vCenter Server and Host Management

ESXi 6.0

vCenter Server 6.0

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About VMware vCenter Server™ and Host Management

vCenter Server and Host Management describes how to start and stop the VMware® vSphere Web Client components, build your vSphere environment, monitor and manage the information generated about the components, and set up roles and permissions for users and groups using the vSphere environment.

In addition, *vCenter Server and Host Management* provides brief introductions to the various tasks you can perform within the system as well as cross-references to the documentation that describes all the tasks in detail.

vCenter Server and Host Management covers ESXi and vCenter Server.

Intended Audience

vCenter Server and Host Management is intended for system administrators who are experienced Windows or Linux system administrators and who are familiar with virtual machine technology and data center operations.

Updated Information

This *vCenter Server and Host Management* is updated with each release of the product or when necessary.

This table provides the update history of the *vCenter Server and Host Management*.

Revision	Description
EN-001396-02	■ Removed information related to vSphere Storage Appliance in "Licensing for vCenter Server," on page 93 and "Licensing for vCenter Server," on page 93. This functionality is deprecated in vSphere 6.0. ■ Updated prerequisites in "Add Third-Party Hosts to the vCenter Server Inventory," on page 73. ■ Updated "Install the Client Integration Plug-In," on page 27 to include a note that the download link does not display if the Client Integration Plug-In is already installed on the system.
EN-001396-01	■ Corrected latency time in "Host Configuration for vMotion," on page 121. ■ Removed information related to Storage Views and Storage Reports from "vSphere Software Components," on page 15. This functionality is deprecated in vSphere 6.0. ■ Corrected default installation location for vSphere Web Client on Windows 2008 in "Configure the vSphere Web Client Timeout Value," on page 34.
EN-001396-00	Initial release.

vSphere Concepts and Features 1

VMware vSphere™ leverages the power of virtualization to transform data centers into simplified cloud computing infrastructures and enables IT organizations to deliver flexible and reliable IT services.

The two core components of vSphere are VMware ESXi™ and VMware vCenter Server™. ESXi is the virtualization platform on which you create and run virtual machines. vCenter Server is a service that acts as a central administrator for ESXi hosts that are connected on a network. vCenter Server allows you to pool and manage the resources of multiple hosts. vCenter Server provides many features that allow you to monitor and manage your physical and virtual infrastructure.

Additional vSphere components are available as plugins that extend the functionality of the vSphere product.

This chapter includes the following topics:

- "Virtualization Basics," on page 13
- "Physical Topology of vSphere Data Center," on page 14
- "vSphere Software Components," on page 15
- "Client Interfaces for vSphere," on page 17
- "vSphere Managed Inventory Objects," on page 18
- "Optional vCenter Server Components," on page 20
- "vCenter Server Plug-Ins," on page 21

Virtualization Basics

A virtual machine is a software computer that, like a physical computer, runs an operating system and applications. The hypervisor serves as a platform for running virtual machines and allows for the consolidation of computing resources.

Each virtual machine contains its own virtual, or software-based, hardware, including a virtual CPU, memory, hard disk, and network interface card.

Software called the hypervisor is installed on the physical hardware in a virtualized data center, and acts as a platform for virtual machines. ESXi is the hypervisor in a vSphere environment. The hypervisor provides physical hardware resources dynamically to virtual machines as needed to support the operation of the virtual machines. The hypervisor allows virtual machines to operate with a degree of independence from the underlying physical hardware. For example, a virtual machine can be moved from one physical host to another, or its virtual disks can be moved from one type of storage to another, without affecting the functioning of the virtual machine.

Because virtual machines are decoupled from specific underlying physical hardware, virtualization allows you to consolidate physical computing resources such as CPUs, memory, storage, and networking into pools of resources that can be dynamically and flexibly made available to virtual machines. With appropriate management software, such as vCenter Server, you can also use a number of features that increase the availability and security of your virtual infrastructure.

Physical Topology of vSphere Data Center

A typical VMware vSphere data center consists of basic physical building blocks such as x86 virtualization servers, storage networks and arrays, IP networks, a management server, and desktop clients.

The vSphere data center topology includes the following components.

Compute servers

Industry standard x86 servers that run ESXi on the bare metal. ESXi software provides resources for and runs the virtual machines. Each computing server is referred to as a standalone host in the virtual environment. You can group a number of similarly configured x86 servers with connections to the same network and storage subsystems to provide an aggregate set of resources in the virtual environment, called a cluster.

Storage networks and arrays

Fibre Channel SAN arrays, iSCSI SAN arrays, and NAS arrays are widely used storage technologies supported by VMware vSphere to meet different data center storage needs. The storage arrays are connected to and shared between groups of servers through storage area networks. This arrangement allows aggregation of the storage resources and provides more flexibility in provisioning them to virtual machines.

IP networks

Each compute server can have multiple physical network adapters to provide high bandwidth and reliable networking to the entire VMware vSphere data center.

vCenter Server

vCenter Server provides a single point of control to the data center. It provides essential data center services such as access control, performance monitoring, and configuration. It unifies the resources from the individual computing servers to be shared among virtual machines in the entire data center. It does this by managing the assignment of virtual machines to the computing servers and the assignment of resources to the virtual machines within a given computing server based on the policies that the system administrator sets.

Computing servers continue to function even in the unlikely event that vCenter Server becomes unreachable (for example, if the network is severed). Servers can be managed separately and continue to run the virtual machines assigned to them based on the resource assignment that was last set. After connection to vCenter Server is restored, it can manage the data center as a whole again.

Management clients

VMware vSphere provides several interfaces for data center management and virtual machine access. These interfaces include vSphere Web Client for access through a web browser or vSphere Command-Line Interface (vSphere CLI).

vSphere Software Components

VMware vSphere is a suite of software components for virtualization. These include ESXi, vCenter Server, and other software components that fulfill a number of different functions in the vSphere environment.

vSphere includes the following software components:

ESXi

A virtualization platform that you use to create the virtual machines as a set of configuration and disk files that together perform all the functions of a physical machine.

Through ESXi, you run the virtual machines, install operating systems, run applications, and configure the virtual machines. Configuration includes identifying the virtual machine's resources, such as storage devices.

The server provides bootstrapping, management, and other services that manage your virtual machines.

vCenter Server

A service that acts as a central administrator for VMware ESXi hosts that are connected on a network. vCenter Server directs actions on the virtual machines and the virtual machine hosts (the ESXi hosts).

vCenter Server is a single Windows or Linux Service and is installed to run automatically. vCenter Server runs continuously in the background. It performs its monitoring and managing activities even when no vSphere Web Clients are connected and when no one is logged on to the computer where it resides. It must have network access to all the hosts it manages and be available for network access from any machine where the vSphere Web Client is run.

You can install vCenter Server in a Windows virtual machine on an ESXi host, allowing it to take advantage of the high-availability that is provided by VMware HA. See the *vSphere Installation and Setup* documentation for details about setting up this configuration.

vCenter Single Sign-On

A service that is part of the vCenter Server management infrastructure. The vCenter Single Sign-On authentication service makes the VMware cloud infrastructure platform more secure by allowing the various vSphere software components to communicate with each other through a secure token exchange mechanism, instead of requiring each component to authenticate a user separately with a directory service like Active Directory.

When you install vCenter Single Sign-On, the following components are deployed.

STS (Security Token Service)

STS certificates enable a user who has logged on through vCenter Single Sign-On to use any vCenter service that vCenter Single Sign-On supports without authenticating to each one. The STS service

issues Security Assertion Markup Language (SAML) tokens. These security tokens represent the identity of a user in one of the identity source types supported by vCenter Single Sign-On.

Administration server

The administration server allows users with administrator privileges to vCenter Single Sign-On to configure the vCenter Single Sign-On server and manage users and groups from the vSphere Web Client. Initially, only the user administrator@vsphere.local has these privileges.

vCenter Lookup Service

vCenter Lookup Service contains topology information about the vSphere infrastructure, enabling vSphere components to connect to each other securely. Unless you are using Simple Install, you are prompted for the Lookup Service URL when you install other vSphere components. For example, the Inventory Service and the vCenter Server installers ask for the Lookup Service URL and then contact the Lookup Service to find vCenter Single Sign-On. After installation, the Inventory Service and vCenter Server system are registered in vCenter Lookup Service so other vSphere components, like the vSphere Web Client, can find them.

VMware Directory Service

Directory service associated with the vsphere.local domain. This service is a multi-tenanted, multi-mastered directory service that makes an LDAP directory available on port 11711. In multisite mode, an update of VMware Directory Service content in one VMware Directory Service instance results in the automatic update of the VMware Directory Service instances associated with all other vCenter Single Sign-On nodes.

vCenter Server plug-ins

Applications that provide additional features and functionality to vCenter Server. Typically, plug-ins consist of a server component and a client component. After the plug-in server is installed, it is registered with vCenter Server and the plug-in client is available to the vSphere Web Client for download. After a plug-in is installed on the vSphere Web Client, it might alter the interface by adding views, tabs, toolbar buttons, or menu options related to the added functionality.

Plug-ins leverage core vCenter Server capabilities, such as authentication and permission management, but can have their own types of events, tasks, metadata, and privileges.

Some vCenter Server features are implemented as plug-ins, and can be managed using the vSphere Web Client Plug-in Manager. These features include vCenter Storage Monitoring, vCenter Hardware Status, and vCenter Service Status.

vCenter Server database

A persistent storage area for maintaining the status of each virtual machine, host, and user managed in the vCenter Server environment. The vCenter Server database can be remote or local to the vCenter Server system.

The database is installed and configured during vCenter Server installation.

If you are accessing your ESXi host directly through the vSphere Web Client, and not through a vCenter Server system and associated vSphere Web Client, you do not use a vCenter Server database.

tcServer

Many vCenter Server functions are implemented as Web services that require the tcServer. The tcServer is installed on the vCenter Server machine as part of the vCenter Server installation.

Features that require the tcServer to be running include: lCIM/Hardware Status tab, Performance charts, WebAccess, Storage Policy-Based services, and vCenter Service status.

vCenter Server agent

On each managed host, the software that collects, communicates, and executes the actions received from vCenter Server. The vCenter Server agent is installed the first time any host is added to the vCenter Server inventory.

Host agent

On each managed host, the software that collects, communicates, and executes the actions received through the vSphere Web Client. It is installed as part of the ESXi installation.

Client Interfaces for vSphere

You have several ways to access vSphere components through vSphere interface options.

vSphere interface options include:

vSphere Web Client

The vSphere Web Client is a Web application installed on a machine with network access to your vCenter Server installation. The vSphere Web Client is the primary interface for connecting to and managing vCenter Server instances.

vSphere Client

The vSphere Client is installed on a Windows machine with network access to your ESXi or vCenter Server system installation. The interface displays slightly different options depending on which type of server you are connected to. A single vCenter Server system or ESXi host can support multiple, simultaneously connected vSphere Clients.

For more information about the the vSphere Client, see *vSphere Single Host Management*.

vSphere Command-Line Interface

A command-line interface for configuring an ESXi host.

See Chapter 10, "Starting and Stopping the vSphere Components," on page 109 for information and instructions about starting and stopping ESXi hosts and vCenter Server.

vSphere Managed Inventory Objects

In vSphere, the inventory is a collection of virtual and physical objects on which you can place permissions, monitor tasks and events, and set alarms. You can group most inventory objects by using folders to more easily manage them.

All inventory objects, with the exception of hosts, can be renamed to represent their purposes. For example, they can be named after company departments or locations or functions. vCenter Server monitors and manages the following components of your virtual and physical infrastructure:

Data Centers

Unlike a folder, which is used to organize a specific object type, a data center is an aggregation of all the different types of objects needed to do work in virtual infrastructure: hosts, virtual machines, networks, and datastores.

Within a data center there are four separate hierarchies.

- Virtual machines (and templates)
- Hosts (and clusters)
- Networks
- Datastores

The data center defines the namespace for networks and datastores. The names for these objects must be unique within a data center. For example, you cannot have two datastores with the same name within a single data center, but you can have two datastores with the same name in two different data centers. Virtual machines, templates, and clusters need not be unique within the data center, but must be unique within their folder.

Objects with the same name in two different data centers are not necessarily the same object. Because of this, moving objects between data centers can create unpredictable results. For example, a network named networkA in data_centerA might not be the same network as a network named networkA in data_centerB. Moving a virtual machine connected to networkA from data_centerA to data_centerB results in the virtual machine changing the network it is connected to.

Managed objects also cannot exceed 214 bytes (UTF-8 encoded).

Clusters

A collection of ESXi hosts and associated virtual machines intended to work together as a unit. When you add a host to a cluster, the host's resources become part of the cluster's resources. The cluster manages the resources of all hosts.

If you enable VMware EVC on a cluster, you can ensure that migrations with vMotion do not fail because of CPU compatibility errors. If you enable vSphere DRS on a cluster, the resources of the hosts in the cluster are merged to allow resource balancing for the hosts in the cluster. If you enable vSphere HA on a cluster, the resources of the cluster are managed as a pool of capacity to allow rapid recovery from host hardware failures.

Datastores

A virtual representation of underlying physical storage resources in the data center. A datastore is the storage location for virtual machine files. These physical storage resources can come from the local SCSI disk of the ESXi host, the Fibre Channel SAN disk arrays, the iSCSI SAN disk arrays, or Network Attached Storage (NAS) arrays. Datastores hide the idiosyncrasies of the underlying physical storage and present a uniform model for the storage resources required by virtual machines.

Folders

Folders allow you to group objects of the same type so you can easily manage them. For example, you can use folders to set permissions across objects, to set alarms across objects, and to organize objects in a meaningful way.

A folder can contain other folders, or a group of objects of the same type: data centers, clusters, datastores, networks, virtual machines, templates, or hosts. For example, one folder can contain hosts and a folder containing hosts, but it cannot contain hosts and a folder containing virtual machines.

data center folders form a hierarchy directly under the root vCenter Server and allow users to group their data centers in any convenient way. Within each data center is one hierarchy of folders with virtual machines and templates, one with hosts and clusters, one with datastores, and one with networks.

Hosts

The physical computer on which ESXi is installed. All virtual machines run on hosts.

Networks

A set of virtual network interface cards (virtual NICs), distributed switches or vSphere Distributed Switches, and port groups or distributed port groups that connect virtual machines to each other or to the physical network outside of the virtual data center. All virtual machines that connect to the same port group belong to the same network in the virtual environment, even if they are on different physical servers. You can monitor networks and set permissions and alarms on port groups and distributed port groups.

Resource pools

Resource pools are used to compartmentalize the CPU and memory resources of a host or cluster. Virtual machines execute in, and draw their resources from, resource pools. You can create multiple resource pools as direct children of a standalone host or cluster and then delegate control over them to other individuals or organizations.

vCenter Server provides, through the DRS components, various options in monitoring the status of the resources and adjusting or suggesting adjustments to the virtual machines using the resources. You can monitor resources and set alarms on them.

Templates

A master copy of a virtual machine that can be used to create and provision new virtual machines. Templates can have a guest operating system and application software installed, and can be customized during deployment to ensure that the new virtual machine has a unique name and network settings.

Virtual machines

A virtualized computer environment in which a guest operating system and associated application software can run. Multiple virtual machines can operate on the same managed host machine concurrently.

vApps

vSphere vApp is a format for packaging and managing applications. A vApp can contain multiple virtual machines.

Optional vCenter Server Components

Optional vCenter Server components are packaged and installed with the base product, but might require a separate license.

Optional vCenter Server features include:

vMotion

A feature that enables you to move running virtual machines from one ESXi host to another ESXi host without service interruption. It requires licensing on both the source and target host. vCenter Server centrally coordinates all vMotion activities.

Storage vMotion

A feature that allows you to move the disks and configuration file of a running virtual machine from one datastore to another without service interruption. It requires licensing on the virtual machine's host.

vSphere HA

A feature that enables a cluster with High Availability. If a host goes down, all virtual machines that were running on the host are promptly restarted on different hosts in the same cluster.

When you enable the cluster for vSphere HA, you specify the number of hosts you want to be able to recover. If you specify the number of host failures allowed as **1**, vSphere HA maintains enough capacity across the cluster to tolerate the failure of one host. All running virtual machines on that host can be restarted on remaining hosts. By default, you cannot turn on a virtual machine if doing so violates required failover capacity. See the *vSphere Availability* documentation for more information.

vSphere DRS

A feature that helps improve resource allocation and power consumption across all hosts and resource pools. vSphere DRS collects resource usage information for all hosts and virtual machines in the cluster and gives recommendations (or migrates virtual machines) in one of two situations:

- Initial placement – When you first power on a virtual machine in the cluster, DRS either places the virtual machine or makes a recommendation.
- Load balancing – DRS attempts to improve resource utilization across the cluster by performing automatic migrations of virtual machines (vMotion) or by providing a recommendation for virtual machine migrations.

vSphere DRS includes distributed power management (DPM) capabilities. When DPM is enabled, the system compares cluster-level and host-level capacity to the demands of virtual machines running in the cluster. Based on the results of the comparison, DPM recommends (or implements) actions that can reduce the power consumption of the cluster.

Storage DRS

A feature that enables you to manage multiple datastores as a single compute resource, called a datastore cluster. A datastore cluster is an aggregation of multiple datastores into a single logical, load-balanced pool. You can treat the datastore cluster as a single flexible storage resource for resource management purposes. You can assign a virtual disk to a datastore cluster, and Storage DRS finds an appropriate datastore for it. The load

balancer takes care of initial placement and future migrations based on workload measurements. Storage space balancing and I/O balancing minimize the risk of running out of space and the risk of I/O bottlenecks slowing the performance of virtual machines.

vSphere Fault Tolerance vSphere Fault Tolerance provides continuous availability for virtual machines by creating and maintaining a Secondary VM that is identical to, and continuously available to replace, the Primary VM in the event of a failover situation.

vCenter Server Plug-Ins

vCenter Server plug-ins extend the capabilities of vCenter Server by providing more features and functions.

Some plug-ins are installed as part of the base vCenter Server product.

vCenter Storage Monitoring Allows you to review information on storage usage and to visually map relationships between all storage entities available in vCenter Server.

vCenter Hardware Status Uses CIM monitoring to display the hardware status of hosts that vCenter Server manages.

vCenter Service Status Displays the status of vCenter services.

Some plug-ins are packaged separately from the base product and require separate installation. You can update plug-ins and the base product independently of each other. VMware modules include:

vSphere Update Manager (VUM) Enables administrators to apply updates and patches across ESXi hosts and all managed virtual machines. Administrators can create user-defined security baselines that represent a set of security standards. Security administrators can compare hosts and virtual machines against these baselines to identify and remediate systems that are not in compliance.

vShield Zones An application-aware firewall built for vCenter Server integration. vShield Zones inspects client-server communications and communications between virtual machines to provide detailed traffic analytics and application-aware firewall partitioning. vShield Zones is a critical security component for protecting virtualized data centers from network-based attacks and misuse.

vRealize Orchestrator A workflow engine that enables you to create and run automated workflows in your vSphere environment. vRealize Orchestrator coordinates workflow tasks across multiple VMware products and third-party management and administration solutions through its open plug-in architecture. vRealize Orchestrator provides a library of workflows that are extensible. You can use any operation available in the vCenter Server API to customize vRealize Orchestrator workflows.

Using the vSphere Web Client 2

Use the vSphere Web Client to connect to vCenter Server systems and manage vSphere inventory objects.

Use of the vSphere Web Client requires a supported Web browser.

VMware has tested and supports the following guest operating systems and browser versions for the vSphere Web Client.

Table 2-1. Supported guest operating systems and browser versions for the vSphere Web Client .

Operating system	Browser
Windows 32-bit and 64-bit	Microsoft Internet Explorer 10 and 11. Mozilla Firefox: the latest browser version, and the one previous version at the time of the vSphere 6.0 release. Google Chrome: the latest browser version, and the one previous version at the time of the vSphere 6.0 release.
Mac OS	Mozilla Firefox: the latest browser version, and the one previous version at the time of the vSphere 6.0 release. Google Chrome: the latest browser version, and the one previous version at the time of the vSphere 6.0 release.

Later versions of these browsers are likely to work, but have not been tested.

The vSphere Web Client requires the Adobe Flash Player version 11.9 or later to be installed with the appropriate plug-in for your browser.

