the Orchestrator service, you must set default ports and configure your firewall to allow incoming TCP connections.

Note Other ports might be required if you are using custom plug-ins.

Table 5-1. VMware vRealize Orchestrator Default Configuration Ports

Port	Number	Protocol	Source	Target	Description
HTTP server port	8280	TCP	End-user Web browser	Orchestrator server	The requests sent to Orchestrator default HTTP Web port 8280 are redirected to the default HTTPS Web port 8281.
HTTPS server port	8281	TCP	End-user Web browser	Orchestrator server	The access port for the Web Orchestrator home page.
Web configuration HTTPS access port	8283	TCP	End-user Web browser	Orchestrator configuration	The SSL access port for the Web UI of Orchestrator configuration.

External Communication Ports

You must configure your firewall to allow outgoing connections so that Orchestrator can communicate with external services.

Table 5-2. VMware vRealize Orchestrator External Communication Ports

Port	Number	Protocol	Source	Target	Description
LDAP	389	TCP	Orchestrator server	LDAP server	The lookup port of your LDAP Authentication server. **Note** LDAP authentication is deprecated and will not be supported in future versions.
LDAP using SSL	636	TCP	Orchestrator server	LDAP server	The lookup port of your secure LDAP Authentication server.
LDAP using Global Catalog	3268	TCP	Orchestrator server	Global Catalog server	The port to which Microsoft Global Catalog server queries are directed.
vCenter Single Sign-On server	7444	TCP	Orchestrator server	vCenter Single Sign-On server	The port used to communicate with the vCenter Single Sign-On server when you configure the **vCenter Single Sign-On authentication (legacy)** with vCenter Single Sign-On 5.5.
SQL Server	1433	TCP	Orchestrator server	Microsoft SQL Server	The port used to communicate with the Microsoft SQL Server instances that are configured as the Orchestrator database.
PostgreSQL	5432	TCP	Orchestrator server	PostgreSQL Server	The port used to communicate with the PostgreSQL Server that is configured as the Orchestrator database.
Oracle	1521	TCP	Orchestrator server	Oracle DB Server	The port used to communicate with the Oracle Database Server that is configured as the Orchestrator database.
SMTP Server port	25	TCP	Orchestrator server	SMTP Server	The port used for email notifications.
vCenter Server API port	443	TCP	Orchestrator server	vCenter Server	The vCenter Server API communication port used by Orchestrator to obtain virtual infrastructure and virtual machine information from the orchestrated vCenter Server instances.

Selecting the Authentication Type

To work properly and manage user permissions, Orchestrator requires a method of authentication.

Orchestrator supports the following types of authentication.

LDAP authentication — Orchestrator connects to a working LDAP server.

Note LDAP authentication is deprecated and will not be supported in future versions.

vRealize Automation authentication — Orchestrator is authenticated through the vRealize Automation component registry.

vSphere authentication — Orchestrator is authenticated through Platform Services Controller.

vCenter Single Sign-On authentication (legacy) — Orchestrator uses vCenter Single Sign-On Server 5.5 as an authentication provider.

When you download, and deploy the Orchestrator Appliance, the Orchestrator server is preconfigured to work with the in-process ApacheDS LDAP directory service that is embedded in the appliance.

Important If you want to use Orchestrator through the vSphere Web Client for managing vSphere inventory objects, you must configure Orchestrator to work with the same Platform Service Controller to which both vCenter Server and vSphere Web Client are connected.

Configuring LDAP Settings

You can configure Orchestrator to connect to a working LDAP server on your infrastructure to authenticate users and to manage user permissions.

Note LDAP authentication is deprecated and will not be supported in future versions.

If you are using secure LDAP over SSL, Windows Server 2008 or 2012, and AD, verify that the **LDAP Server Signing Requirements** group policy is disabled on the LDAP server.

Important Multiple domains that are not in the same tree, but have a two-way trust, are not supported and do not work with Orchestrator. The only configuration supported for multi-domain Active Directory is domain tree. Forest and external trusts are not supported.

1 Import the LDAP Server SSL Certificate on page 30

If your LDAP server uses SSL, you can import the SSL certificate file to Control Center and enable secure connection between Orchestrator and LDAP.

2 Configure the LDAP Authentication on page 31

To connect Orchestrator to a directory server instance, you must provide the host, port, and search base of the LDAP server to generate the connection URL. You must also provide the user credentials and the user and group lookup paths so that the LDAP users can authenticate against the Orchestrator client.

3 Common Active Directory LDAP Errors on page 33

When you encounter the `LDAP:error code 49` error message and experience problems connecting to your LDAP authentication server, you can check which LDAP function is causing the problem.

Import the LDAP Server SSL Certificate

If your LDAP server uses SSL, you can import the SSL certificate file to Control Center and enable secure connection between Orchestrator and LDAP.

You can import the LDAP SSL certificate from the **Certificates** page in Control Center.

Prerequisites

- If you are using LDAP servers, Windows Server 2008, Windows Server 2012, and Active Directory, verify that the **LDAP Server Signing Requirements** group policy is disabled on the LDAP server.
- Obtain a self-signed server certificate or a certificate that is signed by a Certificate Authority.
- Configure your LDAP server for SSL access. See the documentation of your LDAP server for instructions.
- Explicitly specify the trusted certificate to perform the SSL authorization correctly.

Procedure

1 Log in to Control Center as **`root`**.

2 Click **Certificates**.

3 On the **Trusted Certificates** tab, click **Import**.

4 Load the LDAP SSL certificate from a URL or a file.

Option	Action
Import from URL or proxy URL	Type the URL of the LDAP server: **`https://your_LDAP_server_IP_address`** or ***`your_LDAP_server_IP_address:port`***
Import from file	Obtain the LDAP SSL certificate file and browse to import it.

5 Click **Import**.

A message confirming that the import is successful appears.

The imported certificate appears in the Trusted SSL certificates list. The secure connection between Orchestrator and your LDAP server is activated.

What to do next

When you generate the LDAP connection URL, you should enable SSL on the **Configure Authentication Provider** page in Control Center.

Configure the LDAP Authentication

To connect Orchestrator to a directory server instance, you must provide the host, port, and search base of the LDAP server to generate the connection URL. You must also provide the user credentials and the user and group lookup paths so that the LDAP users can authenticate against the Orchestrator client.

The supported directory service types are Active Directory over LDAP and directory services based on OpenLDAP.

Note If you change the LDAP server or the directory service type after you assign access permissions on workflows or actions to Orchestrator objects, you must reset these permissions.

If you change the LDAP settings after you configure custom applications that collect and store user information, the LDAP authentication records become invalid when used on the new LDAP database.

Prerequisites

Use the detailed settings information to configure the LDAP authentication. See "LDAP Authentication Settings," on page 32.

Procedure

1 Log in to Control Center as **`root`**.

2 Click **Configure Authentication Provider**.

3 Select **LDAP Authentication** from the **Authentication mode** drop-down menu.

4 From the **LDAP client** drop-down menu, select the type of directory server that you want to use.

5 Configure the LDAP server in your environment.

6 Click **Save Changes**.

7 Enter credentials for an LDAP user on the **Test Login** to test whether this user can access the Orchestrator client.

After a successful login, the system checks if the user is part of the Orchestrator Administrator group.

What to do next

Configure the database. For more information, see "Configuring the Orchestrator Database Connection," on page 36.

LDAP Authentication Settings

For a successful connection between Orchestrator and the directory server, you must configure the LDAP authentication settings to match the specific LDAP server settings.

Table 5-3. LDAP Authentication Options

Options	Descriptions
Primary LDAP host	The IP address or the DNS name of the first host on which Control Center verifies user credentials.
Secondary LDAP host	The IP address or the DNS name of the host on which Control Center verifies user credentials, if the primary LDAP host becomes unavailable.
Port	The value of the lookup port of your LDAP server. **Note** Orchestrator supports the Active Directory hierarchical domain structure. If your domain controller is configured to use Global Catalog, you must use port 3268. You cannot use the default port 389 to connect to the Global Catalog server.
Root	The root namespace container. If your domain name is *company.org*, your root container is **`dc=company,dc=org`**. **Note** To improve the performance in large service directories, you can narrow the search base by defining a specific container in the tree structure. For example, rather than searching in the entire directory, you can specify **`ou=employees,dc=company,dc=org`**. This search filter returns all the users in the Employees organizational unit. The values that you enter in the required text boxes generate the following LDAP connection URL: `ldap://DomainController:389/ou=employees,dc=company,dc=org`.
Use SSL	If this option is enabled, the connection between Orchestrator and LDAP is encrypted. **Note** If your LDAP uses SSL, you must first import the SSL certificate and restart the Orchestrator server service. See "Import the LDAP Server SSL Certificate," on page 30.
User name	The name of a user account that has permissions to browse the directory tree. You can specify the user name in Active Directory in one of the following formats: ■ Bare user name, for example:**`user`** ■ Distinguished name, for example: **`cn=user,ou=employees,dc=company,dc=org`** ■ Principal name, for example: **`user@company.org`**
Password	The password for the user account that has permissions to browse the directory tree.
User lookup base	An LDAP container or organizational unit where Orchestrator searches for potential users.
Admin group	The Admin group must be an LDAP group to which you grant administrative privileges for Orchestrator. For example, **`Domain Admins`**.

Table 5-3. LDAP Authentication Options (Continued)

Options	Descriptions
Request timeout	A value in milliseconds that determines the period in which the Orchestrator server sends a query to the service directory and expects a reply. If the timeout period elapses, modify this value to check whether the timeout occurs in the Orchestrator server.
Host reachable timeout	A value in milliseconds that determines the timeout period for the connectivity check to the destination host.
Dereference links	When this option is selected, the LDAP server resolves user aliases to the searched user object.
Filter attributes	Filters the LDAP attributes that the LDAP lookup returns. Selecting this check box makes searching in LDAP faster by not returning certain attributes. However, you might need to use some extra LDAP attributes for automation later.

Common Active Directory LDAP Errors

When you encounter the `LDAP:error code 49` error message and experience problems connecting to your LDAP authentication server, you can check which LDAP function is causing the problem.

Table 5-4. Common Active Directory Authentication Errors

Error	Description
525	The user is not found.
52e	The user credentials are not valid.
530	The user is not allowed to log in at this time.
531	The user is not allowed to log in to this workstation.
532	The password has expired.
533	This user account has been disabled.
701	This user account has expired.
773	The user must reset their password.
775	The user account has been locked.

Configuring vRealize Automation Authentication

You can configure Orchestrator to authenticate through the vRealize Automation component registry.

Prerequisites

Install and configure vRealize Automation and verify that your vRealize Automation server is running.

Procedure

1 Log in to Control Center as **`root`**.

2 Click **Configure Authentication Provider**.

3 Select **vRealize Automation** from the **Authentication mode** drop-down menu.

4 In the **Host address** text box, enter your vRealize Automation host address and click **Connect**.

5 Click **Accept Certificate**.

6 In the **User name** and **Password** text boxes, enter the credentials of the vRealize automation administrator account.

   The account is temporarily used only for registering or removing Orchestrator as a solution.

7 (Optional) Select the **Configure licenses** check box.