This chapter includes the following topics:

- "Log in to vCenter Server by Using the vSphere Web Client," on page 24
- "Log Out of vCenter Server Using the vSphere Web Client," on page 24
- "Use the vSphere Web Client Navigator," on page 25
- "Use the vSphere Web Client Inventory Tree," on page 25
- "Customize the User Interface," on page 26
- "Install the Client Integration Plug-In," on page 27
- "Pause and Resume a Task in Progress," on page 28
- "Refresh Data," on page 28
- "Searching the Inventory," on page 29
- "Use Quick Filters," on page 31
- "View Recent Objects," on page 33

- "Configure the vSphere Web Client Timeout Value," on page 34
- "Remove Stored User Data," on page 34
- "Drag and Drop Objects," on page 35
- "Export Lists," on page 35
- "Keyboard Shortcuts," on page 36

Log in to vCenter Server by Using the vSphere Web Client

Log in to vCenter Server by using the vSphere Web Client to manage your vSphere inventory.

Prerequisites

If you want to use vCenter Server 5.0 with vSphere Web Client, verify that the vCenter Server 5.0 system is registered with vSphere Web Client.

If you want to use vCenter Server 5.1 or vCenter Server 5.5 with vSphere Web Client, verify that vCenter Server is installed and that both vCenter Server and vSphere Web Client point to the same vCenter Single Sign-On instance.

In vSphere 6.0, the vSphere Web Client is installed as part of the vCenter Server on Windows or the vCenter Server Appliance deployment. This way, the vSphere Web Client always points to the same vCenter Single Sign-On instance.

Procedure

1. Open a Web browser and enter the URL for the vSphere Web Client: `https://client-hostname/vsphere-client`.
2. Enter the credentials of a user who has permissions on vCenter Server, and click **Login**.
3. If a warning message about an untrusted SSL certificate appears, select the appropriate action based on your security policy.

Option	Action
Ignore the security warning for this login session only.	Click **Ignore**.
Ignore the security warning for this login session, and install the default certificate so that the warning does not appear again.	Select **Install this certificate and do not display any security warnings for this server** and click **Ignore**. Select this option only if using the default certificate does not present a security problem in your environment.
Cancel and install a signed certificate before proceeding.	Click **Cancel** and ensure that a signed certificate is installed on the vCenter Server system before you attempt to connect again.

The vSphere Web Client connects to all the vCenter Server systems on which the specified user has permissions, allowing you to view and manage your inventory.

Log Out of vCenter Server Using the vSphere Web Client

Log out of your vSphere Web Client to disconnect from the vCenter Server system.

Procedure

- Click the username at the top of the vSphere Web Client window and select **Logout**.

Use the vSphere Web Client Navigator

You can use the navigator to browse and select objects in the vSphere Web Client inventory as an alternative to the hierarchical inventory tree.

Unlike the inventory tree, which presents hierarchical arrangements of parent and child objects arranged in the Hosts and Clusters, VMs and Templates, Storage, and Networking views, the navigator presents a graph-based view of the inventory, which allows you to navigate from an object to its related objects, regardless of type.

Procedure

1 From the vSphere Web Client Home, click **vCenter Inventory Lists**.

2 Under **vCenter Inventory Lists**, click one of the object categories to view objects of that type.

   For example, click **Hosts** to view hosts in the vSphere Web Client inventory.

3 Click an object in the list once to display information about the object in the center pane of the vSphere Web Client.

4 (Optional) Click the object again to open it.

   Opening an object brings it to the top of the navigator and displays related object categories beneath it.

   For example, opening a host allows you to see the child resource pools, virtual machines, vApps, datastores, standard networks, distributed switches, and distributed port groups associated with this host.

5 Click one of the tabs in the center pane to access additional information and actions.

Option	Description
Getting Started	View introductory information and access basic actions.
Summary	View basic status and configuration for an object.
Monitor	View alarms, performance data, resource allocation, events, and other status information for an object.
Manage	Configure settings, alarm definitions, tags, and permissions.
Related Objects	View related objects.

Use the vSphere Web Client Inventory Tree

You can use the inventory tree in the vSphere Web Client to browse and select objects as an alternative to the navigator.

The inventory tree shows a hierarchical arrangement of objects in four different views: Hosts and Clusters, VMs and Templates, Storage, or Networking.

Procedure

1 From the vSphere Web Client Home, click **vCenter Inventory Lists**.

2 Under **Inventory Trees**, click one of the four categories to display one of the tree views.

3 Click the triangle next to any object to expand the tree and show the child objects.

4 Select an object in the inventory tree to display information about the object in the center pane.

5 (Optional) Click the selected object to shift to the navigator and bring the object into focus.

6 Click one of the tabs in the center pane to access additional information and actions.

Option	Description
Getting Started	View introductory information and access basic actions.
Summary	View basic status and configuration for an object.
Monitor	View alarms, performance data, resource allocation, events, and other status information for an object.
Manage	Configure settings, alarm definitions, tags, and permissions.
Related Objects	View related objects.

Customize the User Interface

You can customize the look and feel of vSphere Web Client to improve your experience while you perform your tasks.

After you customize the user interface, vSphere Web Client saves the individual user interface customization.

- Rearrange the Components of the User Interface on page 26

  You can rearrange the sidebars in the vSphere Web Client user interface. You can move the sidebars and Navigator pane around the content area to enhance your personal experience by customizing the vSphere Web Client user interface . You change the interface at any time.

- Customize the User Interface by Using the Layout Settings Menu on page 26

  You can customize the user interface of vSphere Web Client by choosing to hide or display different sidebars.

- Disable the Customizable User Interface Feature on page 27

  You can disable the customizable user interface feature by changing the `webclient.properties` file of vCenter Server or vCenter Server Appliance.

Rearrange the Components of the User Interface

You can rearrange the sidebars in the vSphere Web Client user interface. You can move the sidebars and Navigator pane around the content area to enhance your personal experience by customizing the vSphere Web Client user interface . You change the interface at any time.

Procedure

1 In a Web browser, log in to vSphere Web Client.

2 Drag and drop the sidebar you want to move to an appropriate place.

While you hover the sidebar you see two types of arrows. Single arrows move as you hover from one part of the UI to another. Both single and double arrows indicate the target position of the sidebar you want to move.

Customize the User Interface by Using the Layout Settings Menu

You can customize the user interface of vSphere Web Client by choosing to hide or display different sidebars.

Procedure

1 In a Web browser, log in to vSphere Web Client.

2 Click the user name at the top of the vSphere Web Client window and select **Layout Settings**.

3 In the Layout Settings window, select the sidebars that you want the UI to display.

4 Click **OK** to save the changes.

Disable the Customizable User Interface Feature

You can disable the customizable user interface feature by changing the `webclient.properties` file of vCenter Server or vCenter Server Appliance.

Procedure

1 Connect to the vCenter Server or vCenter Server Appliance by using any remote console, and optionally use SSH.

2 Navigate to the `webclient.properties` file and open it in a text editor.

Option	Description
vCenter Server	*installation_directory*\VMware\CIS\cfg\vsphere-client\webclient.properties
vCenter Server Appliance	/etc/vmware/vsphere-client/webclient.properties

3 On a new line, enter **`docking.disabled=true`** and save the file.

Install the Client Integration Plug-In

The Client Integration Plug-in provides access to a virtual machine's console in the vSphere Web Client, and provides access to other vSphere infrastructure features. The Client Integration Plug-in also lets you log in to the vSphere Web Client by using Windows session credentials.

You use the Client Integration Plug-in to deploy OVF or OVA templates and transfer files with the datastore browser. You can also use the Client Integration Plug-in to connect virtual devices that reside on a client computer to a virtual machine.

Install the Client Integration Plug-in only once to enable all the functionality the plug-in delivers. You must close the Web browser before installing the plug-in.

If you install the Client Integration Plug-in from an Internet Explorer browser, you must first disable Protected Mode and enable pop-up windows on your Web browser. Internet Explorer identifies the Client Integration Plug-in as being on the Internet instead of on the local intranet. In such cases, the plug-in is not installed correctly because Protected Mode is enabled for the Internet.

For information about supported browsers and operating systems, see the *vSphere Installation and Setup* documentation.

Watch the video "Installing the Client Integration Plug-In" for information about the Client Integration Plug-In:

Installing the Client Integration Plug-In (http://link.brightcove.com/services/player/bcpid2296383276001?bctid=ref:video_client_plug_in)

Prerequisites

If you use Microsoft Internet Explorer, disable Protected Mode.

Procedure

1 In the vSphere Web Client, navigate to a link to download the Client Integration Plug-in.

Option	Description
vSphere Web Client login page	a Open a Web browser and type the URL for the vSphere Web Client. b At the bottom of the vSphere Web Client login page, click **Download Client Integration Plug-in**. NOTE If the Client Integration Plug-In is already installed on your system, you will not see the link to download the plug-in. If you uninstall the Client Integration Plug-In, the link to download it will display on the vSphere Web Client login page.
OVF deployment wizard	a Select a host in the inventory and select **Actions > All vCenter Actions > Deploy OVF Template**. b Click **Download Client Integration Plug-in**.

2 If the browser blocks the installation either by issuing certificate errors or by running a pop-up blocker, follow the Help instructions for your browser to resolve the problem.

Pause and Resume a Task in Progress

You can pause many tasks in the vSphere Web Client and later resume them from the Work in Progress pane.

Procedure

1 In a dialog box or wizard, click the minimize button.

The task is paused and minimized to the Work in Progress pane. Any changes that you have made in the dialog box or wizard are saved, but not yet applied to the object you are working with.

2 When you are ready to resume the task, click it in the Work in Progress pane.

The dialog box or wizard opens and you can resume the task from where you left off.

Refresh Data

You must manually refresh the data in the vSphere Web Client to see changes made to objects by other users during your session.

For performance reasons, the vSphere Web Client does not continuously refresh data on all objects in the inventory. All changes that you make during your current session are immediately reflected in the client user interface. Change made by other users or in other sessions are not reflected until you manually refresh the data.

Procedure

◆ To update all data in the current vSphere Web Client view, click the refresh icon ( ).

The client view is updated. The date and time of the last refresh are displayed next to the refresh icon.

Searching the Inventory

With vSphere Web Client, you can search the inventory for objects that match specified criteria. You can search the inventories of all vCenter Server systems connected to the same Platform Services Controller or to Platform Services Controllers.

You can only view and search for inventory objects that you have permission to view.

NOTE If your permissions change while you are logged in, the search service might not immediately recognize these changes. To ensure that your search is performed with up-to-date permissions, log out of all your open sessions and log in again before you perform the search.

- Perform a Quick Search on page 29

  A quick search searches all types of objects for the specified search term in the name or other properties of the object.

- Perform a Simple Search on page 30

  A simple search searches all types of objects for the specified search term in the name of the object.

- Perform an Advanced Search on page 30

  With Advanced search, you can search for managed objects that meet multiple criteria.

- Save a Search on page 31

  You can save search queries so that you can retrieve them to rerun later.

- Load a Saved Search on page 31

  You can load a saved search query to rerun the search.

Perform a Quick Search

A quick search searches all types of objects for the specified search term in the name or other properties of the object.

Procedure

1. Type the search term in the search box at the top right of the client window.

   Multiple search terms in a quick or simple search are treated as if they are connected by ORs. For example, searching for `example machine` finds all objects with names containing either "example" or "machine".

   The search results appear below the search box as you type. The number of items displayed is limited to 10.

2. (Optional) Click any item in the search results to display that item in the inventory.

3. (Optional) To see more search results or more details about the search results, click **Show All Results**.

   a (Optional) Select an object in the results table to see additional information about the object.

   b (Optional) Double-click any item in the search results to display that item in the inventory.

   The search results are listed in a table. If differing types of objects are found, the table contains tabs for each type of object. For example, if a search finds hosts and datastores, the following tabs appear: **Datastore**, showing only datastore results and **Host**, showing only host results.

Perform a Simple Search

A simple search searches all types of objects for the specified search term in the name of the object.

Procedure

1 From the vSphere Web Client Home screen, click **New Search**

2 Type the search term in the search box and press Enter.

Multiple search terms in a quick or simple search are treated as if they are connected by ORs. For example, searching for `example machine` finds all objects with names containing either "example" or "machine".

The search results are listed in a table. If differing types of objects are found, the table contains tabs for each type of object. For example, if a search finds hosts and datastores, the following tabs appear: **Datastore**, showing only datastore results and **Host**, showing only host results.

3 (Optional) Select an object in the results table to see additional information about the object.

4 (Optional) Double-click any item in the search results to display that item in the inventory.

Perform an Advanced Search

With Advanced search, you can search for managed objects that meet multiple criteria.

For example, you can search for virtual machines whose name contains a particular string that reside on a particular host.

Procedure

1 From the vSphere Web Client Home, click **New Search** and then click **Advanced Search**.

2 Select the type of object to search for from the **Search for** drop-down menu.

3 Select how to combine the search criteria.

Option	Description
any	The search returns results that match any of the specified criteria.
all	The search returns only results that match all of the specified criteria.

4 Select a property to search for from the drop-down menu.

The properties available depend on the type of object you are searching for.

5 Select the relationship between the search term and the property from the drop-down menu.

The options available in this step depend on the property selected in the previous step. For example, if you select a **Name** property, the options available are **contains**, **is**, and **is not**.

6 Type or select the search term.

7 (Optional) To add additional search criteria, click **Add new criteria** and repeat Step 4 to Step 6.

8 (Optional) To add an additional search, click **Add another object type** and repeat Step 2 to Step 7.

9 Click **Search**.

Search results are displayed in the details pane and in the navigator.

10 (Optional) Click any item in the navigator to see its details without leaving the context of the search.

11 (Optional) Double-click any item in the details pane to display that item in the inventory.

Save a Search

You can save search queries so that you can retrieve them to rerun later.

Procedure

1 Enter a query for either a simple or advanced search.

2 Click **Save**.

3 Type a name for the search and click **OK**.

The search query you entered is saved. You can reload that query later and repeat the search.

Load a Saved Search

You can load a saved search query to rerun the search.

The vSphere Web Client saves search queries, not search results. When you load a saved search, the search query is run again and new results are displayed.

Procedure

1 From the vSphere Web Client Home, click **Saved Searches**.

2 Click the saved search.

The search runs and the results are displayed.

Use Quick Filters

You can use quick filters to find an object or a set of objects in your vSphere Web Client inventory that fit certain criteria.

Quick filters are available in the list views, which appear in the **Objects** tab of an inventory list, on the **Related Objects** tab, and in search results.

For example, you can use the quick filter options for virtual machines to find all virtual machines in your vSphere inventory that are powered on but do not have VMware Tools running.

Procedure

1 From the vSphere Web Client, open a list view.

You can access list views of objects from the **Inventory Lists**, the **Related Objects** tab, and the search results.

2 Click **Show and hide quick filters** ( ) next to the filter box, and select from the available options.

A list of inventory objects that meet your selection criteria is displayed.

What to do next

To clear the filtered list of vSphere inventory objects, deselect the filter criteria or click **Clear** next to the filter group name.

Quick Filters Available for vSphere Objects

Various types of quick filters are available for the vSphere objects in your inventory. No quick filters are available for linked vCenter Server systems, host profiles, and extensions.

Tags are a quick filter option available for all types of vSphere objects, except for linked vCenter Server systems, host profiles, and extensions. You can filter data centers, vApps, and resource pools only by using the tags that are assigned to them. For datastores, clusters, hosts, virtual machines, and VM templates, you can use a number of different quick filters.

Quick Filters for Datastores

You can filter datastores by the following criteria:

- Tags
- Type
- Belongs to Datastore Cluster
- Accessibility
- Maintenance Mode
- Drive Type
- % Free Space
- Storage I/O Control

Quick Filters for Clusters

You can filter clusters by the following criteria:

- Tags
- vSphere DRS
- vSphere HA

Quick Filters for Hosts

You can filter hosts by the following criteria:

- Tags
- Connection State
- Maintenance Mode
- Standalone or Clustered
- Power State
- CPU Count
- NIC Count
- ESX/ESXi Version
- vMotion
- HA State
- FT Support
- EVC Mode

Quick Filters for Virtual Machines

You can filter virtual machines by the following criteria:

- Tags
- State
- Needs Consolidation
- Blocked by Question
- FT Role
- VMware Tools Version Status
- VMware Tools Running Status
- EVC Mode
- Guest OS
- Compatibility
- CPU Count
- NIC Count

Quick Filters for VM Templates

You can filter virtual machine templates by the following criteria:

- Tags
- VMware Tools Version Status
- Guest OS
- Compatibility
- CPU Count
- NIC Count

View Recent Objects

You can quickly navigate to the objects that you visited during your vSphere Web Client session. You can go back and forth between objects you last visited without having to search for the objects in the object navigator or in the inventory tree.

In the **Recent Objects** drop-down menu, you can see a history of the most recent objects that you visited in your environment. Recent objects display two types of objects, the most recent objects that you visited, and the latest objects that you created. The recent objects list is persistent between vSphere Web Client sessions, but the new objects list is not persistent between vSphere Web Client sessions.

Procedure

1. In the vSphere Web Client object navigator, click **Recent Objects** ( ).

2 From the **Recent Objects** drop-down menu, select the object that you want to view.

Objects are listed in two types depending on whether you visited or created the object.

Option	Description
Recent Objects	The last objects that you visited in the vSphere Web Client inventory.
New Objects	The latest objects that you created in the vSphere Web Client inventory.

You have navigated to the object that you selected in the **Recent Objects** menu.

Configure the vSphere Web Client Timeout Value

By default, vSphere Web Client sessions terminate after 120 minutes of idle time, requiring the user to log in again to resume using the client. You can change the timeout value by editing the `webclient.properties` file.

Procedure

1 On the computer where the vSphere Web Client is installed, locate the `webclient.properties` file.

The location of this file depends on the operating system on which the vSphere Web Client is installed.

Operating System	File path
Windows 2008	`C:\ProgramData\VMware\vCenterServer\cfg\vsphere-client`
vCenter Server Appliance	`/etc/vmware/vsphere-client/`

2 Edit the file to include the line `session.timeout = value` where value is the timeout value in minutes. Uncomment the line, if necessary.

To set the client to never time out, specify a negative or 0 value for the timeout.

For example, to set the timeout value to 60 minutes, include the line `session.timeout = 60`.

3 Restart the vSphere Web Client service.

- On Windows operating systems, restart the VMware vSphere Web Client service.
- On the vCenter Server Appliance, restart the vSphere-client service.

Remove Stored User Data

The vSphere Web Client stores user data including saved searches, Work In Progress items, and Getting Started Pages preferences. You can remove this stored data to reset these items to the initial defaults and remove stored data that you no longer need.

You can remove data only for the currently logged-in user. Data stored by other users is not affected.

Procedure

1 In the vSphere Web Client, click the name of the currently logged-in user and select **Remove Stored Data**.

2 Select the data to remove.

Option	Description
"Work in progress" items	All current Work In Progress items for this user are removed.
Getting Started Pages preferences	All Getting Started pages preferences for this user are removed. All Getting Started pages will be displayed in the vSphere Web Client.
Saved Searches	All Saved Searches for this user are removed.

3 Click **OK**.

Drag and Drop Objects

You can select an inventory object, and while holding the left mouse button you can drag and drop it to another object. Drag and drop is an alternative way to quickly initiate operations that are available in the context menu, such as **Move To** and **Migrate**.

For completing some drag-and-drop operations, you do not need to perform any additional actions. For completing others, you might have to go through a wizard.

Procedure

1 In the vSphere Web Client inventory tree or in a list view, select an inventory object group.

   You can drag-and-drop objects within the vSphere Web Client inventory tree, or from a list view to the inventory tree.

   You can access list views from the **Inventory Lists**, the **Related Objects** tab, and search results.

2 Drag an object to a destination object.

   The mouse cursor changes depending on whether you can drop the object to the object you currently point to.

   Table 2-2. Mouse icons indicating possible drag and drop operations

Icon	Description
	You can drop the object that you are dragging into this object.
	You cannot drop the object that you are dragging into this object.

3 Drop the object on the destination object.

   A task starts in the Recent Tasks panel.

4 (Optional) If a wizard opens, follow the prompts to complete the drag-and-drop operation.

The object is moved to the destination object you selected.

Export Lists

You can export the contents of an inventory list view to a CSV file.

Procedure

1 From the vSphere Web Client, open a list view.

   You can access list views of objects from the **Inventory Lists**, the **Related Objects** tab, and the search results.

2 Click **Export List** ( ) at the bottom right corner of a list view.

   The Export List Contents dialog box opens and lists the available options for inclusion in the CSV file.

3 Select whether you want all rows or your current selection of rows to be listed in the CSV file.

4 From the available options, select the columns you want listed in the CSV file.

5 Click **Generate CSV Report**.

6 Click **Save** and provide location on your local machine to save the report.

Keyboard Shortcuts

Keyboard shortcuts allow you to quickly navigate or perform a task in the vSphere Web Client.

Inventory Keyboard Shortcuts

With inventory keyboard shortcuts you can quickly navigate to different inventories in the vSphere Web Client.

Table 2-3. Inventory Keyboard Shortcuts

Keyboard Combination	Action
Ctrl+Alt+s	Quick search
Ctrl+Alt+Home or Ctrl+Alt+1	Home
Ctrl+Alt+2	vCenter Server inventory
Ctrl+Alt+3	Hosts and Clusters inventory
Ctrl+Alt+4	Virtual Machines and Templates inventory
Ctrl+Alt+5	Datastores and Datastores Clusters inventory
Ctrl+Alt+6	Networking inventory

Create a Scheduled Task with a Keyboard Shortcut

You can use a keyboard shortcut to create a scheduled task.

For more information about how to schedule tasks, see "Schedule Tasks," on page 105.

Procedure

1 Select the **Actions** menu and press Ctrl.

The clock icon ( ) appears next to the action that you can schedule.

2 Select the action and configure the scheduling options.

3 Navigate to the object in the inventory.

Configuring Hosts and vCenter Server 3

Configuring ESXi hosts, vCenter Server systems, and the vSphere Web Client involves several tasks.

This chapter includes the following topics:

- "Host Configuration," on page 37
- "Synchronizing Clocks on the vSphere Network," on page 39
- "Configuring vCenter Server," on page 40
- "Using Enhanced Linked Mode," on page 58
- "Configuring Communication Among ESXi, vCenter Server, and the vSphere Web Client," on page 58

Host Configuration

Before you create virtual machines on your hosts, you must configure the hosts to ensure that they have correct licensing, network and storage access, and security settings. Each type of host has a manual that provides information on the configuration for that host.

For information on configuring a host, see the configuration information for the specific vSphere component in the *vSphere Security* documentation, the *vSphere Storage* documentation, or the *vSphere Networking* documentation.

Configure the Boot Device on an ESXi Host

On servers running ESXi, you can select the device that the server boots from.

Procedure

1. Select a host in the inventory.
2. Click the **Manage** tab.
3. Click **Settings**.
4. Select **Processors** and click **Boot Options**.
5. Select a boot device from the drop-down menu.
6. (Optional) To reboot immediately from the device you have selected, select **Apply and Reboot on OK**.

   If you do not select **Apply and Reboot on OK**, the new setting takes effect when the host is next rebooted.
7. Click **OK**.

Configure Agent VM Settings

You can configure the datastore and network settings for the ESX agent virtual machines that you deploy on a host.

An ESX agent is a virtual machine, or a virtual machine and a vSphere Installation Bundle (VIB), that extend the functions of an ESXi host to provide additional services that a vSphere solution requires.

For example, a solution might require a particular network filter or firewall configuration to function. A solution can use an ESX agent to connect to the vSphere Hypervisor and extend the host with functions specific to that solution. For example, the ESX agent can filter network traffic, act as a firewall, or gather other information about the virtual machines on the host.

When you configure the datastore and network settings for ESX agents on a host, all of the ESX agents that you deploy on the host use that datastore and network configuration.

Important ESX agents are not deployed if you do not configure the network and datastore settings.

Procedure

1 Select a host in the vSphere Web Client inventory.

2 Click the **Manage** tab to display configuration information for the host.

3 Click **Settings**.

4 Select **Agent VM Settings**.

The current settings for the ESX agents on the host, if any, appear.

5 Click **Edit**.

6 From the **Datastore** drop-down menu, select a datastore in which to deploy the ESX agent virtual machines.

7 From the **Network** drop-down menu, select a network to connect the ESX agents.

8 Click **OK**.

What to do next

For information about ESX agents and ESX Agent Manager, see *Developing and Deploying vSphere Solutions, vServices, and ESX Agents*.

Set Advanced Host Attributes

You can set advanced attributes for a host.

Caution Changing advanced options is considered unsupported unless VMware technical support or a KB article instruct you to do so. In all other cases, changing these options is considered unsupported. In most cases, the default settings produce the optimum result.

Procedure

1 Browse to the host in the vSphere Web Client navigator.

2 Click the **Manage** tab and click **Settings**.

3 Under **System**, click **Advanced System Settings**.

4 In Advanced Settings, select the appropriate item.

5 Click the **Edit** button to edit the value.

6 Click **OK**.

Synchronizing Clocks on the vSphere Network

Make sure that components on the vSphere network have their clocks synchronized. If the clocks on the machines in your vSphere network are not synchronized, SSL certificates, which are time-sensitive, might not be recognized as valid in communications between network machines.

Unsynchronized clocks can result in authentication problems, which can cause the installation to fail or prevent the vCenter Server Appliance vpxd service from starting.

Make sure any Windows host machine on which a vCenter component runs is synchronized with the NTP server. See the Knowledge Base article Timekeeping best practices for Windows, including NTP.

Edit Time Configuration for a Host

You can configure the time settings on a host manually, or you can synchronize the time and date of the host by using an NTP server.

Procedure

1 In the vSphere Web Client, navigate to the host in the vSphere inventory.

2 Select **Manage**, and select **Settings**.

3 Under System, select **Time configuration** and click **Edit**.

4 Select an option for setting the time and date of the host.

Option	Description
Manually configure the date and time on this host	Set the time and date for the host manually.
Use Network Time Protocol (Enable NTP client)	Synchronize the time and date of the host with an NTP server. The NTP service on the host periodically takes the time and date from the NTP server. a In the **NTP Servers** text box, type the IP addresses or host names of the NTP servers that you want to use. b From the **NTP Service Startup Policy** drop-down list, select an option for starting and stopping the NTP service on the host. ■ **Start and stop with port usage** - Starts or stops the NTP service when the NTP client port is enabled or disabled for access in the security profile of the host. ■ **Start and stop with host** - Starts and stops the NTP service when the host powers on or shuts down. ■ **Start and stop manually** - Enables manual starting and stopping of the NTP service. You can use the **Start**, **Stop**, or **Restart** buttons to control the status of the NTP service on the host manually at any time no matter of the selected startup policy for the NTP service. For the **Start and stop manually** policy, you always use the buttons to control the status of the NTP service.

5 Click **OK**.

Configuring vCenter Server

You can configure vCenter Server from the vSphere Web Client, including settings such as licensing, statistics collection, logging, and other settings.

Configure License Settings for vCenter Server

You must assign a license to a vCenter Server system before its evaluation period expires or its currently assigned license expires. If you upgrade, combine, or divide vCenter Server licenses in My VMware, you must assign the new licenses to vCenter Server systems.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, navigate to the vCenter Server system.
2. Select the **Manage** tab.
3. Under **System**, select **Licensing**.
4. Click **Assign License**.
5. Select a licensing method.
   - Select an existing license and click **OK**.
   - Create a new license.
     a. Click the Create New License (+) icon.
     b. In the New Licenses dialog, type or copy and paste a license key and click **Next**.
     c. On the Edit license names page, rename the new license as appropriate and click **Next**.
     d. Click **Finish**.
     e. In the Assign License dialog, select the newly-created license and click **OK**.

The license is assigned to the vCenter Server system, and one instance from the license capacity is allocated for thevCenter Server system.

Configuring Statistics Settings

To set up how statistical data is recorded, you configure collection intervals for statistics. You can access the stored statistical information through command-line monitoring utilities or by viewing performance charts in the vSphere Web Client.

Configure Statistics Collection Intervals in the vSphere Web Client

Statistic collection intervals determine the frequency at which statistic queries occur, the length of time statistical data is stored in the database, and the type of statistical data that is collected. You can view the collected statistics through the performance charts in the vSphere Web Client or through command-line monitoring utilities.

Note Not all interval attributes are configurable.

Prerequisites

Required privilege: **Performance.ModifyIntervals**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 From Statistics intervals, click a statistics interval attribute to edit its value.

   a In **Interval duration**, select the time interval in which statistics data is collected.

   b In **Save for**, select for how long the archived statistics are kept in the database.

   c In **Statistics level**, select a new level for collecting statistics.

      The lower the level is, the fewer number of statistic counters are used. Level 4 uses all statistics counters. Use it only for debugging purposes.

      The statistics level must be less than or equal to the statistics level that is set for the preceding statistics interval. This is a vCenter Server dependency.

6 (Optional) In Database Size, estimate the effect of the statistics settings on the database.

   a Enter the number of **Physical Hosts**.

   b Enter the number of **Virtual Machines**.

      The estimated space required and number of database rows required are calculated and displayed.

   c If necessary, make changes to your statistics collection settings.

7 Click **OK**.

Example: Relationships Between the Default Settings for Statistics Intervals

- Samples that are collected every 5 minutes are stored for 1 day.
- Samples that are collected every 30 minutes are stored for 1 week.
- Samples that are collected every 2 hours are stored for 1 month.
- Samples that are collected on 1 day are stored for 1 year.

For all statistics intervals, the default level is 1. It uses the Cluster Services, CPU, Disk, Memory, Network, System, and Virtual Machine Operations counters.

Estimate the Effect of Statistics Collection on the Database in the vSphere Web Client

The impact of the statistics collection on your vCenter Server database depends on the current inventory size of vCenter Server.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 (Optional) If necessary, configure the statistics intervals.

2 In Database Size, estimate the effect of the statistics settings on the database.

   a Enter the number of **Physical Hosts**.

   b Enter the number of **Virtual Machines**.

   The estimated space required and number of database rows required are calculated and displayed.

   c If necessary, make changes to your statistics collection settings.

3 Click **OK**.

Data Collection Levels

Each collection interval has a default collection level that determines the amount of data gathered and which counters are available for display in charts. Collection levels are also referred to as statistics levels.

Table 3-1. Statistics Levels

Level	Metrics	Best Practice
Level 1	■ Cluster Services (VMware Distributed Resource Scheduler) – all metrics ■ CPU – cpuentitlement, totalmhz, usage (average), usagemhz ■ Disk – capacity, maxTotalLatency, provisioned, unshared, usage (average), used ■ Memory – consumed, mementitlement, overhead, swapinRate, swapoutRate, swapused, totalmb, usage (average), vmmemctl (balloon) ■ Network – usage (average), IPv6 ■ System – heartbeat, uptime ■ Virtual Machine Operations – numChangeDS, numChangeHost, numChangeHostDS	Use for long-term performance monitoring when device statistics are not required. Level 1 is the default Collection Level for all Collection Intervals.
Level 2	■ Level 1 metrics ■ CPU – idle, reservedCapacity ■ Disk – All metrics, excluding numberRead and numberWrite. ■ Memory – All metrics, excluding memUsed and maximum and minimum rollup values. ■ Virtual Machine Operations – All metrics	Use for long-term performance monitoring when device statistics are not required but you want to monitor more than the basic statistics.
Level 3	■ Level 1 and Level 2 metrics ■ Metrics for all counters, excluding minimum and maximum rollup values. ■ Device metrics	Use for short-term performance monitoring after encountering problems or when device statistics are required. Because of the large quantity of troubleshooting data retrieved and recorded, use level 3 for the shortest time period (Day or Week collection interval).
Level 4	All metrics supported by the vCenter Server, including minimum and maximum rollup values.	Use for short-term performance monitoring after encountering problems or when device statistics are required. Because of the large quantity of troubleshooting data retrieved and recorded, use level 4 for the shortest amount of time.

NOTE When you increase the collection level the storage and system requirements might change. You might need to allocate more system resources to avoid decrease in the performance.

Configure Runtime Settings for vCenter Server

You can change the vCenter Server ID, managed address, and name. Usually, you do not need to change these settings, but you might need to make changes if you run multiple vCenter Server systems in the same environment.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 In the Edit vCenter Server Settings dialog box, select **Runtime Settings**.

5 In **vCenter Server unique ID**, type a unique ID.

   You can change this value to a number from 0 through 63 to uniquely identify each vCenter Server system running in a common environment. By default, an ID value is generated randomly.

6 In **vCenter Server managed address**, type the vCenter Server system address.

   The address can be IPv4, IPv6, a fully qualified domain name, an IP address, or another address format.

7 In **vCenter Server name**, type the name of the vCenter Server system.

   If you change the DNS name of the vCenter Server, use this option to modify the vCenter Server name to match.

8 Click **OK** to save your changes and close the dialog box.

What to do next

If you made changes to the vCenter Server system unique ID, you must restart the vCenter Server system for these changes to take effect.

Configure User Directory Settings

You can configure some of the ways vCenter Server interacts with the user directory server that is configured as an identity source.

For vCenter Server versions before vCenter Server 5.0, these settings apply to an Active Directory associated with vCenter Server. For vCenter Server 5.0 and later, these settings apply to vCenter Single Sign-On identity sources.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **User directory**.

6 In **User directory timeout**, type the timeout interval in seconds for connecting to the directory server.

7 In **Query Limit**, type the number of users and groups for which you can associate permissions on the child inventory objects of the vCenter Server system.

   You can associate permissions with users and groups from the Add Permissions dialog box that displays when you click **Add permissions** in **Manage > Permissions** for a vSphere inventory object.

8 Select the **Enabled** check box next to Validation to have vCenter Server periodically check its known users and groups against the user directory server.

9 In **Validation Period**, enter the number of minutes between instances of synchronization.

10 Click **OK**.

Configure Mail Sender Settings

You must configure the email address of the sender account if you want to enable vCenter Server operations, such as sending email notifications as alarm actions.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **Mail**.

6 In **Mail server**, type the SMTP server information.

   The SMTP server is the DNS name or IP address of the SMTP gateway to use for sending email messages.

7 In **Mail sender**, type the sender account information.

   The sender account is the email address of the sender.

   NOTE You must type the full email address, including the domain name.

   For example, ***mail_server@example.com***.

8 Click **OK**.

What to do next

To test the mail settings, create an alarm that can be triggered by a user action, such as by powering off a virtual machine, and verify that you receive an email when the alarm is triggered.

Configure SNMP Settings

You can configure up to four receivers to receive SNMP traps from vCenter Server. For each receiver, specify a host name, port, and community.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **SNMP receivers**.

6 In **Receiver URL**, type the host name or IP address of the SNMP receiver.

7 Select the **Enabled** check box next to Enable receiver.

8 In **Receiver port**, type the port number of the receiver.

   The port number must be a value between 1 and 65535.

9 In **Community string**, type the community identifier.

10 Click **OK**.

View Port Settings

You can view the ports used by the Web service to communicate with other applications. You cannot configure these port settings.

The Web service is installed as part of the VMware vCenter Server installation. The Web service is a required component for third-party applications that use the VMware SDK application programming interface (API). For information about installing the Web service, see the *vSphere Installation and Setup* documentation.

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **Ports**.

   The ports used by the Web service are displayed.

6 Click **OK**.

Configure Timeout Settings

You can configure the timeout intervals for vCenter Server operations. These intervals specify the amount of time after which the vSphere Web Client times out.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **Timeout settings**.

6 In **Normal operations**, type the timeout interval in seconds for normal operations.

Do not set the value to zero (0).

7 In **Long operations**, enter the timeout interval in minutes for long operations.

Do not set the value to zero (0).

8 Click **OK**.

9 Restart the vCenter Server system for the changes to take effect.

Configure Logging Options

You can configure the amount of detail that vCenter Server collects in log files.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **Logging settings**.

6 Select the logging options.

Option	Description
None (Disable logging)	Turns off logging
Error (Errors only)	Displays only error log entries
Warning (Errors and warnings)	Displays warning and error log entries
Info (Normal logging)	Displays information, error, and warning log entries
Verbose (Verbose)	Displays information, error, warning, and verbose log entries
Trivia (Extended verbose)	Displays information, error, warning, verbose, and trivia log entries

7 Click **OK**.

Changes to the logging settings take effect immediately. You do not need to restart vCenter Server system.

Configure Database Settings

You can configure the maximum number of database connections that can occur simultaneously. To limit the growth of the vCenter Server database and save storage space, you can configure the database to discard information about tasks or events periodically.

NOTE Do not use the database retention options if you want to keep a complete history of tasks and events for your vCenter Server.

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **Database**.

6 In **Maximum connections**, type a number.

   Increase this number if your vCenter Server system performs many operations frequently and performance is critical. Decrease this number if the database is shared and connections to the database are costly. Do not change this value unless one of these issues pertains to your system.

7 Select the **Enabled** check box next to Task cleanup to have vCenter Server periodically delete the retained tasks.

8 (Optional) In **Tasks retained for**, type a value in days.

   Information about tasks that are performed on this vCenter Server system is discarded after the specified number of days.

9 Select the **Enabled** check box next to Event cleanup to have vCenter Server periodically clean up the retained events.

10 (Optional) In **Events retention**, type a value in days.

   Information about events for this vCenter Server system are discarded after the specified number of days.

11 Click **OK**.

Verifying SSL Certificates for Legacy Hosts

You can configure vCenter Server to check the SSL certificates of hosts to which it connects. If you configure this setting, vCenter Server and the vSphere Web Client check for valid SSL certificates before connecting to a host for operations such as adding a host or making a remote console connection to a virtual machine.

vCenter Server 5.1 and vCenter Server 5.5 always connect to ESXi hosts using SSL thumbprint certificates. Starting with vCenter Server 6.0, the SSL certificates are signed by VMware Certificate Authority by default. You can instead use certificates from a third-party CA. Thumbprint mode is supported only for legacy hosts.

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **General**.

4 Click **Edit**.

5 Select **SSL settings**.

6 Determine the host thumbprint for each legacy host that requires validation.

   a Log in to the direct console.

   b Select **View Support Information** on the **System Customization** menu.

      The thumbprint is displayed in the column on the right.

7 Compare the thumbprint you obtained from the host with the thumbprint listed in the vCenter Server Settings dialog box.

8 If the thumbprints match, select the check box for the host.

   Hosts that are not selected will be disconnected after you click **OK**.

9 Click **OK**.

Configure Advanced Settings

In **Advanced Settings**, you can modify the vCenter Server configuration file, `vpxd.cfg`.

You can use **Advanced Settings** to add entries to the `vpxd.cfg` file, but not to edit or delete them. VMware recommends that you change these settings only when instructed to do so by VMware technical support or when you are following specific instructions in VMware documentation.

Prerequisites

Required privilege: **Global.Settings**

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Select **Advanced Settings**.

4 Click **Edit**.

5 In the **Key**, type a key.

6 In the **Value** field, type the value for the specified key.

7 Click **Add**.

8 Click **OK**.

Newly added advanced settings have `config.` appended to the setting keys in the `vpxd.cfg` file. For example:

```
config.example.setting = exampleValue
```

What to do next

Many advanced settings changes require that the vCenter Server system be restarted before they take effect. Consult VMware technical support to determine if your changes require a restart.

Send a Message to Other Logged In Users

You might sometimes need to send messages to users who are currently logged in to a vCenter Server system. For example, if you need to perform maintenance on a desktop, you can ask the user to log out temporarily, or warn them of a future interruption of service.

Procedure

1 In the vSphere Web Client, navigate to the vCenter Server instance.

2 Select the **Manage** tab.

3 Under **Settings**, select **Message of the Day**, and click **Edit**.

4 Type the Message of the Day, and click **OK**.

A warning appears at the top of the vSphere Web Client in every active user session advising users to read the Message of the Day that is set in the relevant vCenter Server system.

Edit the Settings of Services

The vSphere Web Client lists all manageable services running on vCenter Server. You can edit the settings for some of the services.

The vSphere Web Client displays information about all manageable services running in vCenter Server and the vCenter Server Appliance. A list of the default services is available for each vCenter Server instance.

Prerequisites

Verify that the user you use to log in to the vCenter Server instance is a member of the SystemConfiguration.Administrators group in the vCenter Single Sign-On domain.

Procedure

1 Log in as administrator@*your_domain_name* to the vCenter Server instance by using the vSphere Web Client.

2 On the vSphere Web Client Home page, under Administration, click **System Configuration**.

3 Under System Configuration click **Nodes** and select a node from the list.

4 Click the **Related Objects** tab.

   You see the list of services running in the node you selected. Editable settings are not available for all manageable services.

5 Right-click a service from the list and click **Settings**.

   Editable settings are not available for all manageable services.

6 On the **Manage** tab click the **Edit** button.

7 Edit the service configuration properties.

8 Click **OK** to save the settings.

9 (Optional) From the **Actions** menu, select **Restart**.

   You should restart the service only if a restart of the service is required so that the configuration changes are applied.

Start, Stop, and Restart Services

In the vSphere Web Client, you can start, stop, and restart services that are running on vCenter Server. You can restart services upon a configuration change or in case of suspected functional or performance issues.

Prerequisites

Verify that the user you use to log in to the vCenter Server instance is a member of the SystemConfiguration.Administrators group in the vCenter Single Sign-On domain.

Procedure

1 Log in to the vCenter Server by using the vSphere Web Client.

2 On the vSphere Web Client Home page, click **System Configuration**.

3 Under System Configuration click **Services**.

4 From the Services list select a manageable service.

5 From the **Actions** menu select an operation name.

- **Restart**
- **Start**
- **Stop**

NOTE Restarting the Content Library Service also restarts the Transfer Service and the OVF Service. The Content Library Service, the Transfer Service, and the OVF Service run on the same Tomcat server.