8 Click **Register**.

9 In the **Default tenant** text box, enter the default domain to authenticate a user who logs in without a domain name. The default value is **`vsphere.local`**.

10 In the **Admin group** text box, enter an administrators group and click **Search**.

11 Select an administrators group.

12 Click **Save Changes**.

   A message indicates that you saved successfully.

What to do next

For the changes to take effect, restart the Orchestrator server from the Startup Options page in Control Center.

Configuring vCenter Single Sign-On Settings

VMware vCenter Single Sign-On is an authentication service that implements the brokered authentication architectural pattern. You can configure Orchestrator to connect to a vCenter Single Sign-On instance, running a Platform Services Controller server.

The vCenter Single Sign-On server provides an authentication interface called Security Token Service (STS). Clients send authentication messages to the STS, which checks the user's credentials against one of the identity sources. Upon successful authentication, STS generates a token.

The Platform Services Controller contains the vCenter Single Sign-On administrative interface, which part of the vSphere Web Client. To configure vCenter Single Sign-On and manage vCenter Single Sign-On users and groups, you log in to the vSphere Web Client as a user with vCenter Single Sign-On administrator privileges. This might not be the same user as the vCenter Server administrator. You must provide the credentials on the vSphere Web Client login page, and upon authentication, you can access the vCenter Single Sign-On administration tool to create users and assign administrative permissions to other users.

Using the vSphere Web Client, you authenticate to vCenter Single Sign-On by providing your credentials on the vSphere Web Client login page. You can then view all of the vCenter Server instances for which you have permissions. After you connect to vCenter Server, no further authentication is required. The actions that you can perform on objects depend on the user's vCenter Server permissions on those objects.

For more information about Platform Services Controller, see *vSphere Security*.

After you configure Orchestrator to authenticate through vCenter Single Sign-On, make sure that you configure it to work with the vCenter Server instances registered with the vSphere Web Client using the same vCenter Single Sign-On instance.

When you log in to the vSphere Web Client, the Orchestrator Web plug-in communicates with the Orchestrator server on behalf of the user profile you used to log in.

Configure Authentication Through vSphere Platform Services Controller

You register the Orchestrator server with a vCenter Single Sign-On server by using the vSphere authentication mode in Control Center. Use vCenter Single Sign-On authentication with vCenter Server 6.0 and later.

Prerequisites

Install and configure VMware vCenter Single Sign-On and verify that your vCenter Single Sign-On server is running.

Important Ensure that the clocks of the Orchestrator server and the vCenter Server Appliance are synchronized. Otherwise you might receive cryptic vCenter Single Sign-On errors.

Procedure

1 Log in to Control Center as **root**.

2 Click **Configure Authentication Provider**.

3 Select **vSphere** from the **Authentication mode** drop-down menu.

4 In the **Host address** text box, enter your Platform Services Controller host address and click **Connect**.

5 Click **Accept Certificate**.

6 In the **User name** and **Password** text boxes, enter the credentials of the vCenter Single Sign-On administrator account.

The account is temporarily used only for registering or removing Orchestrator as a solution.

7 (Optional) Select the **Configure licenses** check box.

8 Click **Register**.

9 In the **Default tenant** text box, enter the default domain to authenticate a user who logs in without a domain name. The default value is **vsphere.local**.

10 Click **Save Changes**.

A message indicates that you saved successfully.

You successfully registered Orchestrator with vCenter Single Sign-On.

Register Orchestrator as a vCenter Single Sign-On (Legacy) Solution

You can register the Orchestrator server with a vCenter Single Sign-On server by using the Single Sign-On legacy authentication mode in Control Center. Use Single Sign-On legacy authentication only with vCenter Server version 5.5 and its respective update releases starting with Update 2.

Prerequisites

Install and configure VMware vCenter Single Sign-On and verify that your vCenter Single Sign-On server is running.

Important Ensure that the clocks of the Orchestrator server and the vCenter Server Appliance are synchronized. Otherwise you might receive cryptic vCenter Single Sign-On errors.

Procedure

1 Log in to Control Center as **root**.

2 Click **Configure Authentication Provider**.

3 Select **SSO (legacy)** from the **Authentication mode** drop-down menu.

4 In the **Admin URL** text box, enter the URL for the vCenter Single Sign-On administration service interface.

`https://your_vcenter_single_sign_on_server:7444/sso-adminserver/sdk/vsphere.local`

5 In the **STS URL** text box, enter the URL for the vCenter Single Sign-On token service interface.

`https://your_vcenter_single_sign_on_server:7444/sts/STSService/vsphere.local`

6 Click **Connect**.

7 Click **Accept Certificate**.

8 In the **User name** and **Password** text boxes, enter the credentials of the vCenter Single Sign-On administrator.

The account is temporarily used only for registering or removing Orchestrator as a solution.

9 Click **Register**.

You successfully registered Orchestrator with vCenter Single Sign-On.

Configuring the Orchestrator Database Connection

The Orchestrator server requires a database for storing data.

When you download, and deploy the Orchestrator Appliance, the Orchestrator server is configured to work with the PostgreSQL database preinstalled in the appliance.

The preconfigured Orchestrator PostgreSQL database is production ready. For better performance in a high-load production environment, install a separate relational database management system (RDBMS) and create a database for Orchestrator. For more information about creating a database for Orchestrator, see "Setting Up the Orchestrator Database," on page 18. To use the external database with Orchestrator, configure the database for remote connection.

Import the Database SSL Certificate

If your database uses SSL, you must import the SSL certificate to Control Center and establish a secure connection between Orchestrator and the database.

Prerequisites

- Configure your database for SSL access. See your database documentation for instructions.
- Obtain a self-signed server certificate or a certificate that is signed by a Certificate Authority.
- Explicitly specify the trusted certificate to perform the SSL authorization correctly.

Procedure

1 Log in to Control Center as **root**.

2 Click **Certificates**.

3 On the **Trusted Certificates** tab, click **Import**.

4 Load the database SSL certificate from a URL or a file.

Option	Action
Import from URL or proxy URL	Enter the URL of the database server: **`https://your_database_server_IP_address`** or ***`your_database_server_IP_address:port`***
Import from file	Obtain the database SSL certificate file and browse to import it.

The imported certificate appears in the Trusted SSL certificates list. The secure connection between Orchestrator and your database is activated.

What to do next

When you configure the database connection, you must enable SSL on the **Configure Database** page in Control Center.

Configure the Database Connection

To establish a connection to the Orchestrator database, you must set the database connection parameters.

Prerequisites

- Set up a new database to use with the Orchestrator server. See "Setting Up the Orchestrator Database," on page 18.
- If you use an SQL Server database configured to use dynamic ports, verify that the SQL Server Browser service is running.
- To prevent transactional deadlocks when using Microsoft SQL Server database, you must enable the `ALLOW_SNAPSHOT_ISOLATION` and `READ_COMMITTED_SNAPSHOT` database options.
- If your Microsoft SQL Server database uses dynamic ports, ensure that the SQL Server Browser is running.
- To avoid an `ORA-01450` error when using the Oracle database, verify that you have configured the size of the database block properly. The minimum required size depends on the size of the block your Oracle database index is using.
- To store characters in the correct format in an Oracle database, set the `NLS_CHARACTER_SET` parameter to `AL32UTF8` before configuring the database connection and building the table structure for Orchestrator. This setting is crucial for an internationalized environment.
- To configure Orchestrator to communicate with the database over a secure connection, make sure that you import the database SSL certificate. For more information, see "Import the Database SSL Certificate," on page 36.

Procedure

1 Log in to Control Center as **`root`**.

2 Click **Configure Database**.

3 From the **Database type** drop-down menu, select the type of database that you want Orchestrator server to use.

Option	Description
Oracle	Configures Orchestrator to work with an Oracle database instance.
SQL Server	Configures Orchestrator to work with a Microsoft SQL Server database instance.

Option	Description
PostgreSQL	Configures Orchestrator to work with a PostgreSQL database instance.
In-Process DerbyDB	Configures Orchestrator to work with the in-process DerbyDB database. **Note** You must not use DerbyDB for production environments.

4 Enter the database connection parameters and click **Save changes**.

Option	Description
Server address	The database server IP address or DNS name. This option is applicable for all databases.
Port	The database server port is used for communication with your database. This option is applicable for all databases.
Use SSL	Select **Use SSL** to use an SSL connection to the database. To use this option, you must make sure that you import the database SSL certificate into Orchestrator. This option is applicable for all databases.
Database name	The full unique name of your database. The database name is specified in the `SERVICE_NAMES` parameter in the initialization parameter file. This option is valid only for SQL Server, and PostgreSQL databases.
User name	The user name that Orchestrator uses to connect to and operate the selected database. The name you select must be a valid user on the target database with **db_owner** rights. This option is applicable for all databases.
Password	The password for the user name. This option is applicable for all databases.
Instance name (if any)	The name of the database instance that can be identified by the `INSTANCE_NAME` parameter in the database initialization parameter file. This option is valid only for SQL Server and Oracle databases.
Domain	To use Windows authentication, enter the domain name of the SQL Server machine, for example *company.org*. To use SQL authentication, leave this text box blank. This option is valid only for SQL Server and specifies whether you want to use Windows or SQL Server authentication.
Use Windows authentication mode (NTLMv2)	Select to send NTLMv2 responses when using Windows authentication. This option is valid only for SQL Server.

If the specified parameters are correct, a message states that the connection to the database is successful.

5 Update the table structure for Orchestrator, if required.

6 Click **Save changes**.

The database connection is successfully configured.

Export the Orchestrator Database

Create an archive with a full backup of the server database. The database can only be exported if it is PostgreSQL and running on Linux.

Procedure

1 Log in to Control Center as **`root`**.

2 Click **Export Database**.

3 Select whether to export workflow tokens and log events with the database.

4 Click **Export Database**

Control Center creates a `vco-db-dump-databaseName@hostname.gz` file on the machine that you installed the Orchestrator server on. You can use this file to clone and to restore the system.

Import an Orchestrator Database

You can import a previously exported database after you reinstall Orchestrator or if a system failure occurs.

Prerequisites

The new Orchestrator database must be empty.

Procedure

1 Log in to Control Center as **root**.

2 Click **Import Database**.

3 Browse to and select the `.gz` file that you exported from your previous installation.

4 Click **Import Database**

A message states that the database is successfully imported. The new system acquires the database of the old system.

Manage Certificates

Issued for a particular server and containing information about the server public key, the certificate allows you to sign all elements created in Orchestrator and guarantee authenticity. When the client receives an element from your server, typically a package, the client verifies your identity and decides whether to trust your signature.

Important You cannot change the server certificate if Orchestrator uses the in-process Apache Derby database.

Manage Orchestrator Certificates

You can manage the Orchestrator certificates from the **Certificates** page in Control Center or through the Orchestrator client, by using the SSL Trust Manager workflows in the Configuration workflow category.

Import a Certificate to the Orchestrator Trust Store

Control Center uses a secure connection to communicate with vCenter Server, relational database management system (RDBMS), LDAP, Single Sign-On, and other servers. You can import the required SSL certificate from a URL or a PEM-encoded file. Each time you want to use an SSL connection to a server instance, you must import the corresponding certificate from the **Trusted Certificates** tab on the **Certificates** page and import the corresponding SSL certificate.