Configuring Services in the vSphere Web Client

You can monitor and manage services by using the vSphere Web Client. You can change the settings of only a few services.

There are slight differences between the services available for a vCenter Server instance that runs on a Windows system and those available for vCenter Server Appliance on Linux.

NOTE Only the default values of the service properties have undergone all product testing cycles. Avoid the usage of nondefault values without guidance from VMware.

Services that You Can Configure in vCenter Server Appliance

You can use vSphere Web Client to configure the following services in vCenter Server Appliance:

Service	Description
Auto Deploy	Lets you perform stateless ESXi caching. See "Auto Deploy Service," on page 51.
Content Library Service	Manages OVF templates, ISO images, and scripts for vSphere administrators. See "Content Library Service," on page 51.
Hardware Health Service	Collects and analyzes IPMI sensor metrics for hardware that runs ESXi. See "Hardware Health Service," on page 53.
Transfer Service	Provides support for moving content, such as VM templates, scripts, and ISO images across sites and vCenter Server instances. See "Transfer Service Properties," on page 53.
VMware Open Virtualization Format Service	Supports the provisioning of OVF based virtual machines. For a list of settings you can configure for this service, see "VMware Open Virtualization Format Service," on page 56.
VMware Syslog Service	Provides support for system logging, network logging, and collecting logs from hosts. You can use the Syslog service to redirect and store ESXi messages to a server on the network. See "VMware Syslog Service," on page 57.
VMware vSphere ESXi Dump Collector Service	Collects core dumps from remote hosts. See "VMware vSphere ESXi Dump Collector," on page 57.
vAPI Endpoint	Provides a single point of access to vAPI services. For a list of general settings that you can configure for this service, see "vAPI Endpoint," on page 54.

Services that you can configure in vCenter Server

You can configure the following services on a vCenter Server instance that runs on a Windows machine:

Service Name	Description
Auto Deploy	Lets you perform stateless ESXi caching. See "Auto Deploy Service," on page 51.
Content Library Service	Manages OVF templates, ISO images, and scripts for vSphere administrators. See "Content Library Service," on page 51.
Hardware Health Service	Collects and analyzes IPMI sensor metrics for hardware that runs ESXi. See "Hardware Health Service," on page 53.

Service Name	Description
Transfer Service	Provides support for moving content, such as VM templates, scripts, and ISO images across sites and vCenter Server instances. See "Transfer Service Properties," on page 53.
VMware Open Virtualization Format Service	Supports the provisioning of OVF based virtual machines. For a list of settings you can configure for this service, see "VMware Open Virtualization Format Service," on page 56.
VMware vSphere ESXi Dump Collector Service	Collects core dumps from remote hosts. See "VMware vSphere ESXi Dump Collector," on page 57.
vAPI Endpoint	Provides a single point of access to vAPI services. For a list of general settings that you can configure for this service, see "vAPI Endpoint," on page 54.

Auto Deploy Service

vSphere Auto Deploy uses the Auto Deploy Service for stateless ESXi caching. You can change the default configuration properties of the Auto Deploy service.

Auto Deploy and the Auto Deploy Service are installed as part of the vCenter Server installation.

Property	Default Value	Description
cachesize_GB	2	Auto Deploy cache size in gigabytes. The maximum size of an ESXi image or host profile uploads.
loglevel	INFO	The default Auto Deploy log level. Includes information, warnings, errors, and fatal errors.
managementport	6502	Auto Deploy management port. The port on which interfaces that create rules for Auto Deploy, such as vSphere PowerCLI, communicate.
serviceport	6501	Auto Deploy service port. Auto Deploy uses this port to power on ESXi hosts.

Content Library Service

The Content Library service provides simple and effective management of OVF templates, ISO images, and scripts for vSphere administrators. The Content Library service lets you synchronize content across vCenter Server instances.

Property	Default Value	Description
Download Session Expiration Timeout (milliseconds)	300000	Download session expiry timeout in milliseconds. The download session indicates the time for downloading content from a content library item.
Force HTTP for Library Sync	false	Forces data transfers to go through HTTP instead of HTTPS, regardless of the subscription URL protocol. The usage of HTTP improves the speed of file transfer but might cause problems if content libraries contain sensitive information.
Garbage Collect Interval (minutes)	60	Interval in minutes for Content library garbage collection. Garbage collection cleans content library data and files that are no longer used.

Property	Default Value	Description
Garbage Collect Max Retries	5	Number of attemts to clean the content library after the deletion of files fails. Garbage collection cleans content library data and files that are no longer used.
Garbage Collection Start Hour	22	The time of the day when the content library garbage collection starts.
Garbage Collection Stop Hour	8	The time of the day when the content library garbage collection stops.
Library Auto Sync Enabled	true	Enables automatic synchronization of subscribed content libraries.
Library Auto Sync Refresh Interval (minutes)	240	Interval between two consequent automatic synchronizations of the subscribed content library. Measured in minutes.
Library Auto Sync Setting Refresh Interval (seconds)	600	Refresh interval for the automatic synchronization settings of the subscribed library. Measured in seconds. If you change the refresh interval, you must restart vCenter Server
Library Auto Sync Start Hour	20	The time of the day when the automatic synchronization of a subscribed content library starts.
Library Auto Sync Stop Hour	7	The time of the day when the automatic synchronization of a subscribed content library stops. Automatic synchronization stops until the start hour.
Library File Preparation No-Progress Timeout (minutes)	30	Timeout for file preparation of the subscribed content library, measured in minutes.
Library HTTP Connection Timeout (milliseconds)	500000	The HTTP connection timeout for subscribed library, measured in milliseconds.
Library HTTP Socket Connection Timeout (milliseconds)	300000	Subscribed library HTTP connection socket timeout, measured in milliseconds.
Library Maximum Concurrent Sync Items	5	Maximum number of concurrently synchronizing library items for each subscribed library.
Update Session Expiration Timeout (milliseconds)	300000	Update session expiration timeout, measured in milliseconds. Update session is for uploading content to library item.

Note You must log in as a user with an Administrator or a Content library administrator role to change the settings of the Content Library service.

Hardware Health Service

The Hardware Health Service collects and analyses Intelligent Platform Management Interface (IPMI) sensor metrics from hardware that runs ESXi.

Property	Default Value	Description
vws.loglevel	Warning	Level of details of the information included in the logs.

Transfer Service Properties

The Transfer Service lets you move content, such as VM templates, scripts, and ISO images across sites and vCenter Server instances. The Transfer Service has a set of configurable properties that you can change to meet the needs of your virtual environment.

Property	Default Value	Description
Forced Flush to Output Interval	45	Interval between forced flushes to output stream, measured in seconds.
Http Client Buffer Size	262144	Buffer size of the HTTP client input stream during transfers, measured in bytes.
Http Client Socket Timeout	180	Socket timeout of the HTTP client, measured in seconds.
Http Request-handling Timeout	120	Request handling timeout for HTTP transfers, after which service unavailable status is returned to client, measured in seconds.
Http Socket Buffer Size	2048	Buffer size of the HTTP client socket, measured in bytes.
Intermediary I/O Stream Buffer Size	131072	Maximum size of buffer sitting between input and output streams during a transfer, measured in bytes.
Maximum Bandwidth Consumption	0	Bandwidth usage threshold across all transfers, measured in megabits per second Mbps. 0 means unlimited bandwidth.
Maximum Number of Concurrent Priority Transfers	5	Concurrent transfer limit for priority files. If exceeded, transfers are queued. This threadpool is used only to transfer priority objects.
Maximum Number of Concurrent Transfers	20	Concurrent transfer limit. If exceeded, transfers are queued.
NFC Connection Socket Timeout	120	Socket timeout for an NFC connection, measured in seconds. An NFC connection is opened only when interacting with a datastore.
NFC Eager-zeroed Thick Disk Write Timeout	5400	Eager-zeroed thick disk write timeout for an NFC connection, measured in seconds. This timeout must be larger than the socket timeout of NFC connection. An NFC connection is opened only when interacting with datastore.

vAPI Endpoint

The vAPI endpoint provides a single point of access to vAPI services. You can change the properties of the vAPI Endpoint service.

Property	Default Value	Description
[default] endpoint maximum number of execution threads	300	The maximum number of execution threads for the vAPI endpoint.
[default] endpoint minimum number of spare threads	10	The minimum number of threads that are always kept alive for the vAPI endpoint.
[default] endpoint queue size	50	The maximum number of tasks that can queue up for the vAPI endpoint.
[router] Broadcast execution timeout	30	The duration after which vAPI broadcast routing queries time out, measured in seconds.
[router] Federated IS queries timeout	30	Timeout of federated inventory service queries, measured in seconds.
[router] Maximum size of the in-memory cache	10	The maximum size of the identifier cache that is used for routing vAPI calls between management nodes. Measured in megabytes.
[router] Number of broadcast timeout threads	3	The number of threads that handle vAPI broadcast timeouts.
[router] Number of control threads for federated IS queries	10	The number of threads that control the federated Inventory Service queries for vAPI routing.
[router] Number of execution threads for federated IS queries	20	The number of threads that perform the federated Inventory Service queries for vAPI routing.
Bearer token usage allowance	Enabled	Lets you use Bearer SAML tokens in addition to Holder of Key (HoK) tokens. Bearer tokens do not have cryptographic verification of the client identity. Their security is sufficient only when used over a secure encrypted connection.
CloudVM Components	authz,com.vmware.cis,com.vmware.content, com.vmware.transfer,com.vmware.vapi,com.vmware.vapi.rest.navigation, com.vmware.vapi.vcenter,com.vmware.vcenter.inventory, com.vmware.vcenter.pbm.provisioning, com.vmware.vcenter.pbm.provisioning.affinity, com.vmware.vcenter.pbm.provisioning.tagpolicies, com.vmware.vcenter.vdcs, data_service,tagging,vpx_workflow	A comma-separated list of VMware components that require the usage of identifiers. Identifiers must be qualified with a management node ID. The list must not contain spaces. **Caution** Editing the list might result in system failures. Edit this setting only as part of VMware maintenance procedure.

Property	Default Value	Description
Cookie authentication	Enabled	Enables or disables cookie authentication. If you enable the cookie authentication, the session ID is returned in cookie. If you disable it the cookie is returned in the header
Credentials login allowance	Enabled	Lets vAPI users authenticate with a user name and password in addition to using a SAML token.
Enables REST basic authentication	Enabled	Enables login service for simple authentication with username and password.
Global request rate	180	Global request rate. Set to 0 to disable.
Global request rate interval	1	Global request rate interval, measured in seconds. This is the time frame in which only http.request.rate.count requests are allowed. Set to 0 to disable. If you enable this option, the default value is 1.
Maximum allowed request size	204800	The maximum allowed request size, measured in bytes. Set to 0 to disable.
Maximum number of in-flight requests.	2000	The maximum allowed number of in-flight requests. Set to 0 to disable. **Note** In-flight requests take up memory. If you increase this setting, you must increase the memory of the endpoint component.
Maximum number of simultaneous connections to the VIM service	10	The max number of simultaneous connections allowed to the VIM service.
Maximum request age	14400	The maximum request age in seconds.
Maximum session count	1000	The maximum number of allowed sessions. If you leave the value empty, the maximum number of sessions allowed is 10,000.
Maximum session idle time	3600000	The maximum time between requests that a session may remain idle, measured in milliseconds.
Maximum session lifespan	172800000	The maximum session lifespan, measured in milliseconds. Used to capture long sessions.
Minimum session lifespan	86400000	Minimum session lifespan in milliseconds, used for renewable tokens.
Reconfiguration interval	240	Interval between reconfiguration attempts, measured in seconds.
Request rate for anonymous calls	3000	Maximum request rate for anonymous calls. Set to 0 to disable.
Request rate for authorized requests	3800	Maximum request rate for authorized calls. Set to 0 to disable.

Property	Default Value	Description
Request rate interval for anonymous calls	60	Request rate interval for anonymous calls, measured in seconds. This is the time frame in which only request rates for anonymous calls are allowed. Set to 0 to disable. **Note** The vAPI endpoint limits the number of incoming requests to Request rate for anonymous calls per Request rate interval for anonymous calls. For example if the rate is set to 50 seconds and interval is set to 60 seconds, the system allows up to 50 calls per minute. Any calls exceeding the limit return a server busy error.
Request rate interval for authorized calls	60	The request rate interval for authorized calls, measured in seconds. This is the time frame in which only http.authorized.request.rate.count authorized requests are allowed. Set to 0 to disable.
The socket timeout	0	The socket timeout (SO_TIMEOUT), measured in milliseconds that is used when executing a method. A timeout value of 0 is interpreted as an infinite timeout.
Timeout for the HTTP connections to vAPI providers	300000	Timeout for the HTTP connections to vAPI providers, measured in milliseconds.
Token clock tolerance	1000	Clock tolerance for authentication tokens, measured in seconds.
URL Deseriliazation (POST-as-GET)	Enabled	Enables or disables URL deserialization (POST-as-GET).
vAPI Endpoint solution user	Generated at the time of installation	vAPI Endpoint solution user. **Caution** Do not modify this value. Changing only this setting without updating the related settings, might lead to a failure of the component.

VMware Open Virtualization Format Service

The Open Virtualization Format Service enables OVF based provisioning of virtual machines. You can change the configuration properties of this service.

Property	Default Value	Description
OVF Export Session Timeout	5	The amount of time after which the OVF export session times out. Measured in minutes.
OVF Import Session Timeout	10	Waiting time before the OVF import session times out. Measured in minutes.

VMware Syslog Service

The Syslog Service provides support for system logging, network logging, and collecting logs from hosts. You can use the Syslog Service to redirect and store ESXi messages to a server on the network.

Property	Default Value	Description
Common Log Level	N/A	Set the level of information you want to include in the logs. ■ ***** - include all log files. ■ **info** - Only informational log files are redirected to the remote machine. ■ **notice** - Only notices are redirected to the remote machine. A notice message indicates a normal but significant condition. ■ **warn** - Only warnings are redirected to the remote machine. ■ **error** - Only error messages are redirected to the remote machine. ■ **crit** - Only critical log files are redirected to the remote machine. ■ **alert** - Only critical log files are redirected to the remote machine. ■ **emerg** - Only emergency log files are redirected to the remote machine. An emergency message indicates that the system has stopped responding and cannot be used.
Remote Syslog Host	N/A	The IP address of the host you want to use for storing ESXi messages and logs. This is also the IP address of the remote syslog server on the network you use to redirect logs and ESXi messages.
Remote Syslog Port	N/A	The port number to use for communication with the machine to which you want to export log files.
Remote Syslog Protocol	N/A	The communication protocol that Syslog uses. Available protocols are TCP, UDP, and TLS.

VMware vSphere ESXi Dump Collector

The vSphere ESXi Dump Collector service collects core dumps from remote hosts.

Property	Default Value	Description
Coredump Server UDP Port (1025-9999)	6500	The default port on which the core dump server communicates.
Repository max size (1-10 GB)	2	The maximum size of the core dump repository in gigabytes.

Using Enhanced Linked Mode

Enhanced Linked Mode links multiple vCenter Server systems by using one or more Platform Services Controllers. With Enhanced Linked Mode, you can view and search across all linked vCenter Server systems. This mode replicates roles, permissions, licenses, and other key data across systems.

Enhanced Linked Mode provides the following features for both vCenter Server on Windows and vCenter Server Appliance systems:

- You can log in to all linked vCenter Server systems simultaneously with a single user name and password.
- You can view and search the inventories of all linked vCenter Server systems within the vSphere Web Client. The vSphere Client does not support Enhanced Linked Mode.
- Roles, permission, licenses, tags, and policies are replicated across linked vCenter Server systems.

To join vCenter Server systems in Enhanced Linked Mode, connect them to the same Platform Services Controller, or to Platform Services Controllers that share the same vCenter Single Sign-On domain.

Enhanced Linked Mode requires the vCenter Server Standard licensing level, and is not supported with vCenter Server Foundation or vCenter Server Essentials.

In vSphere 5.5 and earlier, Linked Mode relied on Microsoft ADAM to provide replication functionality. Starting in vSphere 6.0, the Platform Services Controller provides replication and ADAM is no longer required. Because of the change in architecture, you must isolate vCenter Server 5.5 systems from any Linked Mode groups before upgrading these systems to vCenter Server 6.0. For more information, see the *vSphere Upgrade* documentation.

Configuring Communication Among ESXi , vCenter Server, and the vSphere Web Client

By default, the vSphere Web Client uses ports 80 and 443 to communicate with vCenter Server and ESXi hosts.

Configure your firewall to allow communication between the vSphere Web Client and vCenter Server by opening ports 80 and 443.

vCenter Server acts as a web service. If your environment requires the use of a web proxy, vCenter Server can be proxied like any other web service.

Providing vCenter Server Availability 4

When you deploy vCenter Server, you must build a highly available architecture that can handle workloads of all sizes.

Availability is critical for solutions requiring continuous connectivity to vCenter Server. To avoid extended periods of downtime, users should run vCenter Server in highly available configurations.

Two options can help you achieve continuous connectivity:

- Option 1: Using a vSphere High Availability cluster and Watchdog
- Option 2: Using a Microsoft Cluster Service (MSCS) cluster

Use option 1 when your vCenter Server environment is virtualized. Use option 2 when vCenter Server is installed on Windows.

NOTE In this document, references to MSCS also apply to WSFC on corresponding Windows Server versions.

This chapter includes the following topics:

- "Using a vSphere High Availability Cluster," on page 59
- "Establishing Watchdog Support," on page 60
- "Using MSCS for vCenter Server Availability," on page 60
- "Set Up MSCS for vCenter Server Availability," on page 61

Using a vSphere High Availability Cluster

One method of providing vCenter Server availability is to use the Watchdog feature in a vSphere HA cluster.

vSphere HA is configured by using vCenter Server at the cluster level. After it has been enabled, vSphere HA monitors hosts and virtual machines (VMs) and takes the user-configured action with or without vCenter Server availability. For more information on vSphere HA and the requirements to set up a cluster, see the *vSphere Availability* documentation.

NOTE Starting with vSphere 6.x, vCenter Server Heartbeat is discontinued. The Watchdog and vSphere HA option replaces this technology and provides vCenter Server availability.

If you are using vCenter Server Appliance, you must use this option instead of an MSCS cluster.

Cluster Recommendations for Protecting vCenter Server

When configuring the vSphere HA and vSphere DRS cluster that you use to provide vCenter Server availability by protecting the vCenter Server database server, observe these recommendations.

- Place all database servers in a dedicated management cluster.
- For vSphere DRS, create VM and host anti-affinity rules to prevent the database servers from running on the same host.
- Set the `ForceAffinePoweron` vSphere DRS advanced option to a value of 1 to enable strict enforcement of vSphere DRS rules when servers are powered on.
- Enable vSphere HA with both host and VM monitoring.
- Enable and properly configure vSphere HA admission control for the cluster.
- Set the VM restart priority for the VM or VMs that are hosting the vCenter Server database to High.

Establishing Watchdog Support

Watchdog monitors and protects vCenter Server services. If any services fail, Watchdog attempts to restart them. If it cannot restart the service because of a host failure, vSphere HA restarts the virtual machine (VM) running the service on a new host.

Watchdog can provide better availability by using vCenter Server processes (PID Watchdog) or the vCenter Server API (API Watchdog).

You can use the service start command to start PID Watchdog and the service stop command to stop it. PID Watchdog monitors only services that are running. After the service is stopped, PID Watchdog does not monitor it. PID Watchdog detects only that a process with the correct executable is in the process table. It does not determine if the process is ready to service requests.

Starting with vSphere 6.x, a Python daemon called API Watchdog checks the status of APIs for the VPXD service. If the APIs are not running, API Watchdog attempts to restart the service two times. If that still does not solve the issue, API Watchdog then reboots the VM.

API Watchdog starts running immediately after deployment of the vCenter Server Appliance. On vCenter Server for Windows, however, you must reboot vCenter Server once before API Watchdog starts working.

API Watchdog generates support bundles before a service restart and also before a VM reboot and these support bundles are stored in `C:\ProgramData\VMware\vCenterServer\data\core\*.tgz` on vCenter Server for Windows and in `/storage/core/*.tgz` for vCenter Server Appliance.

Note To reset the Watchdog capability, delete the data files. On vCenter Server for Windows, the default location is `C:\ProgramData\VMware\vCenterServer\data\iiad\iiad.dat`. On vCenter Server Appliance, it is `/storage /iiad/iiad.dat`.

Using MSCS for vCenter Server Availability

With vCenter Server 5.5 Update 3 and later, Microsoft Cluster Service (MSCS) is supported as an option for providing vCenter Server availability.

Multiple instances of vCenter Server are in a MSCS cluster, but only one instance is active at a time. Use this solution to perform maintenance, such as patching or upgrades, on one node in the cluster without taking down the vCenter Server database.

Another potential benefit of this approach is that MSCS uses a type of "shared-nothing" cluster architecture. The cluster does not involve concurrent disk accesses from multiple nodes. In other words, the cluster does not require a distributed lock manager. MSCS clusters typically include only two nodes and they use a shared SCSI connection between the nodes. Only one server needs the disks at any given time, so no concurrent data access occurs. This sharing minimizes the impact if a node fails.

Unlike the vSphere HA cluster option, the MSCS option works only for Windows virtual machines and does not support thevCenter Server Appliance.

Set Up MSCS for vCenter Server Availability

Use the following steps to set up Microsoft Cluster Service (MSCS) as an availability solution for vCenter Server.

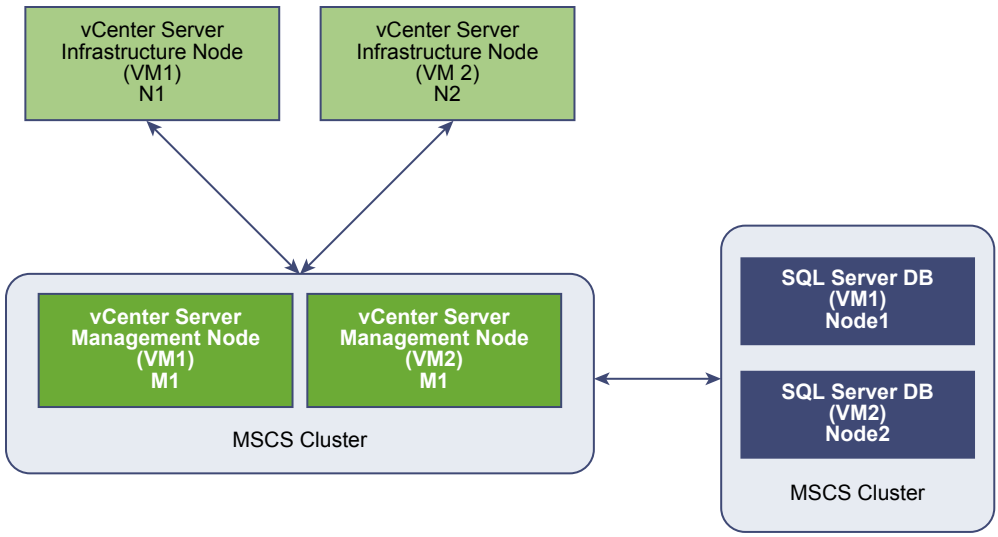
Prerequisites

Before you can set up MSCS for vCenter Server availability, you must create a virtual machine (VM) with one of the following guest operating systems:

- Windows 2008 SP2
- Windows 2012 R2 Datacenter

Also, you must add two raw device mapping (RDM) disks to this VM. These disks must be mounted and when they are added, you must create a separate SCSI controller with the bus sharing option set to physical. The RDM disks must also be independent and persistent.

Figure 4-1. MSCS Cluster for vCenter Server Availability



Note MSCS as an availability solution for vCenter Server is provided only for management nodes of vCenter Server (M node). For infrastructure nodes, customers must deploy multiple N nodes for high availability. You cannot have both M and N nodes on the same VM for MSCS protection.

Procedure

1 Power on the VM.

2 Format the two RDM disks, assign them drive letters, and convert them to MBR.

3 Using **Windows > Server Manager > Features**, Install .net.

4 Install vCenter Server on one of the RDM disks.

5 Set the vCenter Server start option to manual.

6 Power off the VM.

7 Detach the RDM disks.

   Detaching the RDM disks is not a permanent deletion. Do not select **Delete from disk** and do not delete the vmdk files.

8 Clone the VM and select the **Customize the operating system** option, so that the clone has a unique identity.

   Create a unique identity through either the default sysrep file or the custom sysrep file.

9 Attach the shared RDMs to both VMs.

10 Power on both VMs.

11 Change the host name and IP address on the first VM (VM1).

   Note the original IP address and host name that were used at the time of the installation of vCenter Server on VM1. This information is used to assign a cluster role IP.

12 Install failover clustering on both nodes.

13 Create an MSCS cluster on VM1 by including both nodes in the cluster. Also select the validation option for the new cluster.

14 Create a cluster role or service and add all of the vCenter Server services to it, one by one. Use the IP address and host name from step 11 for the role or service.

You have created an MSCS cluster that can support vCenter Server availability.

What to do next

After you have created the MSCS cluster, verify that failover is occurring by powering off the VM hosting vCenter Server (VM1). Within a few minutes, the services should be running on the other VM (VM2).

Managing Third-Party Hypervisors by Using vCenter Host Gateway

5

vCenter Host Gateway is a vCenter Server feature that lets you manage virtual environments that consist of various types of hypervisors.

vCenter Host Gateway is distributed as a virtual appliance. After you deploy and configure the vCenter Host Gateway appliance, you can use the vSphere Web Client to manage both VMware and third-party hypervisors, such as Microsoft Hyper-V.

NOTE You can also use the public API to manage third-party hypervisors. For more information, see *vSphere Management SDK Documentation*.

- vCenter Host Gateway System Requirements on page 64

  To install vCenter Host Gateway, ensure your system meets the hardware and software requirements.

- Supported Third-Party Hypervisors on page 64

  vCenter Host Gateway supports several third-party hypervisors. This enables you to manage more virtual machines and hosts through the vSphere Web Client.

- Deploy the vCenter Host Gateway Appliance on page 65

  vCenter Host Gateway is distributed as a virtual appliance in OVF format that you can deploy by using the vSphere Web Client.

- vCenter Host Gateway User Permissions on page 69

  While deploying the vCenter Host Gateway appliance, you must provide Single Sign-On administrator credentials. vCenter Host Gateway requires those credentials to create a solution user.

- Configure the vCenter Host Gateway Appliance on page 70

  After you deploy the vCenter Host Gateway appliance, you can change the configuration settings by using the Web configuration UI of the appliance.

- Add Third-Party Hosts to the vCenter Server Inventory on page 73

  You can add third-party hosts to the vCenter Server inventory by using the vSphere Web Client.

- Supported Actions for Managing Third-Party Hosts in the vSphere Web Client on page 74

  vCenter Host Gateway lets you perform various operations with third-party hosts and virtual machines.

- Supported Actions for Managing Third-Party Virtual Machines in the vSphere Web Client on page 74

  vCenter Host Gateway lets you perform various operations with third-party hosts and virtual machines.

vCenter Host Gateway System Requirements

To install vCenter Host Gateway, ensure your system meets the hardware and software requirements.

Software Requirements

- vCenter Server 6.0
- Version 7. ESXi 4x or higher

Hardware Requirements

You can run vCenter Host Gateway on any system that meets the minimum hardware requirements.

Table 5-1. Minimum Hardware Requirements

Hardware	Requirements
Number of CPUs	2
vRAM	3 GB
Disk Space	6 GB. If you store logs on the vCenter Host Gateway appliance machine, increase the storage to 10 GB.
Network	A 1 Gbps connection between the vCenter Host Gateway appliance and vCenter Server instance.

Networking Requirements

vCenter Host Gateway requires access to various ports to function properly. You can change the default connectivity if you need to adjust the configuration to suit your own environment.

Table 5-2. Default Connectivity Requirements

Machine	Connection To	Connection Scope	Protocol	Port
Local machine, running the vSphere Web Client	vCenter Host Gateway appliance	Internal Network	HTTPS	5480
vCenter Server	vCenter Host Gateway appliance	Internal Network	HTTPS	8443
			NFC	8902
vCenter Host Gateway appliance	Platform Services Controller	Internal Network	HTTPS	443
vCenter Host Gateway appliance	Hyper-V host that you want to manage	Internal Network	HTTP	80 or 5985
vCenter Host Gateway appliance	Hyper-V host that you want to manage	Internal Network	HTTPS	443 or 5986

Supported Third-Party Hypervisors

vCenter Host Gateway supports several third-party hypervisors. This enables you to manage more virtual machines and hosts through the vSphere Web Client.

Supported Microsoft Hypervisors

vCenter Host Gateway supports the following releases of Microsoft Hyper-V:

- Microsoft Hyper-V Server 2012 R2

- Microsoft Hyper-V Server 2012
- Microsoft Hyper-V Server 2008 R2
- Microsoft Hyper-V Server 2008

NOTE vCenter Host Gateway relies on Windows Remote Management (WinRM) to manage Microsoft Hyper-V Server. To manage Microsoft hypervisors by using vCenter Server, you must verify that you have configured WinRM on the host running Microsoft Hyper-V Server and that WinRM is accessible over the network.

Deploy the vCenter Host Gateway Appliance

vCenter Host Gateway is distributed as a virtual appliance in OVF format that you can deploy by using the vSphere Web Client.

Procedure

1. Start the OVF Deployment Wizard on page 66

   To deploy the vCenter Host Gateway appliance you must start the deployment wizard from the vSphere Web Client.

2. Select the OVF Source Location on page 66

   Specify the location where the source of OVF template resides.

3. Review the OVF Details on page 66

   The OVF template details page of the Deploy OFV Template wizard display available information about the `.ovf` file.

4. Accept the OVF License Agreements on page 67

   The Accept License Agreements page of the Deploy OFV Template wizard appears only if license agreements are packaged with the OVF template.

5. Select OVF Name and Location on page 67

   When you deploy an OVF template, you provide a unique name for the virtual machine or vApp. The name can contain up to 80 characters. You can select a data center or folder location for the virtual machine.

6. Select Storage for the vCenter Host Gateway OVF Template on page 67

   Select the location to store the files for the deployed vCenter Host Gateway template.

7. Setup OVF Network on page 68

   Set up and configure the networks the deployed OVF templates use. The Setup networks page page of the Deploy OVF Template wizard allows you to map source networks to target networks and to specify settings for those networks.

8. Customize the OVF Template on page 68

   Customize the deployment properties of the template. vCenter Host Gateway appliance has specific options that you must set during the deployment.

9. Review the Configuration and Complete the Deployment on page 69

   Review the details of the vCenter Host Gateway appliance configuration and complete the deployment process.

Start the OVF Deployment Wizard

To deploy the vCenter Host Gateway appliance you must start the deployment wizard from the vSphere Web Client.

Prerequisites

Verify that the Client Integration plug-in is installed.

Procedure

1 In a Web browser, log in to vSphere Web Client as an administrator.

2 Select an inventory object that is a valid parent object of a virtual machine, such as data center, folder, cluster, resource pool, or host.

3 From the **Actions** menu, select **Deploy OVF Template**.

The Deploy OVF Template wizard appears.

Select the OVF Source Location

Specify the location where the source of OVF template resides.

Procedure

1 Specify the source location.

Option	Action
URL	Type a URL to an OVF template located on the Internet. Supported URL sources are HTTP and FTP.
Local file	Click **Browse** and select an OVF or OVA template from the local file system.

2 Click **Next**.

Review the OVF Details

The OVF template details page of the Deploy OFV Template wizard display available information about the `.ovf` file.

Procedure

1 Review the OVF template details.

Option	Description
Product	Product name, as specified in the OVF template file.
Version	Version, if the version is specified in the OVF template file.
Vendor	Vendor, if the vendor is specified in the OVF template file.
Publisher	Publisher of the OVF template, if a certificate included in the OVF template file specifies a publisher.
Download size	Size of the OVF file.
Size on disk	Size on disk after you deploy the OVF template.
Description	Description, as provided by the distributor of the OVF template.

2 Click **Next**.

Accept the OVF License Agreements

The Accept License Agreements page of the Deploy OFV Template wizard appears only if license agreements are packaged with the OVF template.

Procedure

1 On the Accept License Agreements page of the wizard, read the End User License Agreements and click **Accept**.

2 Click **Next**.

Select OVF Name and Location

When you deploy an OVF template, you provide a unique name for the virtual machine or vApp. The name can contain up to 80 characters. You can select a data center or folder location for the virtual machine.

Procedure

1 On the Select name and folder page of the Deploy OVF Template wizard, specify a name for the virtual machine.

   The name must be unique within each vCenter Server virtual machine folder.

2 Select or search for a datacenter or folder for the virtual machine.

3 Click **Next**.

Select Storage for the vCenter Host Gateway OVF Template

Select the location to store the files for the deployed vCenter Host Gateway template.

Prerequisites

Select the disk format to store the virtual machine virtual disks.

Procedure

1 On the Select storage page of the Deploy OVF Template wizard, select the virtual disk format to store the virtual machine virtual disks.

Option	Description
Thick Provisioned Lazy Zeroed	Creates a virtual disk in a default thick format. Space required for the virtual disk is allocated when the virtual disk is created. Data remaining on the physical device is not erased during creation, but is zeroed out on demand at a later time on first write from the virtual machine.
Thick Provision Eager Zeroed	Creates a thick virtual disk that supports clustering features such as Fault Tolerance. Space required for the virtual disk is allocated at creation time. In contrast to the flat format, the data remaining on the physical device is zeroed out when the virtual disk is created. Creating disks in this format might take much longer than creating other types of disks.
Thin Provision	Creates a thin disk, which starts small, at first using only as much datastore space as the disk needs for its initial operations. The disk space grows when the virtual machine needs more storage. Use this format to save storage space. For the thin disk, you provision as much datastore space as the disk requires based on the value that you enter for the disk size.

2 Select a datastore to store the deployed OVF template.

The configuration file and virtual disk files are stored on the datastore. Select a datastore large enough to accommodate the virtual machine and all associated virtual disk files.

3 Click **Next**.

Setup OVF Network

Set up and configure the networks the deployed OVF templates use. The Setup networks page page of the Deploy OVF Template wizard allows you to map source networks to target networks and to specify settings for those networks.

Procedure

1 On the Setup networks page of the Deploy OVF Template wizard, select a source network in the table and map it to a destination network.

The Source column lists all networks that are defined in the OVF template. The Destination column contains a list of target networks.

2 From the **IP protocol** list, select the IP type.

3 Select the IP allocation and click **Next**.

Customize the OVF Template

Customize the deployment properties of the template. vCenter Host Gateway appliance has specific options that you must set during the deployment.

Procedure

1 Enter the administrator user name and password for the vCenter Host Gateway appliance.

2 (Optional) If you want to enable SSH-based remote login, select the **SSH Enabled** check box.

3 To synchronize the time of the vCenter Host Gateway with the time of VMware Tools, select the **Tools-based Time Synchronization Enabled** check box.

4 To synchronize the time of the vCenter Host Gateway with one or more NTP servers, enter the host names or IP addresses in the **NTP Server** text box, separated by a comma.

NOTE If you chose to synchronize the time of the appliance with both VMware Tools and an NTP server, and there is a difference between those times, the appliance synchronizes according to the NTP server time.

5 (Optional) Enter the host name or IP address of the Platform Services Controller.

NOTE You can use vCenter Host Gateway only after you register it as a service in the Platform Services Controller. If you leave the text box empty, you must use the vCenter Host Gateway appliance to register vCenter Host Gateway later.

6 Provide a Single Sign-On user name and password.

The user name you enter must have Single Sign-On administrator privileges.

7 Enter the Host Network IP Address Family.

8 Select the **Host Network Mode**.

Option	Description
static	Manual configuration. If you are using static host network mode, enter the **Host Network IP Adddress** and the length of the **Host Network Prefix**.
dhcp	Automatic configuration.
autoconf	Automatic configuration. Available only if you have selected IPv6 address.

9 Enter the **Host Network Default Gateway**.

10 Enter the **Host Network DNS Servers**.

If you need to provide more than one value, separate them by a comma.

11 Enter the **Host Network Identity** name or the fully qualified domain name of the appliance.

12 Click **Next**.

Review the Configuration and Complete the Deployment

Review the details of the vCenter Host Gateway appliance configuration and complete the deployment process.

Procedure

1 On the Ready to complete page of the Deploy OVF Template wizard, review the settings you configured during the deployment .

2 (Optional) Select **Power on after deployment**.

3 Click **Finish** to complete the deployment process.

vCenter Host Gateway User Permissions

While deploying the vCenter Host Gateway appliance, you must provide Single Sign-On administrator credentials. vCenter Host Gateway requires those credentials to create a solution user.

Solution User

vCenter Host Gateway creates a solution user when vCenter Host Gateway is registered as a service in the Platform Services Controller. vCenter Host Gateway requires the solution user to register, unregister, and modify the service.

The name of the solution user is in the format vchgUserName*numeric_value*.

Note Each time you register the vCenter Host Gateway service in the Platform Services Controller, a new solution user is created.

vCenter Host Gateway Privileges

vCenter Host Gateway allows you to manage third-party hosts and virtual machines.
vCenter Host Gateway does not require other privileges.

Configure the vCenter Host Gateway Appliance

After you deploy the vCenter Host Gateway appliance, you can change the configuration settings by using the Web configuration UI of the appliance.

- Restart the vCenter Host Gateway Service on page 70

  You can restart the vCenter Host Gateway service by using the vCenter Host Gateway appliance. If the host name or the certificate of vCenter Host Gateway changes, you must restart the service.

- Synchronize the Time Settings of the vCenter Host Gateway Appliance on page 70

  You can change the time synchronization of the vCenter Host Gateway appliance after the deployment. Synchronization is required when the NTP servers change to ensure the successful registration with the Platform Services Controller.

- Change Network Settings of the vCenter Host Gateway Appliance on page 71

  You can change the network configuration of the vCenter Host Gateway appliance when, for example, your network connection changes.

- Configure Proxy Settings on page 71

  If you connect through a corporate firewall, you can configure the vCenter Host Gateway proxy settings.

- Manage the Registration of the vCenter Host Gateway Service on page 72

  You can unregister the vCenter Host Gateway service from the Platform Services Controller, and change the registration settings.

- Change the Administrator Password of the vCenter Host Gateway Appliance on page 72

  You can change the password of the vCenter Host Gateway after you deploy the appliance.

- Restart or Shut Down the vCenter Host Gateway Appliance on page 73

  You must reboot the vCenter Host Gateway appliance when the network or hardware configuration changes, or after you update the software updates.

- Download a Support Bundle on page 73

  You can download a support bundle for the vCenter Host Gateway appliance. The support bundle contains the log files of the appliance.

Restart the vCenter Host Gateway Service

You can restart the vCenter Host Gateway service by using the vCenter Host Gateway appliance. If the host name or the certificate of vCenter Host Gateway changes, you must restart the service.

Procedure

1. In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.
2. On the **VMware vCenter Host Gateway** tab, click **Summary**.
3. Click **Restart**.

Synchronize the Time Settings of the vCenter Host Gateway Appliance

You can change the time synchronization of the vCenter Host Gateway appliance after the deployment. Synchronization is required when the NTP servers change to ensure the successful registration with the Platform Services Controller.

Procedure

1. In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.

2 On the **VMware vCenter Host Gateway** tab, click **Time**.

3 Select a synchronization method and click **Submit**.

Option	Description
No Synchronization	Select this option if you do not use any synchronization.
NTP Synchronization	Enter one or more NTP server names, separated by a comma. In addition to the names, enter NTPD options for each server, if applicable.
VMware Tools Synchronization	Synchronize the vCenter Host Gateway appliance with VMware Tools

Change Network Settings of the vCenter Host Gateway Appliance

You can change the network configuration of the vCenter Host Gateway appliance when, for example, your network connection changes.

Procedure

1 In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.

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

3 From the **IP Version** drop-down menu, select the IP version that corresponds to your network.

You can select IPv4 or IPv6 version.

4 Select the **Network Mode**.

Option	Description
DHCP	Select this option if a DHCP server is used to allocate the IP address in your environment.
Static	Manually set the networking settings.
Auto	Select this option if the IP address allocation is done by a stateless method. The option is available for IPv6.

5 (Optional) If required, enter values for the following settings:

Option	Description
Host Address	The host address of the appliance in IPv4 or IPv6 format.
Prefix	The valid network prefix. Only for IPv6.
Mask	The valid network mask. Only for IPv4.
Gateway	The default gateway.
DNS servers	The IP addresses of the DNS servers.
Hostname	The FQDN of the host.

6 Click **Save Settings**.

Configure Proxy Settings

If you connect through a corporate firewall, you can configure the vCenter Host Gateway proxy settings.

Procedure

1 In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.

2 On the **Network** tab, click **Proxy**.

3 Select the **Use HTTP Proxy Server** check box.

4 Enter the IP address of the proxy server.

5 Enter the port on which the proxy server listens.

6 (Optional) Provide a proxy user name and password.