You can load the SSL certificate in Orchestrator from a URL address or a PEM-encoded file.

Option	Description
Import from URL or proxy URL	The URL of the remote server: **`https://your_server_IP_address`** or ***`your_server_IP_address:port`***
Import from file	Path to the PEM-encoded certificate file.

Generate a Self-Signed Server Certificate

The Orchestrator Appliance includes a self-signed certificate that is generated automatically, based on the network settings of the appliance. If the network settings of the appliance change, you must generate a new self-signed certificate manually. You can create a self-signed certificate to guarantee encrypted communication and provide a signature for your packages. However, the recipient cannot be sure that the self-signed package is in fact a package issued by your server and not a third party claiming to be you. To prove the identity of your server, use a certificate signed by a Certificate Authority.

You can generate a self-signed certificate on the **Orchestrator Server SSL Certificate** tab from the **Certificates** page in Control Center.

Option	Description
Signature Algorithm	Encryption algorithm to generate a digital signature.
Common Name	Host name of the Orchestrator server.
Organization	Name of your organization. For example, **VMware**.
Organizational Unit	Name of your organizational unit. For example, **R&D**.
Country Code	Country code abbreviation. For example, **US**.

Orchestrator generates a server certificate that is unique to your environment. The details about the public key of the certificate appear in the **Orchestrator Server SSL Certificate** tab. The private key is stored in the `vmo_keystore` table of the Orchestrator database.

Import an Orchestrator Server SSL Certificate

vRealize Orchestrator uses an SSL certificate to identify itself to clients and remote servers during secure communication. By default, Orchestrator includes a self-signed SSL certificate that is generated automatically, based on the network settings of the appliance. You can import an SSL certificate signed by a Certificate Authority to avoid certificate trust errors.

You must import a certificate signed by a Certificate Authority as a PEM-encoded file that contains the public and the private key.

Package Signing Certificate

Packages exported from an Orchestrator server are digitally signed. Import, export, or generate a new certificate to be used for signing packages. Package signing certificates are a form of digital identification that is used to guarantee encrypted communication and a signature for your Orchestrator packages.

The Orchestrator Appliance includes a package signing certificate that is generated automatically, based on the network settings of the appliance. If the network settings of the appliance change, you must generate a new package signing certificate manually.

Note The Orchestrator Appliance includes a self-signed package signing certificate that is generated automatically during the initial Orchestrator configuration. You can change the package signing certificate, after which, all future exported packages are signed with the new certificate.

Configure the Orchestrator Plug-Ins

The default Orchestrator plug-ins are configured only through workflows.

If you want to configure any of the default Orchestrator plug-ins, you need to use the specific workflow from the Orchestrator client.

Manage the Orchestrator Plug-Ins

In the **Manage Plug-Ins** page of Control Center, you can view a list of all plug-ins that are installed in Orchestrator and perform basic management actions.

Change Plug-Ins Logging Level

Instead of changing the logging level for Orchestrator, you can change it only for specific plug-ins.

Install a New Plug-In

With the Orchestrator plug-ins, the Orchestrator server can integrate with other software products. The Orchestrator Appliance includes a set of preinstalled plug-ins and you can also install custom plug-ins.

All Orchestrator plug-ins are installed from Control Center. The file extensions that can be used are `.vmoapp` and `.dar`. A `.vmoapp` file can contain a collection of several `.dar` files and can be installed as an application, while a `.dar` file contains all the resources associated with one plug-in.

Disable a Plug-In

You can disable a plug-in by deselecting the **Enable** check box next to the name of the plug-in.

This action does not remove the plug-in file. For more information on uninstalling a plug-in in Orchestrator, see "Uninstall a Plug-In," on page 41.

If you change the Orchestrator database, you must reinstall the existing plug-ins. See, "Reinstall Plug-Ins," on page 42.

Uninstall a Plug-In

You can use Control Center to disable a plug-in, but this action does not remove the plug-in file from the Orchestrator Appliance file system. To remove the plug-in file, you must log in to the Orchestrator appliance and remove the plug-in file manually.

Procedure

1 Log in to the Orchestrator Appliance as root over SSH.

2 Open the `/etc/vco/app-server/plugins/_VSOPluginInstallationVersion.xml` file with a text editor.

   a Delete the line of code that corresponds to the plug-in that you want to remove.

3 Navigate to `/var/lib/vco/app-server/plugins`.

4 Delete the `.dar` archives that contain the plug-in that you want to remove.

5 Restart the vRealize Orchestrator services.

   The plug-in is removed from Control Center.

6 Log in to the Orchestrator client.

7 Select **Administer** from the drop-down menu in the upper-left corner.

8 Click the **Packages** view.

9 Right-click the package that you want to delete, and select **Delete element with content**.

   Note Orchestrator elements that are locked in the read-only state, for example workflows in the standard library, are not deleted.

10 Click **Delete all**.

11 Restart the vRealize Orchestrator services.

You removed all custom workflows, actions, policies, configurations, settings, and resources related to the plug-in.

Reinstall Plug-Ins

You must reinstall all Orchestrator plug-ins when you change the database server.

Prerequisites

Stop the Orchestrator server service from the **Startup Options** page in Control Center.

Procedure

1 Log in to Control Center as **root**.

2 Click **Troubleshooting**.

3 Click **Force Plug-ins Reinstall**.

The installed plug-ins are forced to reinstall the next time the Orchestrator server service starts.

Configure the Database Connection

To establish a connection to the Orchestrator database, you must set the database connection parameters.

Prerequisites

- Set up a new database to use with the Orchestrator server. See "Setting Up the Orchestrator Database," on page 18.
- If you use an SQL Server database configured to use dynamic ports, verify that the SQL Server Browser service is running.
- To prevent transactional deadlocks when using Microsoft SQL Server database, you must enable the `ALLOW_SNAPSHOT_ISOLATION` and `READ_COMMITTED_SNAPSHOT` database options.
- If your Microsoft SQL Server database uses dynamic ports, ensure that the SQL Server Browser is running.
- To avoid an `ORA-01450` error when using the Oracle database, verify that you have configured the size of the database block properly. The minimum required size depends on the size of the block your Oracle database index is using.
- To store characters in the correct format in an Oracle database, set the `NLS_CHARACTER_SET` parameter to `AL32UTF8` before configuring the database connection and building the table structure for Orchestrator. This setting is crucial for an internationalized environment.
- To configure Orchestrator to communicate with the database over a secure connection, make sure that you import the database SSL certificate. For more information, see "Import the Database SSL Certificate," on page 36.

Procedure

1 Log in to Control Center as **root**.

2 Click **Configure Database**.

3 From the **Database type** drop-down menu, select the type of database that you want Orchestrator server to use.

Option	Description
Oracle	Configures Orchestrator to work with an Oracle database instance.
SQL Server	Configures Orchestrator to work with a Microsoft SQL Server database instance.
PostgreSQL	Configures Orchestrator to work with a PostgreSQL database instance.
In-Process DerbyDB	Configures Orchestrator to work with the in-process DerbyDB database. **Note** You must not use DerbyDB for production environments.

4 Enter the database connection parameters and click **Save changes**.

Option	Description
Server address	The database server IP address or DNS name. This option is applicable for all databases.
Port	The database server port is used for communication with your database. This option is applicable for all databases.
Use SSL	Select **Use SSL** to use an SSL connection to the database. To use this option, you must make sure that you import the database SSL certificate into Orchestrator. This option is applicable for all databases.
Database name	The full unique name of your database. The database name is specified in the `SERVICE_NAMES` parameter in the initialization parameter file. This option is valid only for SQL Server, and PostgreSQL databases.
User name	The user name that Orchestrator uses to connect to and operate the selected database. The name you select must be a valid user on the target database with **db_owner** rights. This option is applicable for all databases.
Password	The password for the user name. This option is applicable for all databases.
Instance name (if any)	The name of the database instance that can be identified by the `INSTANCE_NAME` parameter in the database initialization parameter file. This option is valid only for SQL Server and Oracle databases.
Domain	To use Windows authentication, enter the domain name of the SQL Server machine, for example *company.org*. To use SQL authentication, leave this text box blank. This option is valid only for SQL Server and specifies whether you want to use Windows or SQL Server authentication.
Use Windows authentication mode (NTLMv2)	Select to send NTLMv2 responses when using Windows authentication. This option is valid only for SQL Server.

If the specified parameters are correct, a message states that the connection to the database is successful.

5 Update the table structure for Orchestrator, if required.

6 Click **Save changes**.

The database connection is successfully configured.

Start the Orchestrator Server

To work with Orchestrator, ensure that the Orchestrator server service has started.

Prerequisites

Verify that Orchestrator is configured properly by opening the Validate Configuration page in Control Center.

Procedure

1 Log in to Control Center as **root**.

2 Click **Startup Options**.

3 If the Orchestrator server has stopped, click **Start**.

The Orchestrator server status appears as RUNNING. The first boot can take 5-10 minutes because the server is installing the Orchestrator plug-ins content in the database tables. The Orchestrator server status can be Running, Undefined, and Stopped.

A message states that the service has started successfully.

What to do next

Log in to the Orchestrator client and run or schedule workflows on the vCenter Server inventory objects or other objects that Orchestrator accesses through its plug-ins.

Orchestrator Availability and Scalability

To increase the availability of the Orchestrator services, start multiple Orchestrator server instances in a cluster with a shared database. vRealize Orchestrator works as a single instance until it is configured to work as part of a cluster.

Orchestrator Cluster

Multiple Orchestrator server instances with identical server and plug-ins configurations work together in a cluster and share one database.

All Orchestrator server instances communicate with each other by exchanging heartbeats. Each heartbeat is a timestamp that the node writes to the shared database of the cluster at a certain time interval. Network problems, an unresponsive database server, or overload might cause an Orchestrator cluster node to stop responding. If an active Orchestrator server instance fails to send heartbeats within the failover timeout period, it is considered non-responsive. The failover timeout is equal to the value of the heartbeat interval multiplied by the number of the failover heartbeats. It serves as a definition for an unreliable node and can be customized according to the available resources and the production load.

An Orchestrator node enters standby mode when it loses connection to the database, and remains in this mode until the database connection is restored. The other nodes in the cluster take control of the active work, by resuming all interrupted workflows from their last unfinished items, such as scriptable tasks or workflow invocations.

Orchestrator does not provide a built-in tool for monitoring the cluster status and sending failover notifications. You can monitor the cluster state by using an external component such as a load balancer. To check whether a node is running, you can use the health status REST API service at https://*your_orchestrator_server_IP_or_DNS_name*:8281/vco/api/healthstatus and check the status of the node.

Important Workflow development does not support having more than one active Orchestrator server in a cluster. If you have more than one active Orchestrator node in a cluster, when different users use the different Orchestrator nodes to modify the same resource, concurrency problems occur. To have more than one active Orchestrator server node in a cluster, you must first develop the workflows that you need. After that you can set up Orchestrator to work in a cluster.

Configure an Orchestrator Cluster

To increase the availability of Orchestrator services, you can create a cluster of Orchestrator server instances.

An Orchestrator cluster consists of at least two Orchestrator server instances that share one database.

Prerequisites

- Install at least two Orchestrator server instances.
- Configure the external database that you plan to use as a shared database, so that it can accept connections from the different Orchestrator instances.

  To prevent transactional deadlocks when using Microsoft SQL Server database, you must enable the `ALLOW_SNAPSHOT_ISOLATION` and `READ_COMMITTED_SNAPSHOT` database options.
- If your Microsoft SQL Server database uses dynamic ports, ensure that the SQL Server Browser is running.
- Synchronize the clocks of the virtual machines that the Orchestrator server instances are installed on.

Procedure

1 Configure the first Orchestrator node.

   a Log in to Control Center of the first Orchestrator server as **`root`**.

   b Stop the Orchestrator server service from the **Startup Options** page.

   c Configure the connection to the external shared database. For more information, see "Configuring the Orchestrator Database Connection," on page 36.

   Changes in configuration, such as certificates, licensing, and authentication provider, must be made after the Orchestrator instances are configured to work with the shared database.

   d On the **Troubleshooting** page, click **Force plug-ins reinstall**.

   e Configure the authentication provider. See "Selecting the Authentication Type," on page 29.

   f (Optional) Set any additional system properties. See Chapter 9, "Setting System Properties," on page 73 for reference.

   g (Optional) Open the **Logging Integration** page and configure Orchestrator to use a remote log server.

h (Optional) On the **Orchestrator Node Settings** tab of the **Orchestrator Cluster Management** page, provide values for the Orchestrator node settings and click **Save**.

Option	Description
Number of active nodes	The maximum number of active Orchestrator server instances in the cluster. Active nodes are the Orchestrator server instances that run workflows and respond to client requests. If an active Orchestrator node stops responding, an inactive Orchestrator server instance replaces it. The default number of active Orchestrator nodes in a cluster is one.
Heartbeat interval (in milliseconds)	The time interval, in milliseconds, between two network heartbeats that an Orchestrator node sends to show that it is running. The default value is 12 seconds.
Number of failover heartbeats	The number of absent heartbeats before an Orchestrator node is considered failed. The default value is ten heartbeats.

The default failover timeout is 2 minutes and is equal to the value of the default heartbeat interval multiplied by the number of the default failover heartbeats.

i Verify that the node is configured properly at the **Validate Configuration** page in Control Center.

j (Optional) Install the external plug-ins.

k Start the Orchestrator server service on the first Orchestrator node.

l On the **Startup Options** page, make sure that the **Active Configuration Fingerprint** string and the **Pending Configuration Fingerprint** string match.

Note You might need to refresh the **Startup Options** page several times until the two strings match.

m (Optional) Configure the external plug-ins.

2 Configure the Orchestrator cluster.

a Log in to Control Center of the second Orchestrator server as **root**.

b Click the **Join Node To Cluster** tab in the **Orchestrator Cluster Management** page.

c In the **Host name** text box, enter the host name or IP address of the first Orchestrator server instance.

d In the **User name** and **Password** text boxes, enter your Control Center credentials.

e Click **Join**.

The Orchestrator instance clones the configuration of the node, to which it joins.

You have successfully configured a cluster of Orchestrator instances.

What to do next

You can add more Orchestrator server active nodes to the cluster by changing the value of the **Number of active nodes** text box in the **Orchestrator Cluster Management** page.

Monitoring and Synchronizing an Orchestrator Cluster

After you create a cluster, you can monitor the states of the cluster nodes and take further actions to keep the nodes synchronized.

You can check the configuration synchronization states of the Orchestrator instances that are joined in a cluster from the **Orchestrator Node Settings** tab of the **Orchestrator Cluster Management** page.

Important Control Center reports the state of the local node compared to the other nodes in the cluster.

Configuration Synchronization State	Local Node	Remote Node
Synchronized	The configuration of the local node did not change from the last restart.	The configuration of the remote node is the same as the configuration of the local node.
The node must be restarted	The configuration of the local node changed or was replicated from the remote node. Restart the local node to apply the pending configuration.	The configuration of the remote node is synchronized with the local node but is not applied. Restart the remote node to apply the configuration.
A configuration synchronization is required	N/A	The active configuration of the remote node is different from the active configuration of the local node.
The Control Center of the node is not available	N/A	The Control Center service (`vco-configurator`) of the remote node is stopped or not reachable. The synchronization state cannot be retrieved.
Not available. Local node is missing	The local node is not in the list of cluster nodes. The synchronization state of the local node cannot be retrieved.	N/A

Push Configuration and Restart Nodes

When you change a configuration on the local node, use the **Push Configuration and restart nodes** drop-down menu option to copy the local node configuration to all other nodes in the cluster. If you want to copy the configuration and restart the nodes later, use the **Push Configuration** option.

Removing a Node from an Orchestrator Cluster

If you want to remove a node from a cluster, you must configure the node to work with a database that is not used by an Orchestrator cluster.

Note When you change the database of a node, you must either import or regenerate the certificates and the license.

If Control Center shows nodes that are no longer part of the cluster, access the advanced **Orchestrator Cluster Management** page, at https://*your_orchestrator_server_IP_or_DNS_name*:8283/vco-controlcenter/#/control-app/ha?remove-nodes to remove the leftover records.

Configuring a Load Balancer

Load balancers distribute work among servers in high-availability deployments.

After you configure the Orchestrator cluster, you can set up a load balancer to distribute traffic among multiple instances of vRealize Orchestrator. For more information, see vRealize Orchestrator Load Balancing.

Configuring the Customer Experience Improvement Program

If you choose to participate in the Customer Experience Improvement Program (CEIP), VMware receives anonymous information that helps to improve the quality, reliability, and functionality of VMware products and services.

Categories of Information That VMware Receives

The Customer Experience Improvement Program (CEIP) provides VMware with information that enables VMware to improve the VMware products and services and to fix problems. When you choose to participate in CEIP, VMware regularly collects certain types of technical information about your use of the VMware products and services in CEIP reports.

To learn about the types of information VMware collects and how it uses this information, visit the VMware CEIP Portal at http://www.vmware.com/trustvmware/ceip.html

Join the Customer Experience Improvement Program

Join the Customer Experience Improvement Program from Control Center.

Procedure

1 Log in to Control Center as **root** and open the **Customer Experience Improvement Program** page.

2 Select the **Join the Customer Experience Improvement Program** check box to enable CEIP or deselect the check box to disable the Program and then click **Save**.

3 (Optional) Deselect the **Automatic proxy discovery** check box if you want to add a proxy host manually.

Using the API services 6

In addition to configuring Orchestrator by using Control Center, you can modify the Orchestrator server configuration settings by using the Orchestrator REST API, the Control Center REST API, or the command line utility, stored in the appliance.

The Configuration plug-in is included by default in the Orchestrator package. You can access the Configuration plug-in workflows from either the Orchestrator workflow library or the Orchestrator REST API. With these workflows, you can change the trusted certificate and keystore settings of the Orchestrator server. For information on all available Orchestrator REST API services calls, see the *Orchestrator REST API Reference* documentation, located at https://*orchestrator_server_IP_or_DNS_name*:8281/vco/api/docs.

Managing SSL Certificates and Keystores by Using the REST API

In addition to managing SSL certificates by using Control Center, you can also manage trusted certificates and keystores when you run workflows from the Configuration plug-in or by using the REST API.

The Configuration plug-in contains workflows for importing and deleting SSL certificates and keystores. You can access these workflows by navigating to **Library > Configuration > SSL Trust Manager** and **Library > Configuration > Keystores** in the Workflows view of the Orchestrator client. You can also run these workflows by using the Orchestrator REST API.

Delete an SSL Certificate by Using the REST API

You can delete an SSL certificate by running the Delete trusted certificate workflow of the Configuration plug-in or by using the REST API.

Procedure

1 Make a `GET` request at the URL of the Workflow service of the Delete trusted certificate workflow.

```
GET https://{orchestrator_host}:{port}/vco/api/workflows?conditions=name=Delete trusted certificate
```

2 Retrieve the definition of the Delete trusted certificate workflow by making a GET request at the URL of the definition.

```
GET https://{orchestrator_host}:{port}/vco/api/workflows/8a70a326-ffd7-4fef-97e0-2002ac49f5bd
```

3 Make a POST request at the URL that holds the execution objects of the Delete trusted certificate workflow.

```
POST https://{orchestrator_host}:{port}/vco/api/workflows/8a70a326-
ffd7-4fef-97e0-2002ac49f5bd/executions/
```

4 Provide the name of the certificate you want to delete as an input parameter of the Delete trusted certificate workflow in an execution-context element in the request body.

Import SSL Certificates by Using the REST API

You can import SSL certificates by running a workflow from the Configuration plug-in or by using the REST API.

You can import a trusted certificate from a file or a URL. For information about importing certificates in Orchestrator by using Control Center, see "Manage Orchestrator Certificates," on page 39.

Procedure

1 Make a GET request at the URL of the Workflow service.

Option	Description
Import trusted certificate from a file	Imports a trusted certificate from a file.
Import trusted certificate from URL	Imports a trusted certificate from a URL address.
Import trusted certificate from URL using proxy server	Imports a trusted certificate from a URL address by using a proxy server.
Import trusted certificate from URL with certificate alias	Imports a trusted certificate with a certificate alias, from a URL address.

To import a trusted certificate from a file, make the following GET request:

```
GET https://{orchestrator_host}:{port}/vco/api/workflows?conditions=name=Import
                trusted certificate from a file
```

2 Retrieve the definition of the workflow by making a GET request at the URL of the definition.

To retrieve the definition of the Import trusted certificate from a file workflow, make the following GET request:

```
GET https://{orchestrator_host}:{port}/vco/api/workflows/93a7bb21-0255-4750-9293-2437abe9d2e5
```

3 Make a POST request at the URL that holds the execution objects of the workflow.

For the Import trusted certificate from a file workflow, make the following POST request:

```
POST https://{orchestrator_host}:
{port}/vco/api/workflows/93a7bb21-0255-4750-9293-2437abe9d2e5/executions
```

4 Provide values for the input parameters of the workflow in an execution-context element of the request body.

Parameter	Description
`cer`	The CER file from which you want to import the SSL certificate. This parameter is applicable for the Import trusted certificate from a file workflow.
`url`	The URL from which you want to import the SSL certificate. For non-HTPS services, the supported format is *IP_address_or_DNS_name:port*. This parameter is applicable for the Import trusted certificate from URL workflow.

Create a Keystore by Using the REST API

You can create a keystore by running the Create a keystore workflow of the Configuration plug-in or by using the REST API.

Procedure

1 Make a `GET` request at the URL of the Workflow service of the Create a keystore workflow.

```
GET https://{orchestrator_host}:{port}/vco/api/workflows?conditions=name=Create a keystore
```

2 Retrieve the definition of the Create a keystore workflow by making a `GET` request at the URL of the definition.

```
GET https://{orchestrator_host}:{port}/vco/api/workflows/6c301bff-e8fe-4ae0-
ad08-5318178594b3/
```

3 Make a `POST` request at the URL that holds the execution objects of the Create a keystore workflow.

```
POST https://{orchestrator_host}:{port}/vco/api/workflows/6c301bff-e8fe-4ae0-
ad08-5318178594b3/executions/
```

4 Provide the name of the keystore you want to create as an input parameter of the Create a keystore workflow in an execution-context element in the request body.