7 Click **Save Settings** to apply your changes.

Manage the Registration of the vCenter Host Gateway Service

You can unregister the vCenter Host Gateway service from the Platform Services Controller, and change the registration settings.

You must change the vCenter Host Gateway service registration when you perform one of the following tasks:

- Platform Services Controller host name
- vCenter Host Gateway host name
- vCenter Host Gateway certificate

Before you change the vCenter Host Gateway service registration, you must unregister the service.

Procedure

1 In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.

2 Click the **Registration** tab.

3 Click **Unregister**.

This operation unregisters vCenter Host Gateway from thePlatform Services Controller and deletes the solution user.

4 In the **IP or host name** text box, enter the IP address of the Platform Services Controller.

5 Enter a Single Sign-On administrator user name and password.

6 Click **Register**.

Change the Administrator Password of the vCenter Host Gateway Appliance

You can change the password of the vCenter Host Gateway after you deploy the appliance.

Procedure

1 In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.

2 Click the **Admin** tab.

3 Enter the current administrator password.

4 Enter and confirm the new administrator password.

5 Click **Change Password**.

6 Select whether you want to use SSH login for the administrator user.

7 Click **Submit**.

Restart or Shut Down the vCenter Host Gateway Appliance

You must reboot the vCenter Host Gateway appliance when the network or hardware configuration changes, or after you update the software updates.

Procedure

1 In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.

2 Click the **System** tab.

3 Select a power management option.

Option	Description
Reboot	Restart the vCenter Host Gateway appliance.
Shutdown	Power off the vCenter Host Gateway appliance. To power on the appliance again, you must use the vSphere Web Client.

4 Log out of the vSphere Web Client and log in again to see the changes in the power state of the vCenter Host Gateway appliance.

Download a Support Bundle

You can download a support bundle for the vCenter Host Gateway appliance. The support bundle contains the log files of the appliance.

Procedure

1 In a Web browser, log in to the Web interface of the vCenter Host Gateway appliance.

2 On the **VMware vCenter Host Gateway** tab, click **Download Support Bundle**.

3 Select the location where you want to save the file in `.tar.gz` format and click **Save**.

Add Third-Party Hosts to the vCenter Server Inventory

You can add third-party hosts to the vCenter Server inventory by using the vSphere Web Client.

Prerequisites

Verify that you have a valid ESXi 6.0 license for each third-party host that you add.

Procedure

1 In the vSphere Web Client, navigate to a data center or host folder.

2 Click **Actions > Add Host**.

3 Enter the name or IP address of the host, followed by the port.

```
hostname:port
```

4 From the **Type** drop-down menu, select a third-party host type.

5 Click **Next**.

6 If prompted, confirm that the connection is as secure as required.

7 If prompted, check and verify the host certificate.

8 In the **Username** and **Password** text boxes, enter administrator credentials and click **Next**.

9 Review the host summary information and click **Next**.

10 Assign a licence key to the host and click **Next**.

11 On the page that displays lockdown options, leave the default options selected, and click **Next**.

12 Select a location for the virtual machines that already exist on the host and click **Next**.

13 Review the summary information and click **Finish**.

Supported Actions for Managing Third-Party Hosts in the vSphere Web Client

vCenter Host Gateway lets you perform various operations with third-party hosts and virtual machines.

Table 5-3. Supported Operations with Hosts

Operation	Options and Limitations
Add Host	See "Add Third-Party Hosts to the vCenter Server Inventory," on page 73.
Remove Host	See *vCenter Server and Host Management*.
Reconnect Host	If attempts to reconnect the host fail, add the host again.
Disconnect Host	See *vCenter Server and Host Management*.
Shut down Host	See *vCenter Server and Host Management*.
Reboot Host	See *vCenter Server and Host Management*.

Supported Actions for Managing Third-Party Virtual Machines in the vSphere Web Client

vCenter Host Gateway lets you perform various operations with third-party hosts and virtual machines.

Table 5-4. Supported Operations for Virtual Machines on Third-Party Hosts

Operation	Options and Limitations
Create a virtual machine	You can customize the name, CPU and RAM. For more information, see *vSphere Virtual Machine Administration*.
Change the name of the virtual machine	You can only change the name of the virtual machine. For more information, see *vSphere Virtual Machine Administration*.
Delete a virtual machine	No specific options and limitations. For more information, see *vSphere Virtual Machine Administration*.
Configure the virtual machine power states	You can change the basic power configuration: ■ Power On ■ Power Off ■ Suspend ■ Reset For more information, see *vSphere Virtual Machine Administration*.

Organizing Your Inventory 6

Plan how you will set up your virtual environment. A large vSphere implementation might contain several virtual data centers with a complex arrangement of hosts, clusters, resource pools, and networks. It might involve multiple vCenter Server systems connected using Enhanced Linked Mode. Smaller implementations might require a single virtual data center with a much less complex topology. Regardless of the scale of your virtual environment, consider how the virtual machines it will support are going to be used and administered.

Here are questions you should answer as you create and organize an inventory of virtual objects:

- Will some virtual machines require dedicated resources?
- Will some virtual machines experience periodic spikes in workload?
- Will some virtual machines need to be administered as a group?
- Do you want to use multiple vSphere Standard Switches, or you want to have a single vSphere Distributed Switch per data center?
- Do you want to use vMotion and Distributed Resource Management with certain virtual machines but not others?
- Will some virtual objects require one set of system permissions, while other objects will require a different set of permissions?

The left pane of the vSphere Web Client displays your vSphere inventory. You can add and arrange objects in any way with the following restrictions:

- The name of an inventory object must be unique with its parent.
- vApp names must be unique within the Virtual Machines and Templates view.
- System permissions are inherited and cascade.

Tasks for Organizing Your Inventory

Populating and organizing your inventory involves the following activities:

- Create data centers.
- Add hosts to the data centers.
- Organize inventory objects in folders.
- Setup networking by using vSphere Standard Switches or vSphere Distributed Switches. To use services such as vMotion, TCP/IP storage, Virtual SAN, and Fault Tolerance, setup VMkernel networking for these services. For more information, see *vSphere Networking*.

- Configure storage systems and create datastore inventory objects to provide logical containers for storage devices in your inventory. See *vSphere Storage*.
- Create clusters to consolidate the resources of multiple hosts and virtual machines. You can enable vSphere HA and vSphere DRS for increased availability and more flexible resource management. See *vSphere Availability* for information about configuring vSphere HA and *vSphere Resource Management* for information about configuring vSphere DRS.
- Create resource pools to provide logical abstraction and flexible management of the resources in vSphere. Resource pools can be grouped into hierarchies and used to hierarchically partition available CPU and memory resources. See *vSphere Resource Management* for details.

This chapter includes the following topics:

- "Create Data Centers," on page 76
- "Add a Host," on page 76
- "Create Clusters," on page 77
- "Create a Folder," on page 78

Create Data Centers

A virtual data center is a container for all the inventory objects required to complete a fully functional environment for operating virtual machines. You can create multiple data centers to organize sets of environments. For example, you might create a data center for each organizational unit in your enterprise or create some data centers for high performance environments and others for less demanding virtual machines.

Prerequisites

In the vSphere Web Client verify that you have sufficient permissions to create a data center object.

Note Inventory objects can interact within a data center, but interaction across data centers is limited. For example, you can hot migrate virtual machines from one host to another host in the same data center, but not from a host in one data center to a host in a different data center.

Procedure

1. In the vSphere Web Client, navigate to the vCenter Server object.
2. Select **Actions > New Datacenter**.
3. Rename the data center and click **OK**.

What to do next

Add hosts, clusters, resource pools, vApps, networking, datastores, and virtual machines to the data center.

Add a Host

You can add hosts under a data center object, folder object, or cluster object. If a host contains virtual machines, those virtual machines are added to the inventory together with the host.

You can also add hosts to a DRS cluster, for details see *vSphere Resource Management*.

Prerequisites

- Verify that a data center, folder, or cluster exists in the inventory.
- Obtain the user name and password of the root user account for the host.

- Verify that hosts behind a firewall are able to communicate with the vCenter Server system and all other hosts through port 902 or other custom-configured port.
- Verify that all NFS mounts on the host are active.

Required privileges:

- **Host.Inventory.Add host to cluster**
- **Resource.Assign virtual machine to resource pool**
- **System.View** on the virtual machines folder where you want to place the virtual machines of the host.

Procedure

1. In the vSphere Web Client, navigate to a data center, cluster, or folder within a data center.
2. Right-click the data center, cluster, or folder and select **Add Host**.
3. Type the IP address or the name of the host and click **Next**.
4. Type administrator credentials and click **Next**.
5. Review the host summary and click **Next**.
6. License the host through one of the following methods.
   - Assign an already existing license.
   - Assign a new license.
     a. Click **Create New Licenses**. The Add Host wizard minimizes in Work in Progress and the New Licenses wizard appears.
     b. Type of copy and paste the new license key from My VMware and click **Next**.
     c. Enter a new name for the license and click **Next**.
     d. Review the new license and click **Finish**.
7. In the Add Host wizard click **Next**.
8. (Optional) Select a lookdown mode option to disable the remote access for the administrator account after vCenter Server takes control of this host.
9. (Optional) If you add the host to a data center or a folder, select a location for the virtual machines that reside on the host and click **Next**.
10. Review the summary and click **Finish**.

A new task for adding the host appears in the Recent Tasks pane. It might take a few minutes for the task to complete.

Create Clusters

A cluster is a group of hosts. When a host is added to a cluster, the resources of the host become part of the resources of the cluster. The cluster manages the resources of all hosts within it. Clusters enable, vSphere High Availability (HA), vSphere Distributed Resource Scheduler (DRS), and the VMware Virtual SAN features.

Prerequisites

- Verify that you have sufficient permissions to create a cluster object.
- Verify that a data center, or folder within a data center, exists in the inventory.

Procedure

1 Browse to a data center in the vSphere Web Client navigator.

2 Right-click the data center and select **New Cluster**.

3 Enter a name for the cluster.

4 Select DRS and vSphere HA cluster features.

Option	Description
To use DRS with this cluster	a Select the DRS **Turn ON** check box. b Select an automation level and a migration threshold.
To use HA with this cluster	a Select the vSphere HA **Turn ON** check box. b Select whether to enable host monitoring and admission control. c If admission control is enabled, specify a policy. d Select a VM Monitoring option. e Specify the virtual machine monitoring sensitivity.

5 Select an Enhanced vMotion Compatibility (EVC) setting.

   EVC ensures that all hosts in a cluster present the same CPU feature set to virtual machines, even if the actual CPUs on the hosts differ. This prevents migrations with vMotion from failing due to incompatible CPUs.

6 Select the Virtual SAN cluster feature.

   a Select the Virtual SAN **Turn ON** check box.

   b Specify whether to add disks automatically or manually to the Virtual SAN cluster.

7 Click **OK**.

The cluster is added to the inventory

What to do next

Add hosts to the cluster.

For information about configuring vSphere HA, see *vSphere Availability*, and for information about configuring vSphere DRS see *vSphere Resource Management*. For information about Virtual SAN, see *VMware Virtual SAN* .

Create a Folder

You can use folders to group objects of the same type for easier management. For example, permissions can be applied to folders, allowing you to use folders to group objects that should have a common set of permissions.

A folder can contain other folders, or a group of objects of the same type. For example, a single folder can contain virtual machines and another folder containing virtual machines, but it cannot contain hosts and a folder containing virtual machines.

You can create these types of folders: Host and Cluster folders, Network folders, Storage folders, and VM and Template folders.

Procedure

1 In the navigator, select either a data center or another folder as a parent object for the folder.

2 Right-click the parent object and select the menu option to create the folder.

Option	Description
The parent object is a data center.	If the parent object is a data center, you can select the type of folder to create: ■ Select **All vCenter Actions > New Host and Cluster Folder**. ■ Select **All vCenter Actions > New Network Folder**. ■ Select **All vCenter Actions > New Storage Folder**. ■ Select **All vCenter Actions > New VM and Template Folder**.
The parent object is a folder.	If the parent object is a folder, the new folder is of the same type as the parent folder. Select **All vCenter Actions > New Folder**.

3 Type the name for the folder and click **OK**.

What to do next

Move objects into the folder by right-clicking the object and selecting **Move To**. Select the folder as the destination.

Tagging Objects 7

Tags allow you to attach metadata to objects in the vSphere inventory to make these objects more sortable and searchable.

A tag is a label that you can apply to objects in the vSphere inventory. When you create a tag, you assign that tag to a category. Categories allow you to group related tags together. When you define a category, you can also specify which object types its tags can be applied to and whether more than one tag in the category can be applied to an object. For example, if you wanted to tag your virtual machines by guest operating system type, you could create a category called 'operating system', and specify that it applies to virtual machines only and that only a single tag can be applied to a virtual machine at any time. The tags in this category could be "Windows", "Linux", and "Mac OS".

If multiple vCenter Server instances are configured to use Enhanced Linked Mode, tags and tag categories are replicated across all these vCenter Server instances.

Tagging replaces the custom attributes functionality found in previous versions of vCenter Server. If you have existing custom attributes, you can convert them into tags.

This chapter includes the following topics:

- "Migrate Custom Attributes to Tags," on page 81
- "Create a Tag Category," on page 83
- "Delete a Tag Category," on page 83
- "Edit a Tag Category," on page 84
- "Create a Tag," on page 85
- "Apply a Tag to an Object," on page 85
- "Remove a Tag from an Object," on page 85
- "Delete a Tag," on page 86
- "Edit a Tag," on page 86
- "Tagging Best Practices," on page 87

Migrate Custom Attributes to Tags

Tags replace the custom attributes functionality found in previous versions of vSphere. If you have existing custom attributes, you can migrate them to tags.

During the migration, the custom attribute names are converted to categories. Custom attribute values are converted to tag names.

Procedure

1 In the vSphere Web Client object navigator, browse to any object that has custom attributes.

2 Click the object's **Summary** tab.

3 Select **Actions > Tags & Custom Attributes > Edit Custom Attributes...**

4 In the Migrate Custom Attribues dialog box, click **Migrate**.

The Migrate Custom Attributes to Tags wizard appears.

5 Read the instructions and click **Next**.

6 Select the custom attributes to migrate and click **Next**.

The Create Tag Categories page displays the name of each custom attribute as a new tag category.

7 (Optional) Select a category to edit its options.

Option	Description
Category Name	The category name must be unique to the currently-selected vCenter Server system.
Description	You can provide text in the description to describe the purpose or usage of the category.
Cardinality	■ Select **1 tag per object** to allow only one tag from this category to be applied to an object at any one time. Use this option for categories whose tags are mutually exclusive. For example, a category called Priority with tags High, Medium, and Low should allow one tag per object, because an object should have only one priority. ■ Select **Many tags per object** to allow multiple tags from the category to be applied to an object at any one time. Use this option for categories whose tags are not mutually exclusive. After you have set the cardinality of a category, you can change the cardinality from **1 tag per object** to **Many tags per object**, but not from **Many tags per object** to **1 tag per object**.
Associable Object Types	Select whether tags in this category can be assigned to all objects or only to a specific type of managed object, such as virtual machines or datastores. After you have set the associable object types for a category, you can change a category that is associable with a single object type to be associable with all object types, but you cannot restrict a category that is associable to all object types to being associable to a single object type.

8 (Optional) Select a tag to edit its attributes.

Option	Description
Name	The tag name must be unique across all linked vCenter Server systems.
Description	You can provide text in the description to describe the purpose or usage of the tag.

9 Click **Finish**.

The selected custom attributes are converted to categories and tags.

Create a Tag Category

You use categories to group tags together and define how tags can be applied to objects.

Every tag must belong to one and only one category. You must create at least one category before creating any tags.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Create vSphere Tag Category** on the root vCenter Server.

Procedure

1 From the vSphere Web Client Home, click **Tags**.

2 Click the **Items** tab and click **Categories**.

3 Click the New Category icon.

4 Edit the category options.

Option	Description
Category Name	The category name must be unique to the currently-selected vCenter Server system.
Description	You can provide text in the description to describe the purpose or usage of the category.
Cardinality	■ Select **1 tag per object** to allow only one tag from this category to be applied to an object at any one time. Use this option for categories whose tags are mutually exclusive. For example, a category called Priority with tags High, Medium, and Low should allow one tag per object, because an object should have only one priority. ■ Select **Many tags per object** to allow multiple tags from the category to be applied to an object at any one time. Use this option for categories whose tags are not mutually exclusive. After you have set the cardinality of a category, you can change the cardinality from **1 tag per object** to **Many tags per object**, but not from **Many tags per object** to **1 tag per object**.
Associable Object Types	Select whether tags in this category can be assigned to all objects or only to a specific type of managed object, such as virtual machines or datastores. After you have set the associable object types for a category, you can change a category that is associable with a single object type to be associable with all object types, but you cannot restrict a category that is associable to all object types to being associable to a single object type.

5 Click **OK**.

Delete a Tag Category

You delete a category to remove it from your vSphere environment.

Deleting a category also deletes all tags associated with that category.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Delete vSphere Tag Category** on the root vCenter Server.

Procedure

1 From the vSphere Web Client Home, click **Tags**.

2 Click the **Items** tab and click **Categories**.

3 Select a category from the list and click the Delete Category icon (✕).

4 Click **Yes** to confirm deletion of the category.

The category and all its associated tags are deleted.

Edit a Tag Category

You can edit a category to change its name, cardinality, or associable objects.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Edit vSphere Tag Category** on the root vCenter Server.

Procedure

1 From the vSphere Web Client Home, click **Tags**.

2 Click the **Items** tab and click **Categories**.

3 Select a category and click the Edit Category icon (✎).

4 Edit the category parameters.

Option	Description
Category Name	The category name must be unique to the currently-selected vCenter Server system.
Description	You can provide text in the description to describe the purpose or usage of the category.
Cardinality	■ Select **1 tag per object** to allow only one tag from this category to be applied to an object at any one time. Use this option for categories whose tags are mutually exclusive. For example, a category called Priority with tags High, Medium, and Low should allow one tag per object, because an object should have only one priority. ■ Select **Many tags per object** to allow multiple tags from the category to be applied to an object at any one time. Use this option for categories whose tags are not mutually exclusive. After you have set the cardinality of a category, you can change the cardinality from **1 tag per object** to **Many tags per object**, but not from **Many tags per object** to **1 tag per object**.
Associable Object Types	Select whether tags in this category can be assigned to all objects or only to a specific type of managed object, such as virtual machines or datastores. After you have set the associable object types for a category, you can change a category that is associable with a single object type to be associable with all object types, but you cannot restrict a category that is associable to all object types to being associable to a single object type.

5 Click **OK**

Create a Tag

You use tags to add metadata to inventory objects. You can record information about your inventory objects in tags and use the tags in searches.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Create vSphere Tag** on root vCenter Server.

Procedure

1 From the vSphere Web Client Home, click **Tags**.

2 Click the **Items** tab and click **Tags**.

3 Click the New Tag icon.

4 In the **vCenter Server** drop-down menu, select the vCenter Server instance on which to create this tag.

5 In the **Name** text box, enter a name for the tag.

   Tag names must be unique within the category in which they are created.

6 (Optional) In the **Description** text box, enter a description for the tag.

7 In the **Category** drop-down menu, select an existing category or create a new category.

   If you select **[New Category]**, the dialogue box expands to show the options for creating a category. See "Create a Tag Category," on page 83.

8 Click **OK**.

Apply a Tag to an Object

After you have created tags, you can apply them as metadata to objects in the vSphere Web Client inventory.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Assign or Unassign vSphere Tag** on the root vCenter Server instance.

Procedure

1 Browse to the object in the vSphere Web Client inventory.

2 Click the **Manage** tab and click **Tags**.

3 Click the Assign Tag icon ( ).

4 (Optional) From the **Categories** drop-down menu, select a category to limit the tags displayed to ones from that category.

5 Select a tag from the list and click **OK**.

That tag is assigned to the object. The assigned tags for each object appear in the list on the **Tags** tab.

Remove a Tag from an Object

You can remove a tag that has been applied to an object.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Assign or Unassign vSphere Tag** on the root vCenter Server instance.

Procedure

1 Browse to the object in the vSphere Web Client inventory.

2 Click the **Manage** tab and click **Tags**.

3 Select a tag to remove and click the Detach Tag icon ( ).

4 Click **Yes** to confirm the removal of the tag.

Delete a Tag

You can delete a tag when it is no longer needed. Deleting a tag removes it from all the objects to which it is applied.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Delete vSphere Tag** on the root vCenter Server instance.

Procedure

1 From the vSphere Web Client Home, click **Tags**.

2 Click the **Items** tab and click **Tags**.

3 Select the tag to delete.

4 Click the Delete Tag icon ( ).

5 Click **OK** to confirm tag deletion.

Edit a Tag

You can edit a tag to change its name or description.