Delete a Keystore by Using the REST API

You can delete a keystore by running the Delete a keystore workflow of the Configuration plug-in or by using the REST API.

Procedure

1 Make a `GET` request at the URL of the Workflow service of the Delete a keystore workflow.

```
GET https://{orchestrator_host}:{port}/vco/api/workflows?conditions=name=Delete a keystore
```

2 Retrieve the definition of the Delete a keystore workflow by making a `GET` request at the URL of the definition.

```
GET https://{orchestrator_host}:
{port}/vco/api/workflows/7a3389eb-1fab-4d77-860b-81b66bb45b86/
```

3 Make a `POST` request at the URL that holds the execution objects of the Delete a keystore workflow.

```
POST https://{orchestrator_host}:
{port}/vco/api/workflows/7a3389eb-1fab-4d77-860b-81b66bb45b86/executions/
```

4 Provide the keystore you want to delete as an input parameter of the Delete a keystore workflow in an execution-context element in the request body.

Add a Key by Using the REST API

You can add a key by running the Add key workflow of the Configuration plug-in or by using the REST API.

Procedure

1 Make a `GET` request at the URL of the Workflow service of the Add key workflow.

```
GET https://{orchestrator_host}:{port}/vco/api/workflows?conditions=name=Add key
```

2 Retrieve the definition of the Add key workflow by making a `GET` request at the URL of the definition.

```
GET https://{orchestrator_host}:{port}/vco/api/workflows/6c301bff-e8fe-4ae0-
ad08-5318178594b3/
```

3 Make a `POST` request at the URL that holds the execution objects of the Add key workflow.

```
POST https://{orchestrator_host}:{port}/vco/api/workflows/6c301bff-e8fe-4ae0-
ad08-5318178594b3/executions/
```

4 Provide the keystore, key alias, PEM-encoded key, certificate chain and key password as input parameters of the Add key workflow in an execution-context element in the request body.

Automating the Orchestrator Configuration by Using the Control Center REST API

The Control Center REST API provides access to resources for configuring the Orchestrator server. You can use the Control Center REST API with third-party systems to automate the Orchestrator configuration.

The root endpoint of the Control Center REST API is https://*orchestrator_server_IP_or_DNS_name*:8283/vco-controlcenter/api. For information on all available service calls that you can make to the Control Center REST API, see the *Control Center REST API Reference* documentation, at https://*orchestrator_server_IP_or_DNS_name*:8283/vco-controlcenter/docs.

Command-Line Utility

You can use the Orchestrator command-line utility to automate the Orchestrator configuration.

Access the command-line utility by logging in to the Orchestrator Appliance as root over SSH. The utility is located in `/var/lib/vco/tools/configuration-cli/bin`. To see the available configuration options, run `./vro-configure.sh --help`.

Additional Configuration Options 7

You can use Control Center to change the default Orchestrator behavior.

This chapter includes the following topics:

Create a New User in Control Center

To avoid potential security issues, instead of changing the root password, you can create a new user account and assign it a password at any time. By creating this new user account, you disable the access of the root account to Control Center.

Procedure

1 Log in to Control Center as **root**.

2 On the **Settings** page, click **Change Credentials**.

3 In the **Old password** text box, enter your current password.

4 In the **New user name** text box, enter the new user name.

5 In the **New password** text box, enter the new password.

6 Reenter the new password to confirm it.

7 Click **Change Credentials**.

Export the Orchestrator Configuration

Control Center provides a mechanism to export the Orchestrator configuration settings to a local file. You can use the mechanism to take a snapshot of your system configuration at any moment and import this configuration into a new Orchestrator instance.

You should export and save your configuration settings regularly, especially when making modifications, performing maintenance tasks, or upgrading the system.

Important Keep the file with the exported configuration safe and secure, because it contains sensitive administrative information.

Procedure

1 Log in to Control Center as **root**.

2 Click **Export/Import Configuration**.

3 Select the type of files you want to export.

Note If you select **Export plug-in configurations** and the plug-in configurations contain encrypted properties, you must also select **Export server configuration** to successfully decrypt the data when importing.

4 (Optional) Enter a password to protect the configuration file.

Use the same password when you import the configuration later.

5 Click **Export**.

Orchestrator creates an `orchestrator-config-export-`*`hostname-dateReference`*`.zip` file that is downloaded on your local machine. You can use this file to clone or to restore the system.

Note If you choose to clone the Orchestrator instance, you must not import the database settings to the cloned Orchestrator. You must configure a connection to a different external database, instead.

Import the Orchestrator Configuration

You can restore a previously exported system configuration after you reinstall Orchestrator or if a system failure occurs.

If you use the import procedure to clone the Orchestrator configuration, the vCenter Server plug-in configuration becomes invalid and does not work, because a new vCenter Server plug-in ID is generated.

Prerequisites

Stop the Orchestrator server from the **Startup Options** page in Control Center.

Procedure

1 Log in to Control Center as **root**.

2 Click **Export/Import Configuration** and navigate to the **Import Configuration** tab.

3 Browse to and select the `.zip` file that you exported from your previous installation.

4 Enter the password that you used when exporting the configuration.

This step is not necessary if you have not exported the configuration with a password.

5 Click **Import**.

6 Select the type of files you want to import.

Important Do not use Force import plug-ins, unless you want all the plug-ins with new versions to be substituted with previous versions that the exported file might contain. Version incompatibility might cause the plug-ins to stop working.

7 Click **Finish Import**.

A message states that the configuration is successfully imported. The new system replicates the old configuration completely.

What to do next

- Verify that vRealize Orchestrator is configured properly by opening the **Validate Configuration** page in Control Center.
- Restart the Orchestrator server from the **Startup Options** page in Control Center for the changes to take effect.

Migrating the Orchestrator Configuration

The Orchestrator migration tool is used to migrate VMware vCenter Orchestrator 5.5.x and VMware vRealize Orchestrator 6.0.x Windows standalone configurations to VMware vRealize Orchestrator 7.x. The Orchestrator Migration Tool bundles the configuration settings, plug-ins, plug-in configurations, certificates, and license information into an archive that can be imported into vRealize Orchestrator 7.x.

The following command-line options can be used with the `vro-migrate export` command:

Option	Description
`password`	Set a password to protect the exported archive. If no password is provided the archive is not protected.
`vroRootPath`	Specify the root path of the vRealize Orchestrator server.

Migrate the Orchestrator Configuration

Migrate your 5.5.x and 6.0.x Orchestrator Windows standalone configuration to the Orchestrator Appliance.

Prerequisites

- Stop the source and destination Orchestrator servers.
- Back up the database of the source Orchestrator server, including the database schema.
- You must set the `PATH` environment variable by pointing it to the bin folder of the Java JRE installed with Orchestrator.

Procedure

1 Download the migration tool from the destination Orchestrator server.

   a Log in to Control Center as **`root`**.

   b Open the **Export/Import Configuration** page and click the **Migrate Configuration** tab.

   c Download the migration tool as specified in the description, or download it directly from https://*orchestrator_server_IP_or_DNS_name*:8283/vco-controlcenter/api/server/migration-tool.

2 Export the Orchestrator configuration from the source Orchestrator server.

   a Unzip the downloaded archive and place the folder in the Orchestrator install folder.

   The default path to the Orchestrator install folder in a Windows-based installation is `C:\Program Files\VMware\Orchestrator`.

   b Use the Windows command prompt to navigate to the `bin` folder under the Orchestrator install folder.

   By default, the path to the `bin` folder is `C:\Program Files\VMware\Orchestrator\migration-cli\bin`.

   c Run the `export` command from the command line.

```
C:\Program Files\VMware\Orchestrator\migration-cli\bin\vro-migrate.bat
                export
```

   This command combines the VMware vRealize Orchestrator configuration files and plug-ins into an export archive.

   The archive is created in the same folder as the `migration-cli` folder.

3 Import the configuration to the destination Orchestrator server.

   a Open **Export/Import Configuration** in Control Center and click the **Migrate Configuration** tab.

   b Click **Import**.

   c Select the type of files that you want to import.

   Note

   If the source and destination Orchestrator servers are configured to use the same external database, leave the **Migrate database settings** check box unselected to avoid upgrading the database schema to the newer version. Otherwise the source Orchestrator environment stops working.

   d Click **Finish Migration**.

A message indicates that the migration finished successfully.

What to do next

- Verify that vRealize Orchestrator is configured properly by opening the **Validate Configuration** page in Control Center.
- Restart the Orchestrator server from the **Startup Options** page in Control Center for the changes to take effect.

Configuring the Workflow Run Properties

By default, you can run up to 300 workflows per node and up to 10,000 workflows can be queued if the number of actively running workflows is reached.

When the Orchestrator node has to run more than 300 concurrent workflows, the pending workflow runs are queued. When an active workflow run completes, the next workflow in the queue starts to run. If the maximum number of queued workflows is reached, the next workflow runs fail until one of the pending workflows starts to run.

On the **Advanced Options** page in Control Center, you can configure the workflow run properties.

Option	Description
Enable safe mode	If safe mode is enabled, all running workflows are canceled and are not resumed on the next Orchestrator node start.
Number of concurrent running workflows	The maximum number of concurrent Orchestrator node workflows that run simultaneously.
Maximum amount of running workflows in the queue	The number of workflow run requests that the Orchestrator node accepts before becoming unavailable.
Maximum number of preserved runs per workflow	The maximum number of finished workflow runs kept as history per workflow in a cluster. If the number is exceeded, the oldest workflow runs are deleted.
Log events expiration days	The number of days log events for the cluster are kept in the database before being purged.

Orchestrator Log Files

VMware Technical Support routinely requests diagnostic information when you submit a support request. This diagnostic information contains product-specific logs and configuration files from the host on which the product runs.

You can download a zip bundle that includes the Orchestrator configuration files and log files from the **Export Logs** menu in Control Center.

Table 7-1. Orchestrator Log Files list

File Name	Location	Description
`scripting.log`	`/var/log/vco/app-server`	Provides scripting log messages of workflows and actions. Use the `scripting.log` file to isolate workflow runs and action runs from normal Orchestrator operations. This information is also included in the `server.log` file.
`server.log`	`/var/log/vco/app-server`	Provides information about all activities on the Orchestrator server. Analyze the `server.log` file when you debug Orchestrator or any application that runs on Orchestrator.
`metrics.log`	`/var/log/vco/app-server`	Contains runtime information about the server. The information is added to this log file once every 5 minutes.
`localhost_access_log.txt`	`/var/log/vco/app-server`	This is the HTTP request log of the server.
`localhost_access_log.`*`date`*`.txt`	`/var/log/vco/configuration`	This is the HTTP request log of the Control Center service.
`controlcenter.log`	`/var/log/vco/configuration`	The log file of the Control Center service.

Logging Persistence

You can log information in any kind of Orchestrator script, for example workflow, policy, or action. This information has types and levels. The type can be either persistent or non-persistent. The level can be `DEBUG`, `INFO`, `WARN`, `ERROR`, `TRACE`, and `FATAL`.

Table 7-2. Creating Persistent and Non-Persistent Logs

Log Level	Persistent Type	Non-Persistent Type
`DEBUG`	Server.debug("short text", "long text");	System.debug("text")
`INFO`	Server.log("short text", "long text");	System.log("text");

Table 7-2. Creating Persistent and Non-Persistent Logs (Continued)

Log Level	Persistent Type	Non-Persistent Type
WARN	Server.warn("short text", "long text");	System.warn("text");
ERROR	Server.error("short text", "long text");	System.error("text");

Persistent Logs

Persistent logs (server logs) track past workflow run logs and are stored in the Orchestrator database. To view server logs, you must select a workflow, a completed workflow run, or a policy and click the **Events** tab in the Orchestrator client.

Non-Persistent Logs

When you use a non-persistent log (system log) to create scripts, the Orchestrator server notifies all running Orchestrator applications about this log, but this information is not stored in the database. When the application is restarted, the log information is lost. Non-persistent logs are used for debugging purposes and for live information. To view system logs, you must select a completed workflow run in the Orchestrator client and click **Logs** on the **Schema** tab.

Orchestrator Logs Configuration

On the **Configure Logs** page in Control Center, you can set the level of server log that you require. If either of the logs is generated multiple times a day, it becomes difficult to determine what causes problems.

The default log level of the server log is `INFO`. Changing the log level affects all new messages that the server enters in the logs and the number of active connections to the database. The logging verbosity decreases in descending order.

Caution Only set the log level to `DEBUG` or `ALL` to debug a problem. Do not use these settings in a production environment because it can seriously impair performance.

Log Rotation Settings

To prevent the server log from becoming too large, you can set the maximum file size and count of the server log by modifying the values in the **Max file count** and **Max file size (MB)** text boxes.

Orchestrator Log Files Export

You can use Control Center to generate a ZIP archive of troubleshooting information containing configuration, server, wrapper, and installation log files.

The log information is stored in a ZIP archive named `vco-logs-`*`date_hour`*`.zip`.

Inspect the Workflow Logs

You can quickly inspect and export the system logs and server logs of finished workflows by accessing the Inspect Workflows page in Control Center.

Note When you are using Orchestrator as part of a cluster, the system logs are saved on only the server node, from which the workflow is started.

Important Log information is stored temporarily.

- System logs are stored in files up to 10 MB in size. The maximum number of log files is 5 per node.
- Server logs are stored for 15 days in the database.

Procedure

1 Log in to Control Center as **root**.

2 Click **Inspect Workflows**.

3 Click the **Finished Workflows** tab.

4 (Optional) Select the type of workflow tokens that you want to inspect, select the date range and click **Apply**.

5 (Optional) Search a workflow by name, ID, or token ID.

6 Click on the token ID you want to inspect.

The workflow execution log view appears in full screen.

7 Inspect the system logs and server logs.

8 (Optional) Click **Export Token Logs** to export the workflow token logs in a `.zip` file.

Filter the Orchestrator Logs

You can filter the Orchestrator server logs for a specific workflow run and collect diagnostic data about the workflow run.

The Orchestrator logs contain a lot of useful information which you can monitor in real time. When multiple instances of the same workflow are running at the same time, you can track the different workflow runs by filtering the diagnostic data about each run in the Orchestrator live log stream.

Procedure

1 Log in to Control Center as **root**.

2 Click **Live Log Stream**.

3 In the search bar, enter your search parameters.

For example, you can filter the logs by a user name, workflow name, workflow ID, or a token ID.

4 (Optional) Select **Case sensitive** and **Filter (grep)** to filter the search results further.

By selecting **Filter (grep)** the live stream only shows the lines that match your search parameters.

The Orchestrator live log stream is filtered according to your search parameters.

What to do next

You can use third-party log analyzing tools, if you want to filter old logs, that are not accessible through the Live Log Stream page in Control Center.

Configuration Use Cases and Troubleshooting

8

You can configure the Orchestrator server to work with the vCenter Server appliance, you can also uninstall plug-ins from Orchestrator, or change the self-signed certificates.

The configuration use cases provide task flows that you can perform to meet specific configuration requirements of your Orchestrator server, as well as troubleshooting topics to understand and solve a problem, if a workaround exists.

This chapter includes the following topics:

Register Orchestrator as a vCenter Server Extension

After you register Orchestrator server with vCenter Single Sign-On and configure it to work with vCenter Server, you must register Orchestrator as an extension of vCenter Server.

Procedure

1 Log in to the Orchestrator client as an administrator.

2 Click the **Workflows** view.

3 In the workflows hierarchical list, expand **Library > vCenter > Configuration**.

4 Right-click the **Register vCenter Orchestrator as a vCenter Server extension** workflow and select **Start workflow**.

5 Select the vCenter Server instance to register Orchestrator with.

6 Enter https://*your_orchestrator_server_IP_or_DNS_name*:8281 or the service URL of the load balancer that redirects the requests to the Orchestrator server nodes.

7 Click **Submit**.

Unregister Orchestrator Authentication

Unregister Orchestrator as a Single Sign-On solution from the Configure Authentication Provider page in Control Center.

If you want to reconfigure the Orchestrator vCenter Single Sign-On or vRealize Automation authentication you must first unregister the Orchestrator authentication.

Procedure

1 Log in to Control Center as **root**.

2 Click **Configure Authentication Provider**.

3 Click **Unregister**.

4 (Optional) Enter your credentials if you want to delete registration data from the identity server.

5 Click **Unregister** from the **Identity service** section.

You have successfully unregistered your Orchestrator server instance.

Changing SSL Certificates

By default, the Orchestrator server uses a self-signed SSL certificate to communicate remotely with the Orchestrator client. You can change the SSL certificates if, for example, your company security policy requires you to use its SSL certificates.

When you attempt to use Orchestrator over a trusted SSL Internet connection, and you open Control Center in a Web browser, you receive a warning that the connection is untrusted, if you use Mozilla Firefox, or that problems have been detected with the Web site's security certificate, if you use Internet Explorer.

After you click **Continue to this website (not recommended)**, even if you have imported the SSL certificate in the trusted store, you continue to see the Certificate Error red notification in the address bar of the Web browser. You can work with Orchestrator in the Web browser, but a third-party system might not work properly when attempting to access the API over HTTPS.

You might also receive a certificate warning when you start the Orchestrator client and attempt to connect to the Orchestrator server over an SSL connection.

You can resolve the problem by installing a certificate signed by a commercial certificate authority (CA). To stop receiving a certificate warning from the Orchestrator client, add your root CA certificate to the Orchestrator keystore on the machine on which the Orchestrator client is installed.

Adding a Certificate to the Local Store

After you receive a certificate from a CA, you must add the certificate to your local storage to work with Control Center without receiving certificate warnings or error messages.

This workflow describes the process of adding the certificate to your local storage by using Internet Explorer.

1 Open Internet Explorer and go to https://*orchestrator_server_IP_or_DNS_name*:8283/.

2 When prompted, click **Continue to this website (not recommended)**.

The certificate error appears on the right side of the address bar in Internet Explorer.

3 Click the Certificate Error and select **View Certificates**.

4 Click **Install Certificate**.

5 On the Welcome page of the Certificate Import Wizard, click **Next**.

6 In the Certificate Store window, select **Place all certificates in the following store**.

7 Browse and select **Trusted Root Certification Authorities**.

8 Complete the wizard and restart Internet Explorer.

9 Navigate to the Orchestrator server over your SSL connection.

You no longer receive warnings, and you do not receive a Certificate Error in the address bar.

Other applications and systems, such as VMware Service Manager, must have access to the Orchestrator REST APIs though an SSL connection.

Change the Certificate of the Orchestrator Appliance Management Site

The Orchestrator Appliance uses Light HTTPd to run its own management site. You can change the SSL certificate of the Orchestrator Appliance management site if, for example, your company security policy requires you to use its SSL certificates.

Prerequisites

By default the Orchestrator Appliance SSL certificate and private key are stored in a PEM file, which is located at: `/opt/vmware/etc/lighttpd/server.pem`. To install a new certificate, ensure that you export your new SSL certificate and private key from the Java keystore to a PEM file.

Procedure

1 Log in to the Orchestrator Appliance Linux console as root.

2 Locate the `/opt/vmware/etc/lighttpd/lighttpd.conf` file and open it in an editor.

3 Find the following line:

```
#### SSL engine
ssl.engine = "enable"
ssl.pemfile = "/opt/vmware/etc/lighttpd/server.pem"
```

4 Change the `ssl.pemfile` attribute to point to the PEM file containing your new SSL certificate and private key.

5 Save the `lighttpd.conf` file.

6 Run the following command to restart the light-httpd server.

```
service vami-lighttp restart
```

You successfully changed the certificate of the Orchestrator Appliance management site.

Cancel Running Workflows

Cancel workflows when the Orchestrator server is stopped, otherwise the operation might not be successful.

Prerequisites

Stop the Orchestrator server from the **Startup Options** page in Control Center.

Procedure

1 Log in to Control Center as **`root`**.

2 Click **Troubleshooting**.

3 Cancel running workflows.

Option	Description
Cancel all workflow runs	Enter a workflow ID, to cancel all tokens for that workflow. If the server is not stopped, the workflow tokens might not be cancelled.
Cancel workflow runs by ID	Enter all token IDs you want to cancel. Separate them with a comma. If the server is not stopped, the workflow tokens might not be cancelled.
Cancel all tokens	Cancel all running workflows on the server. You must stop the server to use this option.

On the next server start, the workflows are set in a cancelled state.

What to do next

Verify that the workflows are cancelled from the **Inspect Workflows** page in Control Center.

Enable Orchestrator Server Debugging

You can start the Orchestrator server in debug mode to debug issues when developing a plug-in.

Procedure

1 Log in to Control Center as **root**.

2 Click **Orchestrator Debugging**.

3 Click **Enable debugging**.

4 (Optional) Enter a port, different from the default one.

5 (Optional) Click **Suspend**.

By selecting this option, you must attach a debugger before starting the Orchestrator server.

6 Click **Save**.

7 Open the Startup Options page in Control Center and click **Restart**.

The Orchestrator server is suspended upon start until you attach a remote Java debugger to the defined port.

Back Up the Orchestrator Configuration and Elements

You can take a snapshot of your Orchestrator configuration and import this configuration into a new Orchestrator instance to back up your Orchestrator configuration. You can also back up the Orchestrator elements that you modified.

If you edit any standard workflows, actions, policies, or configuration elements, and then import a package containing the same elements with a higher Orchestrator version number, your changes to the elements are lost. To make modified and custom elements available after the upgrade, you must export them in a package before you start the procedure.

Each Orchestrator server instance has unique certificates, and each vCenter Server plug-in instance has a unique ID. The certificates and the unique ID define the identity of the Orchestrator server and the vCenter Server plug-in. If you do not back up the Orchestrator elements or export the Orchestrator configuration for backup purposes, make sure that you change these identifiers.

Procedure

1 Log in to Control Center as **root**.

2 Click **Export/Import Configuration**.

3 Select the type of files you want to export.

4 (Optional) Enter a password to protect the configuration file.

Use the same password when you import the configuration.

5 Click **Export**.

6 Log in to the Orchestrator client application.

7 Create a package that contains all the Orchestrator elements that you created or edited.

a Click the **Packages** view.

b Click the menu button in the title bar of the Packages list and select **Add package**.

c Enter a name for the new package and click **OK**.