After a tag has been created, you cannot change the tag's category.

Prerequisites

Required privilege: **Inventory Service.vSphere Tagging.Edit vSphere Tag** on the root vCenter Server instance.

Procedure

1 From the vSphere Web Client Home, click **Tags**.

2 Click the **Items** tab and click **Tags**.

3 Select the tag to edit.

4 Click the Edit Tag icon ( ).

5 (Optional) In the **Name** text box, enter a new name for the tag.

   Tag names must be unique within their category.

6 (Optional) In the **Description** text box, edit the description for the tag.

7 Click **OK**.

Tagging Best Practices

Incorrect tagging can lead to replication errors. To avoid these errors, diligently follow best practices when tagging objects.

When working with tags in multiple node situations, expect replication delays between the nodes (generally 30 seconds to 2 minutes depending on your setup). Follow these best practices to avoid replication errors:

- After creating a tag, if you immediately assign that tag to a local object, assign it from the management node where you created the tag.
- After creating a tag, if you immediately assign that tag to a remote object, assign it from the management node to which the object is local. Depending on your environment setup, allow for replication time to propagate the new tag before you use the tag.
- Avoid simultaneously creating categories and tags from different management nodes before categories and tags across nodes can finish the replication process. If duplicate categories or tags are created from different nodes at the same time, the duplicates might not be detected and will appear. If you see these results, manually delete duplicates from one management node.

License Management and Reporting 8

vSphere provides centralized a license management and reporting system that you can use to manage licenses for ESXi hosts, vCenter Server systems, Virtual SAN clusters, and solutions. Solutions are products that integrate with vSphere such as vCenter Site Recovery Manager, vCloud Networking and Security, vCenter Operations Manager, and others.

- Licensing Terminology and Definitions on page 90

  The licensing system in vSphere uses specific terminology and definitions to refer to different licensing-related objects.

- The License Service in vSphere 6.0 on page 91

  In vSphere 6.0, the License Service is part of the Platform Services Controller and delivers centralized license management and reporting functionality to vSphere and to products that integrate with vSphere.

- Licensing for Environments with vCenter Server Systems 6.0 and 5.5 on page 91

  If your vSphere 6.0 environment consists of vCenter Server 6.0 and 5.5 systems, you should consider the differences in the license management and reporting between vSphere 6.0 and vSphere 5.5.

- Licensing for Products in vSphere on page 92

  ESXi hosts, vCenter Server, and Virtual SAN clusters are licensed differently. To apply their licensing models correctly, you must understand how the associated assets consume license capacity, the way the evaluation period for each product functions, what happens if a product license expires, and so on.

- Suite Licensing on page 94

  Suite products combine multiple components to provide a certain set of capabilities. Suite products have a single license that you can assign to all suite components. When participating in a suite, suite components have different licensing models than their standalone versions. Examples of suite products are vCloud Suite and vSphere with Operations Management.

- Managing Licenses on page 95

  To license an asset in vSphere, you must assign it a license that holds an appropriate product license key. You can use the license management functionality in the vSphere Web Client to license multiple assets at a time from a central place. Assets are vCenter Server systems, hosts, Virtual SAN clusters, and solutions.

- Viewing Licensing Information on page 100

  You can view the licensing state of the vSphere environment from a central place by using the license management functionality in the vSphere Web Client. You can view the licenses that are available in vSphere, current license assignments and usage, available license capacity, licensed features in use, and so on.

- Generating Reports for License Usage in the vSphere Web Client on page 102

  You can track the license usage of your vSphere environment by generating reports for the license usage of assets for a certain time period. Assets are hosts, vCenter Server systems, Virtual SAN clusters, and solutions.

Licensing Terminology and Definitions

The licensing system in vSphere uses specific terminology and definitions to refer to different licensing-related objects.

License Key
A license key encodes details about the product it is associated with, the license expiration date, the license capacity, and other information. The license key is assigned to an object to activate the functionality of its associated product.

License
A container for a license key of a VMware product. To use a license key, you create a license object in the vSphere Web Client, and insert the license key into the license. Once the license is created, you can assign it to assets .

Product Edition
A set of specific features that are associated with a unique license key. When assigned, the license key unlocks the features in the product edition. Examples of product editions are vSphere Enterprise, vSphere Standard, vCenter Server Essentials, and so on.

Feature
Functionality that is enabled or disabled by a license that is associated with a specific product edition. Examples of features are vSphere DRS, vSphere vMotion, and vSphere High Availability.

Solution
A product that is packed and distributed independently from vSphere. You install a solution in vSphere to take advantage of certain functionality. Every solution has a licensing model specific for the solution, but uses the License Service for license management and reporting. Examples of solutions are vCenter Site Recovery Manager, vCenter Operations Manager, vCloud Network and Security, and so on.

Asset
Any object in vSphere that requires licensing. The license administrator in vSphere can assign one license to one or multiple assets of the same type if the license has sufficient capacity. Suite licenses can be assigned to all assets that are part of the suite. Assets are vCenter Server systems, ESXi hosts, and products that integrate with vSphere such as vCenter Site Recovery Manager, vCenter Operations Manager, and others.

License Capacity
The number of units that you can assign to assets. The units of a license capacity can be of different types depending on the product that the license is associated with. For example, a license for vCenter Server determines the number of vCenter Server systems that you can license.

License Usage
The number of units that an asset uses from the capacity of a license. For example, if you assign a per-virtual-machine license to vCenter Site Recovery Manager, the license usage for vCenter Site Recovery Manager is the number of protected virtual machines.

The License Service in vSphere 6.0

In vSphere 6.0, the License Service is part of the Platform Services Controller and delivers centralized license management and reporting functionality to vSphere and to products that integrate with vSphere.

You can use the License Service with newly installed vSphere 6.0 environments, or environments that are upgraded from vSphere 5.x to vSphere 6.0 . For details about upgrading the license management in vCenter Server 5.x to the License Service in vSphere 6.0, see the *vSphere Upgrade* guide.

The License Service provides an inventory of licenses in the vSphere environment, and manages the license assignments for ESXi hosts, vCenter Server systems, and clusters with enabled Virtual SAN. The License Service also manages the license assignments for products that integrate with vSphere, such as vCenter Operations Manager, vCenter Site Recovery Manager, and so on.

If your vSphere environment has several Platform Services Controllers that are joined through one vCenter Single Sign-on domain, the licensing inventory is replicated across all Platform Services Controllers . This way, the licensing data for each asset and all available licenses are replicated across all of the Platform Services Controllers, and each individual Platform Services Controller contains a copy of that data and licenses for all of the Platform Services Controllers.

NOTE Licensing data is replicated across multiple Platform Services Controllers on a 10 minute interval.

For example, suppose that your environment consists of two Platform Services Controllers that are connected to four vCenter Server systems each, and every vCenter Server system has 10 hosts connected to it. The License Service stores information about the license assignments and usage for all eight vCenter Server systems, and the 80 hosts that are connected to those systems. The License Service also lets you manage the licensing for all eight vCenter Server systems and the 80 hosts that are connected to them through the vSphere Web Client.

Licensing for Environments with vCenter Server Systems 6.0 and 5.5

If your vSphere 6.0 environment consists of vCenter Server 6.0 and 5.5 systems, you should consider the differences in the license management and reporting between vSphere 6.0 and vSphere 5.5.

The License Service in vSphere 6.0 manages the licensing data for all ESXi hosts, Virtual SAN clusters, and solutions that are associated with the vCenter Server 6.0 systems in the vSphere environment. However, every standalone vCenter Server 5.5 system manages the licensing data only for the hosts, solutions, and Virtual SAN clusters that are associated with that system . Licensing data for linked vCenter Server 5.5 systems is replicated only for the vCenter Server 5.5 systems in the group.

Due to the architectural changes in vSphere 6.0, you can either manage the licensing data for all assets that are associated with all vCenter Server 6.0 systems in vSphere, or manage the licensing data for individual vCenter Server 5.5 systems or a group of linked vCenter Server 5.5 systems. The licensing interface in the vSphere Web Client 6.0 lets you select between all vCenter Server 6.0 systems and vCenter Server 5.5 systems.

Licensing for Products in vSphere

ESXi hosts, vCenter Server, and Virtual SAN clusters are licensed differently. To apply their licensing models correctly, you must understand how the associated assets consume license capacity, the way the evaluation period for each product functions, what happens if a product license expires, and so on.

Licensing for ESXi Hosts

ESXi hosts are licensed with vSphere licenses. Each vSphere license has a certain CPU capacity that you can use to license multiple physical CPUs on ESXi hosts. When you assign a vSphere license to a host, the amount of CPU capacity that is consumed is equal to the number of physical CPUs in the host. vSphere Desktop that is intended for VDI environments is licensed on per virtual machine basis.

To license an ESXi host, you must assign it a vSphere license that meets the following prerequisites:

- The license must have CPU capacity that is sufficient to license all physical CPUs on the host. For example, to license two ESXi hosts that have four CPUs each, you need to assign a vSphere license with a minimum capacity of 8 CPUs to the hosts.
- The license must support all the features that the host uses. For example, if the host is associated with a vSphere Distributed Switch, the license that you assign must support the vSphere Distributed Switch feature.

If you attempt to assign a license that has insufficient capacity or does not support the features that the host uses, the license assignment will be unsuccessful.

You can assign and reassign the CPU capacity of a vSphere license to any combination of ESXi hosts. For example, suppose that you purchase a vSphere license for 10 CPUs. You can assign the license to any of the following combinations of hosts:

- Five 2-CPU hosts
- Three 2-CPU hosts and one 4-CPU host
- Two 4-CPU hosts and one 2-CPU host
- One 8-CPU host and one 2-CPU host

Dual-core and quad-core CPUs, such as Intel CPUs that combine two or four independent CPUs on a single chip, count as one CPU.

Evaluation Mode

When you install ESXi, its default license is evaluation mode. Evaluation mode licenses expire after 60 days. An evaluation mode license provides the set of features that equals the highest vSphere product edition.

If you assign a license to an ESXi host before its evaluation period expires, the time available in the evaluation period is decreased by the time already used. To explore the entire set of features that are available for the host, you can set it back to evaluation mode, and use it for the remaining evaluation period.

For example, suppose that you use an ESXi host in evaluation mode for 20 days and then assign a vSphere Standard license to the host. If you set the host back to evaluation mode, you can explore the entire set of features that are available for the host for the remaining evaluation period of 40 days.

License and Evaluation Period Expiry

For ESXi hosts, license or evaluation period expiry leads to disconnection from vCenter Server. All powered on virtual machines continue to work, but you cannot power on virtual machines after they are powered off. You cannot change the current configuration of the features that are already in use. You cannot use the features that remained unused while the host was in evaluation mode.

Licensing ESXi Hosts After Upgrade

If you upgrade an ESXi to a version that starts with the same number, you do not need to replace the existing license with a new one. For example, if you upgrade a host from ESXi 5.1 to 5.5, you can use the same license for the host.

If you upgrade an ESXi host to version that starts with a different number, you must apply a new license. For example, if you upgrade an ESXi host from 5.x to 6.x, you need to license the host with a vSphere 6 license.

vSphere Desktop

vSphere Desktop is intended for VDI environments such as Horizon View. The license usage for vSphere Desktop equals the total number of powered on desktop virtual machines running on the hosts that are assigned a vSphere Desktop license.

Licensing for vCenter Server

vCenter Server systems are licensed with vCenter Server licenses that have per-instance capacity.

To license a vCenter Server system, you need a vCenter Server license that has the capacity for at least one instance.

Evaluation Mode

When you install a vCenter Server system, it is in evaluation mode. An evaluation mode license of a vCenter Server system expires 60 days after the product is installed no matter whether you assign a license to vCenter Server or not . You can set vCenter Server back to evaluation mode only within 60 days after its installation.

For example, suppose that you install a vCenter Server system and use it in evaluation mode for 20 days and assign the system an appropriate license. The evaluation mode license of vCenter Server will expire after the remaining 40 days of the evaluation period.

License and Evaluation Period Expiry

When the license or evaluation period of a vCenter Server system expires, all hosts disconnect from that vCenter Server system.

Licensing vCenter Server after Upgrade

If you upgradevCenter Server to a version that starts with the same number, you can keep the same license. For example, if you upgrade a vCenter Server system from vCenter Server 5.1 to 5.5., you can keep the same license on the system.

If you upgrade vCenter Server to a version that starts with a different number, you must apply a new license. For example, if you upgrade a vCenter Server system from 5.x to 6.x, you must license the system with a vCenter Server 6 license.

If you upgrade the edition of the license, for example, from vCenter Server Foundation to vCenter Server Standard, you must replace the existing license on the system with the upgraded license.

Licensing for Clusters with Enabled Virtual SAN

After you enable Virtual SAN on a cluster, you must assign the cluster an appropriate Virtual SAN license.

Just like vSphere licenses, Virtual SAN licenses have per CPU capacity. When you assign a Virtual SAN license to a cluster, the amount of license capacity that is used equals the total number of CPUs in the hosts that participate in the cluster. For example, if you have a Virtual SAN cluster that contains 4 hosts with 8 CPUs each, you need to assign the cluster a Virtual SAN license with a minimum capacity of 32 CPUs.

The license usage of the Virtual SAN cluster is recalculated and updated in one of the following cases:

- If you assign a new license to the Virtual SAN cluster.
- If you add a new host to the Virtual SAN cluster.
- If a host is removed from the cluster.
- If the total number of CPUs in a cluster changes.

You must maintain the Virtual SAN clusters in compliance with the Virtual SAN licensing model. The total number of CPUs of all hosts in the cluster must not exceed the capacity of the Virtual SAN license that is assigned to the cluster.

License and Evaluation Period Expiry

When the license or the evaluation period of a Virtual SAN expires, you can continue to use the currently configured Virtual SAN resources and features. However, you cannot add SSD or HDD capacity to an existing disk group or create new disk groups.

Virtual SAN for Desktop

Virtual SAN for Desktop is intended for use in VDI environments, such as vSphere for Desktop or Horizon™ View™. The license usage for Virtual SAN for Desktop equals the total number of powered on VMs in a cluster with enabled Virtual SAN.

To remain EULA compliant, the license usage for Virtual SAN for Desktop must not exceed the license capacity. The number of powered on desktop VMs in a Virtual SAN cluster must be less than or equal to the license capacity of Virtual SAN for Desktop.

Suite Licensing

Suite products combine multiple components to provide a certain set of capabilities. Suite products have a single license that you can assign to all suite components. When participating in a suite, suite components have different licensing models than their standalone versions. Examples of suite products are vCloud Suite and vSphere with Operations Management.

Licensing for VMware vCloud® Suite

VMware vCloud® Suite combines multiple components into a single product to cover the complete set of cloud infrastructure capabilities. When used together, the vCloud Suite components provide virtualization, software-defined data center services, policy-based provisioning, disaster recovery, application management, and operations management.

A vCloud Suite edition combines components such as vSphere, vCloud Director, vCloud Networking and Security, and others, under a single license. vCloud Suite editions are licensed on per-CPU basis. Many of the vCloud Suite components are also available as standalone products licensed on per-virtual machine basis. However, when these components are obtained through vCloud Suite, they are licensed on per-CPU basis.

The components from a vCloud Suite edition are activated with a single license key. For example, if you have a license key for vCloud Suite Standard, you assign the same key to all assets that will run vCloud Suite, for example, ESXi hosts, vCloud Automation Center, vCloud Director, and others.

All virtual machines running on a CPU licensed with a vCloud Suite edition can use all components included in that vCloud Suite edition. You can run unlimited number of virtual machines on the CPUs that are licensed with a vCloud Suite edition. To run virtual machines on CPUs that are not licensed for vCloud Suite, you need individual licenses for the products that you want to use.

For more information about the licensing model of vCloud Suite, see the vCloud Suite documentation.

Licensing for vSphere® with Operations Management

VMware vSphere® with Operations Management™ combines vSphere and vCenter™ Operations ManagementSuite™ Standard under a single suite with a single license. vSphere with Operations Management lets you gain operational insight in vSphere and optimize resource allocation by providing monitoring, performance, and capacity information about the vSphere environment.

vSphere with Operations Management is licensed on a per-processor basis. To run vSphere with Operations Management, you must assign ESXi hosts a vSphere with Operations Management license. You can run unlimited number of virtual machines on the hosts that are licensed for vSphere with Operations Management.

Managing Licenses

To license an asset in vSphere, you must assign it a license that holds an appropriate product license key. You can use the license management functionality in the vSphere Web Client to license multiple assets at a time from a central place. Assets are vCenter Server systems, hosts, Virtual SAN clusters, and solutions.

In vSphere, you can assign one license to multiple assets of the same type if the license has enough capacity. You can assign a suite license to all components that belong to the suite product edition. For example, you can assign one vSphere license to multiple ESXi hosts, but you cannot assign two licenses to one host. If you have a vCloud Suite license, you can assign the license to ESXi hosts, vCloud Networking and Security, vCenter Site Recovery Manager, and so on.

Managing Licenses in vSphere (http://link.brightcove.com/services/player/bcpid2296383276001?bctid=video_manage_vsphere_license)

Create New Licenses

When you purchase, divide, or combine license keys in My VMware, you must use the new keys to license assets in your vSphere environment. You must go to the vSphere Web Client and create a new license object for every license key. In the vSphere Web Client, a license is a container for a license key of a VMware product. After you create the new licenses, you can assign them to assets.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select the **Licenses** tab.
3. Click the **Create New Licenses** (+) icon.

4 In the text area of the Enter licenses keys page, enter one license key per line, and click **Next**.

   You can enter a list of keys in one operation. A new license will be created for every license key that you enter.

5 On the Edit license names page, rename the new licenses as appropriate and click **Next** .

6 On the Ready to complete page, review the new licenses and click **Finish**.

A new license is created for every license key that you entered.

What to do next

Assign the new licenses to hosts, vCenter Server systems, or other products that you use with vSphere. You must not keep unassigned licenses in the inventory.

Assign a License to Multiple Assets

To continue using product functionality, you must assign appropriate licenses to assets in evaluation mode, or assets with expiring licenses. When you upgrade a license edition, combine, or split licenses in My VMware, you must assign the new licenses to assets. You can assign licenses that are already available, or create new licenses and assign them to the assets in a single workflow. Assets are vCenter Server systems, ESXi hosts, Virtual SAN clusters, and other products that integrate with vSphere .

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1 In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.

2 Select the **Assets** tab.

3 Select the **vCenter Server systems**, **Hosts**, **Clusters**, or **Solutions** tab.

4 Use Shift+click to select the assets to license.

5 Click **Assign License**.

6 Select a licensing method.

   - Select an existing license and click **OK**.
   - Create a new license.

     a Click the Create New License (+) icon.

     b In the New Licenses dialog, type or copy and paste a license key and click **Next**.

     c On the Edit license names page, rename the new license as appropriate and click **Next**.

     d Click **Finish**.

     e In the Assign License dialog, select the newly-created license and click **OK**.

The license is assigned to the assets. Capacity from the license is allocated according to the license usage of the assets. For example, if you assign the license to 3 hosts with 4 CPUs each, the consumed license capacity is 12 CPUs.

Configure License Settings for an ESXi Host

You must assign a license to an ESXi host before its evaluation period expires or its currently assigned license expires. If you upgrade, combine, or divide vSphere licenses in My VMware, you must assign the new licenses to ESXi hosts.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, navigate to the host in the inventory.
2. Select the **Manage** tab.
3. Under **System**, select **Licensing**.
4. Click **Assign License**.
5. Select a licensing method.
   - Select an existing license and click **OK**.
   - Create a new license.
     a. Click the Create New License (+) icon.
     b. In the New Licenses dialog, type or copy and paste a license key and click **Next**.
     c. On the Edit license names page, rename the new license as appropriate and click **Next**.
     d. Click **Finish**.
     e. In the Assign License dialog, select the newly-created license and click **OK**.

The license is assigned to the host. Capacity from the license is allocated according to the license usage of the host.

Configure License Settings for vCenter Server

You must assign a license to a vCenter Server system before its evaluation period expires or its currently assigned license expires. If you upgrade, combine, or divide vCenter Server licenses in My VMware, you must assign the new licenses to vCenter Server systems.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, navigate to the vCenter Server system.
2. Select the **Manage** tab.
3. Under **System**, select **Licensing**.
4. Click **Assign License**.

5 Select a licensing method.

- Select an existing license and click **OK**.
- Create a new license.

  a Click the Create New License (+) icon.

  b In the New Licenses dialog, type or copy and paste a license key and click **Next**.

  c On the Edit license names page, rename the new license as appropriate and click **Next**.

  d Click **Finish**.

  e In the Assign License dialog, select the newly-created license and click **OK**.