The syntax for package names is *`domain.your_company.folder.package_name`*..

For example, `com.vmware.myfolder.mypackage`.

d Right-click the package and select **Edit**.

e On the **General** tab, add a description for the package.

f On the **Workflows** tab, add workflows to the package.

g (Optional) Add policy templates, actions, configuration elements, resource elements, and plug-ins to the package.

8 Export the package.

a Right-click the package you want to export, and select **Export package**.

b Browse to and select a location where you want to save the package and click **Open**.

c (Optional) Use the corresponding certificate to sign the package.

d (Optional) Impose restrictions on the exported package.

e (Optional) To apply restrictions for the contents of the exported package, deselect the options as required.

Option	Description
Export version history	The version history of the package is not exported.
Export the values of the configuration settings	The attribute values of the configuration elements in the package are not exported.
Export global tags	The global tags in the package are not exported.

f Click **Save**.

9 Import the Orchestrator configuration to the new Orchestrator server instance.

a Log in to Control Center of the new Orchestrator instance as **`root`**.

b Click **Export/Import Configuration** and navigate to the **Import Configuration** tab.

c Browse to select the .zip file you exported from your previous installation.

d Type the password you used while exporting the configuration.

This step is not necessary if you have not specified a password.

e Click **Import**.

10 Import the package that you exported to the new Orchestrator instance.

a Log in to the Orchestrator client application of the new Orchestrator instance.

b From the drop-down menu in the Orchestrator client, select **Administer**.

c Click the **Packages** view.

d Right-click in the left pane and select **Import package**.

e Browse to and select the package that you want to import and click **Open**.

Certificate information about the exporter appears.

f Review the package import details and select **Import** or **Import and trust provider**.

The Import package view appears. If the version of the imported package element is later than the version on the server, the system selects the element for import.

g Deselect the elements that you do not want to import.

For example, deselect custom elements for which later versions exist.

h (Optional) Deselect the **Import the values of the configuration settings** check box if you do not want to import the attribute values of the configuration elements from the package.

i From the drop-down menu, choose whether you want to import tags from the package.

Option	Description
Import tags but preserve existing values	Import tags from the package without overwriting existing tag values.
Import tags and overwrite existing values	Import tags from the package and overwrite their values.
Do not import tags	Do not import tags from the package.

j Click **Import selected elements**.

Backing Up and Restoring vRealize Orchestrator

You can use vSphere Data Protection to back up and restore a virtual machine (VM) that contains a vRealize Orchestrator instance.

vSphere Data Protection is a VMware disk-based backup and recovery solution designed for vSphere environments. vSphere Data Protection is fully integrated with vCenter Server. With vSphere Data Protection, you can manage backup jobs and store backups in deduplicated destination storage locations. After you deploy and configure vSphere Data Protection, you can access vSphere Data Protection by using the vSphere Web Client interface to select, schedule, configure, and manage backups and recoveries of virtual machines. During a backup, vSphere Data Protection creates a quiesced snapshot of the virtual machine. Deduplication is automatically performed with every backup operation.

For information about how to deploy and configure vSphere Data Protection, see the *vSphere Data Protection Administration* documentation.

Back Up vRealize Orchestrator

You can back up your vRealize Orchestrator instance as a virtual machine.

You can export your database prior to the full VM backup. For information on how to export your database, see "Export the Orchestrator Database," on page 38. If vRealize Orchestrator and the external database are on different machines, you must back up the database separately.

Note To ensure that all components of a VM in a single product are backed up together, store the VMs of your vRealize Orchestrator environment in a single vCenter Server folder and create a backup policy job for that folder.

Prerequisites

- Verify that the vSphere Data Protection appliance is deployed and configured. For information about how to deploy and configure vSphere Data Protection, see the *vSphere Data Protection Administration* documentation.
- Use the vSphere Web Client to log in to the vCenter Server instance that manages your environment. Log in as the user with administrator privileges that was used during the vSphere Data Protection configuration.

Procedure

1. On the vSphere Web Client Home page, click **vSphere Data Protection**.
2. Select your vSphere Data Protection appliance from the **VDP appliance** drop-down menu and click **Connect**.
3. On the **Getting Started** tab, click **Create Backup Job**.
4. Click **Guest Images** to back up your vRealize Orchestrator instance and click **Next**.
5. Select **Full Image** to back up the entire virtual machine and click **Next**.
6. Expand the **Virtual Machines** tree and select the check box of your vRealize Orchestrator VM.
7. Follow the prompts to set the backup schedule, retention policy, and name of the backup job.

   For more information about how to back up and restore virtual machines, see the *vSphere Data Protection Administration* documentation.

   Your backup job appears in the list of backup jobs on the **Backup** tab.
8. (Optional) Open the **Backup** tab, select your backup job and click **Backup now** to back up your vRealize Orchestrator.

   Note Alternatively, you can wait for the backup to start automatically according to the schedule that you set.

   The backup process appears on the **Recent Tasks** page.

The image of your VM appears in the list of backups on the **Restore** tab.

What to do next

Open the **Restore** tab and verify that the image of your VM is in the list of backups.

Restore a vRealize Orchestrator Instance

You can restore your vRealize Orchestrator instance on its original location or on a different location on the same vCenter Server.

If your vRealize Orchestrator and external database run on different machines, you must first restore the database and then the vRealize Orchestrator VM.

Prerequisites

- Verify that the vSphere Data Protection appliance is deployed and configured. For information about how to deploy and configure vSphere Data Protection, see the *vSphere Data Protection Administration* documentation.
- Back up your vRealize Orchestrator instance. See "Back Up vRealize Orchestrator," on page 67.
- Use the vSphere Web Client to log in to the vCenter Server instance that manages your environment. Log in as the user with administrator privileges that you used during the vSphere Data Protection configuration.

Procedure

1. On the vSphere Web Client Home page, click **vSphere Data Protection**.
2. Select your vSphere Data Protection appliance from the **VDP appliance** drop-down menu and click **Connect**.
3. Open the **Restore** tab.
4. From the list of backup jobs, select the vRealize Orchestrator backup that you want to restore.

   Note If you have multiple VMs, you must restore them simultaneously so that they are synchronized.

5. To restore your vRealize Orchestrator instance on the same vCenter Server, click the **Restore** icon and follow the prompts to set the location on your vCenter Server where to restore your vRealize Orchestrator.

   Do not select **Power On**, as the appliance must be the last component to be powered on. For information about how to back up and restore a virtual machine, see the *vSphere Data Protection Administration* documentation.

   A message that states that the restore is successfully initiated appears.
6. (Optional) Power on your database hosts if they are external and restore your load balancer configuration.
7. Power on the vRealize Orchestrator Appliance.

The restored vRealize Orchestrator VM appears in the vCenter Server inventory.

What to do next

Verify that vRealize Orchestrator is configured properly by opening the **Validate Configuration** page in Control Center.

Disaster Recovery of Orchestrator by Using Site Recovery Manager

You must configure Site Recovery Manager to protect your vRealize Orchestrator. Secure this protection by completing the common configuration tasks for Site Recovery Manager.

Prepare the Environment

You must ensure that you meet the following prerequisites before you start configuring Site Recovery Manager.

- Verify that vSphere 5.5 is installed on the protected and recovery sites.
- Verify that you are using Site Recovery Manager 5.8.
- Verify that vRealize Orchestrator is configured.

Configure Virtual Machines for vSphere Replication

You must configure the virtual machines for vSphere Replication or array based replication in order to use Site Recovery Manager.

To enable vSphere Replication on the required virtual machines, perform the following steps.

Procedure

1 In the vSphere Web Client, select a virtual machine on which vSphere Replication should be enabled and click **Actions > All vSphere Replication Actions > Configure Replication**.

2 In the Replication type window, select **Replicate to a vCenter Server** and click **Next**.

3 In the Target site window, select the vCenter for the recovery site and click **Next**.

4 In the Replication server window, select a vSphere Replication server and click **Next**.

5 In the Target location window, click **Edit** and select the target datastore, where the replicated files will be stored and click **Next**.

6 In the Replication options window, keep the default setting and click **Next**.

7 In the Recovery settings window, enter time for **Recovery Point Objective (RPO)** and **Point in time instances**, and click **Next**.

8 In the Ready to complete window, verify the settings and click **Finish**.

9 Repeat these steps for all virtual machines on which vSphere Replication must be enabled.

Create Protection Groups

You create protection groups to enable Site Recovery Manager to protect virtual machines.

When you create protection groups, wait to ensure that the operations finish as expected. Make sure that Site Recovery Manager creates the protection group and that the protection of the virtual machines in the group is successful.

Prerequisites

Verify that you performed one of the following tasks:

- Included virtual machines in datastores for which you configured array-based replication
- Configured vSphere Replication on virtual machines
- Performed a combination of some or all of the above

Procedure

1 In the vSphere Web Client, select **Site Recovery** > **Protection Groups**.

2 On the **Objects** tab, click the icon to create a protection group.

3 On the Protection group type page, select the protected site, select the replication type, and click **Next**.

Option	Action
Array-based replication groups	Select **Array Based Replication (ABR)** and select an array pair.
vSphere Replication protection group	Select **vSphere Replication**.

4 Select datastore groups or virtual machines to add to the protection group.

Option	Action
Array-based replication protection groups	Select datastore groups and click **Next**.
vSphere Replication protection groups	Select virtual machines from the list, and click **Next**.

When you create vSphere Replication protection groups, only virtual machines that you configured for vSphere Replication and that are not already in a protection group appear in the list.

5 Review your settings and click **Finish**.

You can monitor the progress of the creation of the protection group on the **Objects** tab under **Protection Groups**.

- If Site Recovery Manager successfully applied inventory mappings to the protected virtual machines, the protection status of the protection group is OK.
- If Site Recovery Manager successfully protected all of the virtual machines associated with the storage policy, the protection status of the protection group is OK.

Create a Recovery Plan

You create a recovery plan to establish how Site Recovery Manager recovers virtual machines.

Procedure

1 In the vSphere Web Client, select **Site Recovery** > **Recovery Plans**.

2 On the **Objects** tab, click the icon to create a recovery plan.

3 Enter a name and description for the plan, select a folder, then click **Next**.

4 Select the recovery site and click **Next**.

5 Select the group type from the menu.

Option	Description
VM protection groups	Select this option to create a recovery plan that contains array-based replication and vSphere Replication protection groups.
Storage policy protection groups	Select this option to create a recovery plan that contains storage policy protection groups.

The default is **VM protection groups**.

Note If using stretched storage, select **Storage policy protection groups** for the group type.

6 Select one or more protection groups for the plan to recover, and click **Next**.

7 Click the **Test Network** value, select a network to use during test recovery, and click **Next**.

The default option is to create an isolated network automatically.

8 Review the summary information and click **Finish** to create the recovery plan.

Organize Recovery Plans in Folders

You can create folders in which to organize recovery plans.

Organizing recovery plans into folders is useful if you have many recovery plans. You can limit the access to recovery plans by placing them in folders and assigning different permissions to the folders for different users or groups.

Procedure

1 In the Home view of the vSphere Web Client, click **Site Recovery**.

2 Expand **Inventory Trees** and click **Recovery Plans**.

3 Select the **Related Objects** tab and click **Folders**.

4 Click the **Create Folder** icon, enter a name for the folder to create, and click **OK**.

5 Add new or existing recovery plans to the folder.

Option	Description
Create a new recovery plan	Right-click the folder and select **Create Recovery Plan**.
Add an existing recovery plan	Drag and drop recovery plans from the inventory tree into the folder.

6 (Optional) To rename or delete a folder, right-click the folder and select **Rename Folder** or **Delete Folder**.

You can only delete a folder if it is empty.

Edit a Recovery Plan

You can edit a recovery plan to change the properties that you specified when you created it. You can edit recovery plans from the protected site or from the recovery site.

Procedure

1 In the vSphere Web Client, select **Site Recovery** > **Recovery Plans**.

2 Right-click a recovery plan, and select **Edit Plan**.

You can also edit a recovery plan by clicking the **Edit recovery plan** icon in the **Recovery Steps** view in the **Monitor** tab.

3 (Optional) Change the name or description of the plan in the **Recovery Plan Name** text box, and click **Next**.

4 On the Recovery site page, click **Next**.

You cannot change the recovery site.

5 (Optional) Select or deselect one or more protection groups to add them to or remove them from the plan, and click **Next**.

6 (Optional) Click the test network to select a different test network on the recovery site, and click **Next**.

7 Review the summary information and click **Finish** to make the specified changes to the recovery plan.

You can monitor the update of the plan in the Recent Tasks view.

9 Setting System Properties

You can set system properties to change the default Orchestrator behavior.

This chapter includes the following topics:

Disable Access to the Orchestrator Client By Nonadministrators

You can configure the Orchestrator server to deny access to the Orchestrator client to all users who are not members of the Orchestrator administrator group.

By default, all users who are granted execute permissions can connect to the Orchestrator client. However, you can limit access to the Orchestrator client to Orchestrator administrators by setting an Orchestrator configuration system property.

IMPORTANT If the property is not configured, or if the property is set to false, Orchestrator permits access to the Orchestrator client by all users.

Procedure

1 Log in to Control Center as **root**.

2 Click **System Properties**.

3 Click the **Add** icon (+).

4 In the **Key** text box enter **com.vmware.o11n.smart-client-disabled**.

5 In the **Value** text box enter **true**.

6 (Optional) In the **Description** text box enter **Disable Orchestrator client connection**.

7 Click **Add**.

8 Click **Save changes** from the pop-up menu.

A message indicates that you have saved successfully.

9 Restart the Orchestrator server.

You disabled access to the Orchestrator client to all users other than members of the Orchestrator administrator group.

Setting Server File System Access for Workflows and Actions

In Orchestrator, the workflows and actions have limited access to specific file system directories. You can extend access to other parts of the server file system by modifying the `js-io-rights.conf` Orchestrator configuration file.

Rules in the js-io-rights.conf File Permitting Write Access to the Orchestrator System

The `js-io-rights.conf` file contains rules that permit write access to defined directories in the server file system.

Mandatory Content of the js-io-rights.conf File

Each line of the `js-io-rights.conf` file must contain the following information.

- A plus (`+`) or minus (`-`) sign to indicate whether rights are permitted or denied
- The read (`r`), write (`w`), and execute (`x`) levels of rights
- The path on which to apply the rights

Default Content of the js-io-rights.conf File

The default content of the `js-io-rights.conf` configuration file in the Orchestrator Appliance is as follows:

```
-rwx /
+rwx /var/run/vco
-rwx /etc/vco/app-server/security/
+rx /etc/vco
+rx /var/log/vco/
```

The first two lines in the default `js-io-rights.conf` configuration file allow the following access rights:

`-rwx /`	All access to the file system is denied.
`+rwx /var/run/vco`	Read, write, and execute access is permitted in the `/var/run/vco` directory.

Rules in the js-io-rights.conf File

Orchestrator resolves access rights in the order they appear in the `js-io-rights.conf` file. Each line can override the previous lines.

Important You can permit access to all parts of the file system by setting `+rwx /` in the `js-io-rights.conf` file. However, doing so represents a high security risk.

Set Server File System Access for Workflows and Actions

To change which parts of the server file system that workflows and the Orchestrator API can access, modify the `js-io-rights.conf` configuration file. The `js-io-rights.conf` file is created when a workflow attempts to access the Orchestrator server file system.

Procedure

1 Log in to the Orchestrator Appliance Linux console as **`root`**.

2 Navigate to `/etc/vco/app-server`.

3 Open the `js-io-rights.conf` configuration file in a text editor.

4 Add the necessary lines to the `js-io-rights.conf` file to allow or deny access to areas of the file system.

For example, the following line denies the execution rights in the */path_to_folder*/noexec directory:

```
-x /path_to_folder/noexec
```

/path_to_folder/noexec retains execution rights, but */path_to_folder*/noexec/bar does not. Both directories remain readable and writable.

You modified the access rights to the file system for workflows and for the Orchestrator API.

Set Access to Operating System Commands for Workflows and Actions

The Orchestrator API provides a scripting class, `Command`, that runs commands in the Orchestrator server host operating system. To prevent unauthorized access to the Orchestrator server host, by default, Orchestrator applications do not have permission to run the `Command` class. If Orchestrator applications require permission to run commands on the host operating system, you can activate the `Command` scripting class.

You grant permission to use the `Command` class by setting an Orchestrator configuration system property.

Procedure

1 Log in to Control Center as **`root`**.

2 Click **System Properties**.

3 Click the **Add** icon (+).

4 In the **Key** text box, enter **`com.vmware.js.allow-local-process`**.

5 In the **Value** text box, enter **`true`**.

6 In the **Description** text box, enter a description for the system property.

7 Click **Add**.

8 Click **Save changes** from the pop-up menu.

A message indicates that you have saved successfully.

9 Restart the Orchestrator server.

You granted permissions to Orchestrator applications to run local commands in the Orchestrator server host operating system.

Note By setting the `com.vmware.js.allow-local-process` system property to `true`, you allow the `Command` scripting class to write anywhere in the file system. This property overrides any file system access permissions that you set in the `js-io-rights.conf` file for the `Command` scripting class only. The file system access permissions that you set in the `js-io-rights.conf` file still apply to all scripting classes other than `Command`.

Set JavaScript Access to Java Classes

By default, Orchestrator restricts JavaScript access to a limited set of Java classes. If you require JavaScript access to a wider range of Java classes, you must set an Orchestrator system property to allow this access.

Allowing the JavaScript engine full access to the Java virtual machine (JVM) presents potential security issues. Malformed or malicious scripts might have access to all of the system components to which the user who runs the Orchestrator server has access. Consequently, by default the Orchestrator JavaScript engine can access only the classes in the `java.util.*` package.

If you require JavaScript access to classes outside of the `java.util.*` package, you can list in a configuration file the Java packages to which to allow JavaScript access. You then set the `com.vmware.scripting.rhino-class-shutter-file` system property to point to this file.

Procedure

1 Create a text configuration file to store the list of Java packages to which to allow JavaScript access.

For example, to allow JavaScript access to all the classes in the `java.net` package and to the `java.lang.Object` class, you add the following content to the file.

```
java.net.*
java.lang.Object
```

2 Save the configuration file with an appropriate name and in an appropriate place.

3 Log in to Control Center as **root**.

4 Click **System Properties**.

5 Click the **Add** icon ().

6 In the **Key** text box enter **com.vmware.scripting.rhino-class-shutter-file**.

7 In the **Value** text box enter the path to your configuration file.

8 In the **Description** text box enter a description for the system property.

9 Click **Add**.

10 Click **Save changes** from the pop-up menu.

A message indicates that you have saved successfully.

11 Restart the Orchestrator server.

The JavaScript engine has access to the Java classes that you specified.

Set Custom Timeout Property

When vCenter Server is overloaded, it takes more time to return the response to the Orchestrator server than the 20000 milliseconds set by default. To prevent this situation, you must modify the Orchestrator configuration file to increase the default timeout period.

If the default timeout period expires before the completion of certain operations, the Orchestrator server log contains errors.

```
Operation 'getPropertyContent' total time : '5742228' for 1823 calls, mean time : '3149.0', min
time : '0', max time : '32313' Timeout, unable to get property 'info'
com.vmware.vmo.plugin.vi4.model.TimeoutException
```

Procedure

1 Log in to Control Center as **root**.

2 Click **System Properties**.

3 Click the **Add** icon ().

4 In the **Key** text box enter **com.vmware.vmo.plugin.vi4.waitUpdatesTimeout**.

5 In the **Value** text box enter the new timeout period in milliseconds.

6 (Optional) In the **Description** text box enter a description for the system property.

7 Click **Add**.

8 Click **Save changes** from the pop-up menu.

A message indicates that you have saved successfully.

9 Restart the Orchestrator server.

The value you set overrides the default timeout setting of 20000 milliseconds.

Where to Go From Here 10

When you have installed and configured vRealize Orchestrator, you can use Orchestrator to automate frequently repeated processes related to the management of the virtual environment.

- Log in to the Orchestrator client, run, and schedule workflows on the vCenter Server inventory objects or other objects that Orchestrator accesses through its plug-ins. See *Using the VMware vRealize Orchestrator Client*.
- Duplicate and modify the standard Orchestrator workflows and write your own actions and workflows to automate operations in vCenter Server.
- Develop plug-ins and Web services to extend the Orchestrator platform.
- Run workflows on your vSphere inventory objects by using the vSphere Web Client.

Log In to the Orchestrator Client from the Orchestrator Appliance Web Console

To perform general administration tasks or to edit and create workflows, you must log in to the Orchestrator client interface.

The Orchestrator client interface is designed for developers with administrative rights who want to develop workflows, actions, and other custom elements.

Important Ensure that the clocks of the Orchestrator Appliance and the Orchestrator client machine are synchronized.

Prerequisites

- Download and deploy the Orchestrator Appliance.
- Verify that the appliance is up and running.

Procedure

1. In a Web browser, go to the IP address of your Orchestrator Appliance virtual machine.

   http://*orchestrator_appliance_ip*

2. Click **Start Orchestrator Client**.
3. Type the IP or the domain name of the Orchestrator Appliance in the **Host name** text box.

   The IP address of the Orchestrator Appliance is displayed by default.

4. Log in by using the Orchestrator client user name and password.

   If you are using vRealize Automation authentication, vCenter Single Sign-On, or another directory service as an authentication method, type the respective credentials to log in to the Orchestrator client.

5 In the Security Warning window select an option to handle the certificate warning.

The Orchestrator client communicates with the Orchestrator server by using an SSL certificate. A trusted CA does not sign the certificate during installation. You receive a certificate warning each time you connect to the Orchestrator server.

Option	Description
Ignore	Continue using the current SSL certificate. The warning message appears again when you reconnect to the same Orchestrator server, or when you try to synchronize a workflow with a remote Orchestrator server.
Cancel	Close the window and stop the login process.
Install this certificate and do not display any security warnings for it anymore.	Select this check box and click **Ignore** to install the certificate and stop receiving security warnings.

You can change the default SSL certificate with a certificate signed by a CA. For more information about changing SSL certificates, see *Installing and Configuring VMware vRealize Orchestrator*.

What to do next

You can import a package, start a workflow, or set root access rights on the system.

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