The license is assigned to the vCenter Server system, and one instance from the license capacity is allocated for thevCenter Server system.

Assign a License to a Virtual SAN Cluster

You must assign a license to a Virtual SAN cluster before its evaluation period expires or its currently assigned license expires. If you upgrade, combine, or divide Virtual SAN licenses in My VMware, you must assign the new licenses to Virtual SAN clusters.

When you enable Virtual SAN for a cluster, you can use Virtual SAN in evaluation mode to explore its features. The evaluation period starts when Virtual SAN is enabled, and expires after 60 days. To use Virtual SAN, you must license the cluster before the evaluation period expires. Just like vSphere licenses, Virtual SAN licenses have per CPU capacity. When you assign a Virtual SAN license to a cluster, the amount of license capacity that is used equals the total number of CPUs in the hosts participating in the cluster. The license usage of the Virtual SAN cluster is recalculated and updated every time you add or remove a host from the cluster.

Prerequisites

- To view and manage Virtual SAN licenses, you must have the **Global.Licenses** on the vCenter Server systems, where the vSphere Web Client runs.

Procedure

1 In the vSphere Web Client, navigate to a cluster with enabled Virtual SAN.

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

3 Under Configuration, select **Licensing** and click **Assign License**.

4 Select a licensing method.

- Select an existing license and click **OK**.
- Create a new Virtual SAN license.

  a Click the Create New License (+) icon.

  b In the New Licenses dialog box, type or copy and paste a Virtual SAN license key and click **Next**.

  c On the Edit license names page, rename the new license as appropriate and click **Next**.

  d Click **Finish**.

  e In the Assign License dialog, select the newly created license and click **OK**.

Set Assets to Evaluation Mode

To explore the complete set of features available for an asset, you can set it to evaluation mode.

Different products have different terms for using their evaluation mode. Before you set an asset to evaluation mode, you should consider the specifics for using the evaluation mode of its associated product. For details, see the licensing model documentation for the relevant product at "Licensing for Products in vSphere," on page 92

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select the **Assets** tab.
3. Select the **vCenter Server systems**, **Hosts**, **Clusters**, or **Solutions** tab.
4. Select the asset that you want to set to evaluation mode.
5. Click **Assign License**.
6. Select **Evaluation License**.
7. Click **OK** to save your changes.

The asset is in evaluation mode. You can explore the entire set of features that are available for the asset.

Note You must assign an appropriate license to the asset before its evaluation period expires. Otherwise the asset will get into unlicensed state and certain functionality will be blocked.

Rename a License

After you create a license, you can change its name.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select the **Licenses** tab.
3. Select the license to rename, and click **Rename License**.
4. Type the new license name and click **OK**.

Remove Licenses

To remain in compliance with the licensing models of products that you use with vSphere, you must remove all unassigned licenses from the inventory. If you have divided, combined, or upgraded licenses in My VMware, you must remove the old licenses.

For example, suppose that you have upgraded a vSphere license from 5.5 to 6.0 in My VMware. You assign the license to ESXi 6.0 hosts. After assigning the new vSphere 6.0 licenses, you must remove the old vSphere 5.5 license from the inventory.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select the **Licenses** tab.
3. From the **Show** drop-down menu, select **Unassigned** to display only the unassigned licenses.
4. By pressing Ctrl+A select all licenses to remove.
5. Click **Remove Licenses** (✖) .
6. Review the confirmation message and click **Yes**.

Viewing Licensing Information

You can view the licensing state of the vSphere environment from a central place by using the license management functionality in the vSphere Web Client. You can view the licenses that are available in vSphere, current license assignments and usage, available license capacity, licensed features in use, and so on.

View Licensing Information About the vSphere Environment

You can view the available licenses in vSphere along with their expiration dates, available capacity, and usage. You can also view the available products and assets.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select a tab for the licensing information that you want to view.

Tab	Description
Licenses	Lists all licenses that are available in the vSphere environment. For every license, you can view the associated license key, license usage, license capacity, and expiration date.
Products	Lists the products that have licenses available in the vSphere environment. You can view the licenses that are available for every product, licensed features, license usage, and license capacity.
Assets	Displays licensing information about the assets that are available in the vSphere environment. Assets are vCenter Server systems, hosts, Virtual SAN clusters, and other products that you use with vSphere that are listed under Solutions.

What to do next

To comply with the EULA of vSphere and the products that you use with vSphere, you should not keep unassigned licenses in the inventory.

- If any unassigned licenses exist, assign these licenses to assets.

- Remove all expired licenses or licenses that you do not intend to assign. For example, if you have upgraded, divided, or combined any licenses in My VMware, you must remove the old licenses from the inventory.

View Available Licenses and Features About a Product

You can view information about a product, such as the available licenses, features, and license capacity in the vSphere Web Client.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select **Products**.
3. In the table, select the product for which you want to view information.
4. To view the licenses that are available for the product, click the arrow next to the product name to expand the row.
5. To view the licensed features for the product, click the **View Features** toolbar icon.

View the Features that an Asset Uses

You can view the features that an asset uses before you assign it a license. For example, if an ESXi host is in evaluation mode, you can view which features the hosts uses and then assign an appropriate license to it.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select the **Assets** tab.
3. Select the **vCenter Server systems**, **Hosts**, **Clusters** or the **Solutions** option.
4. Select an asset and click the **View Features in Use** toolbar icon.

View the License Key of the License

In vSphere, a license holds a license key for a product. You can view the associated license key for every license.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1. In the vSphere Web Client, select **Administration**, and under **Licensing**, select **Licenses**.
2. Select the **Licenses** tab.
3. In the table, select a license.

4 Click **View License Key**.

View the Licensed Features for an Asset

Before you start to use a feature on an asset, you can check whether the asset is licensed to use this feature. For example, to use vSphere HA, you should check whether all hosts in a vSphere HA cluster are licensed for this feature.

Prerequisites

- To view and manage licenses in the vSphere 6.0 environment, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1 In the vSphere Web Client, navigate to the asset whose licensed features you want to view.

2 Click the **Manage** tab.

3 Select the **Settings** option.

4 Under System, select **Licensing**.

The list of features that you can configure on the asset appears on the right.

Generating Reports for License Usage in the vSphere Web Client

You can track the license usage of your vSphere environment by generating reports for the license usage of assets for a certain time period. Assets are hosts, vCenter Server systems, Virtual SAN clusters, and solutions.

You can use the license reporting in vSphere for the following tasks:

- View statistics about the license usage and capacity for all products that have been assigned licenses in vSphere for a certain time period.
- Export license usage reports in CSV format for further analysis and processing.

The License Service takes snapshots of the license usage in the vSphere environment every day. A license usage snapshot contains data about the current license assignment and usage. The license usage information that you can view in the license reporting interface contains aggregated statistics from the snapshots that are collected in the period that you select.

The license usage reports that you can export in CSV format contain the raw data from the license usage snapshots that are collected during the selected period. You can analyze the data from CSV reports by aggregating it with third-party tools or scripts.

View the License Usage for Multiple Products

Tracking the license usage for products helps you to estimate the overall license requirements for your environment and to keep it correctly licensed. You can filter the license usage data by time period.

Prerequisites

- To view and generate license usage reports for the products in vSphere 6.0, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1 In the vSphere Web Client, select **Administration**, and under **Licensing** select **Reports**.

2 From the **Time period** drop-down menu, select a preconfigured or a custom time period for which you want to generate license use data.

3 If you select a custom time period, select the start and end dates, and click **Recalculate**.

The Report Summary shows the license usage for each product as a percentage of the license capacity for the product over the selected period.

View License Usage Details for a Single Product

You can view details about the license usage and capacity of a certain product. You can filter the license usage data by time period.

Prerequisites

- To view and generate license usage reports for the products in vSphere 6.0, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1 In the vSphere Web Client, select **Administration**, and under **Licensing** select **Reports**.

2 From the **Time period** drop-down menu, select a preconfigured or a custom time period for which you want to generate license usage data.

3 If you select a custom time period, specify the start and end dates, and click **Recalculate**.

4 Select a product from the Report Summary pane.

Details about the license usage for the selected product appear. The Usage Breakdown table lists all the licenses for the product that are assigned to assets in the selected period. The table can list licenses that are not used currently but were assigned to assets in the selected period.

The License Service collects license usage snapshots every day. The license usage on the Usage Breakdown table is an aggregated value from the raw data in the license usage snapshots that are collected within the selected time period.

Export a License Usage Report

You can export a report for the license usage of products for a certain time period. The report is exported in a CSV file that you can later open with third-party applications.

Important A tamper-detection feature in the License Service protects the license usage information. If the licensing data in the License Service database has been edited, you cannot export a license usage report.

Prerequisites

- To export license usage reports, you must have the **Global.Licenses** privilege on the vCenter Server system, where the vSphere Web Client runs.

Procedure

1 In the vSphere Web Client, select **Administration**, and under **Licensing** select **Reports**.

2 Click **Export Licensing Usage Report**.

The Export Licensing Usage Report window appears.

3 Select a preconfigured or a custom time period for the license usage report from the **Time period** drop-down menu.

4 Click **Generate CSV report**.

The operation takes a few seconds.

5 Click **Save**.

6 Browse to the location where you want to save the file and click **Save**.

The license usage for products over the selected time period is exported in a CSV file. The CSV file is contained in a `.zip` file that is saved to the location that you specified.

The exported report contains raw data about the license usage of products over the selected period. The rows of the exported CSV file list the license usage snapshots that the License Service has collected daily over the selected period. You can use third-party tools to open the CSV report and analyse its data.

A license usage snapshot contains data about the assigned licenses, associated products, license expiration date, license units (cost units), capacity, usage, asset ID, and so on. Permanent licenses do not have an expiration date listed. vCloud Suite is licensed on per CPU basis, and so, the license usage for vCloud Suite products is reflected only for ESXi hosts that are assigned licenses from the corresponding vCloud Suite editions.

Working with Tasks 9

vSphere tasks are activities and actions that occur on an object within the vSphere inventory.

This chapter includes the following topics:

- "Managing Tasks," on page 105
- "Schedule Tasks," on page 105

Managing Tasks

Tasks represent system activities that do not complete immediately, such as migrating a virtual machine. They are initiated by high-level activities that you perform with the vSphere Web Client in real time and activities that you schedule to occur at a later time or on a recurring basis.

For example, powering off a virtual machine is a task. You can perform this task manually every evening, or you can set up a scheduled task to power off the virtual machine every evening for you.

View Tasks

You can view tasks that are associated with a single object or all objects in the vSphere Web Client.

By default, the tasks list for an object also includes tasks performed on its child objects. You can filter the list by removing tasks performed on child objects and by using keywords to search for tasks.

If you are logged in to a vCenter Server system that is part of a Connected Group, a column in the task list displays the name of the vCenter Server system on which the task was performed.

Procedure

1. Navigate to an object in the inventory.
2. Click the **Monitor** tab, then click **Tasks**.

   The task list contains tasks performed on the object and detailed information, such as target, task status, initiator, and start/completion time of the task.
3. (Optional) To view related events for a task, select the task in the list.

Schedule Tasks

You can schedule tasks to run once in the future or multiple times, at a recurring interval.

The tasks you can schedule are listed in the following table.

Table 9-1. Scheduled Tasks

Scheduled Task	Description
Add a host	Adds the host to the specified data center or cluster.
Change the power state of a virtual machine	Powers on, powers off, suspends, or resets the state of the virtual machine.
Change cluster power settings	Enable or disable DPM for hosts in a cluster.
Change resource settings of a resource pool or virtual machine	Changes the following resource settings: ■ CPU – Shares, Reservation, Limit. ■ Memory – Shares, Reservation, Limit.
Check compliance of a profile	Checks that a host's configuration matches the configuration specified in a host profile.
Clone a virtual machine	Makes a clone of the virtual machine and places it on the specified host or cluster.
Create a virtual machine	Creates a new virtual machine on the specified host.
Deploy a virtual machine	Creates a new virtual machine from a template on the specified host or cluster.
Migrate a virtual machine	Migrate a virtual machine to the specified host or datastore by using migration or migration with vMotion.
Make a snapshot of a virtual machine	Captures the entire state of the virtual machine at the time the snapshot is taken.
Scan for Updates	Scans templates, virtual machines, and hosts for available updates. This task is available only when vSphere Update Manager is installed.
Remediate	Installs missing patches from the baselines selected for remediation on the hosts discovered during the scan operation and applies the newly configured settings. This task is available only when vSphere Update Manager is installed.

You create scheduled tasks by using the Scheduled Task wizard. For some scheduled tasks, this wizard opens the wizard used specifically for that task. For example, if you create a scheduled task that migrates a virtual machine, the Scheduled Task wizard opens the Migrate Virtual Machine wizard, which you use to set up the migration details.

Scheduling one task to run on multiple objects is not possible. For example, you cannot create one scheduled task on a host that powers on all virtual machines on that host. You must create a separate scheduled task for each virtual machine.

After a scheduled task runs, you can reschedule it to run again at another time.

Create a Scheduled Task

You can create scheduled tasks for operations that you want to automatically run once or at a recurring interval.

If the task to schedule is not available in the vSphere Web Client, use the vSphere API. See the vSphere SDK *Programming Guide*.

Caution Do not schedule multiple tasks simultaneously on the same object. The results are unpredictable.

Prerequisites

Required privilege: **Schedule Task.Create tasks**

Procedure

1 In the vSphere Web Client, navigate to the object for which you want to schedule a task.

2 Select **Manage**, and select **Scheduled Tasks**.

3 From the **Schedule New Task** drop-down list, select the task to schedule.

A wizard opens for the task with (scheduled) appended next to its name. The wizard contains a **Scheduling options** page, where you configure the scheduling options for the task. For example, to schedule taking a virtual machine snapshot, the Take a VM Snapshot wizard (scheduled) opens. In **Edit settings**, you enter the properties for the snapshot, and in **Scheduling options**,you configure the scheduling options for the task.

4 In the **Scheduling options** page, configure the required settings for the task.

a Type a name and a description for the task.

b To configure the scheduling settings for the task, click **Change** next to Configured Scheduler.

Table 9-2. Scheduler options

Option	Description
Run this action now	Runs the scheduled task immediately.
Run this action after startup	Runs the task after a certain number of minutes.
Schedule this action to run later	Runs the scheduled task at a date and time that you specify.
Setup a recurring schedule for this action	Runs the scheduled task on a recurring pattern.
Hourly	1 Type the number of hours after which to run the task. 2 Type the number of minutes after the hour to run the task. For example, to start a task at the half-hour mark of every fifth hour, type **5** hours and **30** minutes.
Daily	1 Type the number of days on which to run the task. 2 Type the start time for the task. For example, to run the task at 2:30 pm every four days, type **4** and **2:30**.
Weekly	1 Type the number of weeks on which the task must run. 2 Select the day of the week you want the task to run. 3 Type the start time for the task. For example, to run the task at 6 am every Tuesday and Thursday, type **1** week, **6 am**, and select **Tuesday** and **Thursday**.
Monthly	1 Type the start time for the task. 2 Select the days by using one of the following methods. ■ Type a specific day of the month and the number of months to run the task on. For example, the tenth day every five months. ■ Select **first**, **second**, **third**, **fourth**, or **last**, and select the day of the week and the number of months to run the task on. **last** runs the task on the last week in the month that the day occurs. For example, if you select the last Monday of the month and the month ends on a Sunday, the task runs six days before the end of the month.

c Set up email notifications and click **OK**.

Change or Reschedule a Task

After a scheduled task is created, you can change the schedule, frequency, and other attributes of the task. You can edit and reschedule tasks before or after they run.

Prerequisites

Required privilege:**Schedule Task.Modify**

Procedure

1 In the vSphere Web Client, navigate to the object for which you want to edit a scheduled task.

   To view all scheduled tasks for a vCenter Server instance, navigate to that vCenter Server instance.

2 Select **Manage > Scheduled Tasks**.

3 Right-click the task and select **Edit**.

4 Change the task attributes as necessary.

5 Click **OK**.

Remove a Scheduled Task

Removing a scheduled task removes all future occurrences of the task. The history associated with all completed occurrences of the task remains in the vCenter Server database.

Prerequisites

Required privilege:**Scheduled task.Remove**

Procedure

1 In the vSphere Web Client, navigate to the object for which you want to remove a scheduled task.

   To view all scheduled tasks for a vCenter Server instance, navigate to that vCenter Server instance.

2 Select **Manage > Scheduled Tasks**.

3 Right-click the task to remove and select **Remove**.

Starting and Stopping the vSphere Components 10

You can start and stop each one of the major vSphere components, ESXi, and vCenter Server. You might want to stop a component to perform maintenance or upgrade operations.

This chapter includes the following topics:

- "Start an ESXi Host," on page 109
- "Reboot or Shut Down an ESXi Host," on page 109
- "Starting vCenter Server," on page 110

Start an ESXi Host

When you install ESXi, it starts itself through the installation reboot process. If your ESXi host is shut down, you must manually restart it.

Procedure

◆ On the physical box where ESXi is installed, press the power button until the power on sequence begins.

The ESXi host starts, locates its virtual machines, and proceeds with its normal ESXi functions.

Reboot or Shut Down an ESXi Host

You can power off or restart any ESXi host by using the vSphere Web Client. Powering off a managed host disconnects it from vCenter Server, but does not remove it from the inventory.

Prerequisites

Required privileges:

- **Host.Configuration.Maintenance**
- **Global.Log event**

Procedure

1. In the vSphere Web Client, navigate to the host that you want to shut down.
2. Power off all virtual machines on the host.
3. Right-click the host and select **Power > Reboot** or **Power > Shutdown**.
   - If you select **Reboot**, the ESXi host shuts down and starts.
   - If you select **Shut Down**, the ESXi host shuts down. You must manually power the system back on.

4 Provide a reason for the shut down.

   This information is added to the log.

Starting vCenter Server

vCenter Server runs as a Windows service. vCenter Server starts when you start the Windows machine on which it is installed. It also restarts when that machine is rebooted.

Verify That vCenter Server Is Running

You can verify that the vCenter Server service is running.

Procedure

1 Go to the Services console for your version of Windows.

   For example, select **Control Panel > Administrative Tools > Services** and click **VMware VirtualCenter Server**.

   The Status column indicates whether the service started.

2 Right-click the vCenter Server service and select **Properties**.

3 In the VMware vCenter Server Services Properties dialog box, click the **General** tab and view the service status.

Restart the vCenter Server System

The vCenter Server service starts when the machine on which it is installed is booted. You can manually restart the vCenter Server system.

Procedure

1 Go to the Services console for your version of Windows.

   For example, select **Control Panel > Administrative Tools > Services** and click **VMware VirtualCenter Server**.

2 Right-click **VMware VirtualCenter Server**, select **Start**, and wait for startup to complete.

3 Close the Properties dialog box.

Stop the vCenter Server System

vCenter Server is a Windows service. You can use the Windows interface to select the service and stop it.

You should not have to stop the vCenter Server service. The vCenter Server should operate without interruption. Continuous operation ensures that all monitoring and task activities are performed as expected.

Procedure

1 Go to the Services console for your version of Windows.

   For example, select **Start > Control Panel > AdministrativeTools > Services**.

2 Click **VMware VirtualCenter Server Service**.

3 Right-click **VMware VirtualCenter Server**, select **Stop**, and wait for it to stop.

4 Close the Properties dialog box.

Managing Hosts in vCenter Server 11

To access the full capabilities of your hosts and to simplify the management of multiple hosts, you should connect your hosts to a vCenter Server system.

For information about configuration management of ESXihosts, see the *vSphere Networking* documentation, the *vSphere Storage* documentation, or the *vSphere Security* documentation.

The views and capabilities displayed vary depending on whether the vSphere Web Client is connected to a vCenter Server system or an ESXi host. Unless indicated, the process, task, or description applies to all kinds of vSphere Web Client connections.

This chapter includes the following topics:

- "Disconnecting and Reconnecting a Host," on page 111
- "Remove a Host from a Cluster," on page 112
- "Understanding Managed Host Removal," on page 113
- "Remove a Managed Host from vCenter Server," on page 114

Disconnecting and Reconnecting a Host

You can disconnect and reconnect a host that a vCenter Server system manages. Disconnecting a managed host does not remove it from vCenter Server; it temporarily suspends all monitoring activities that vCenter Server performs.

The managed host and its associated virtual machines remain in the vCenter Server inventory. By contrast, removing a managed host from vCenter Server removes the managed host and all its associated virtual machines from the vCenter Server inventory.

Disconnect a Managed Host

Disconnect a managed host to temporarily suspend all vCenter Server monitoring and management activities.

Disconnecting a managed host does not remove it from the vCenter Server inventory. The managed host and its associated virtual machines remain in the vCenter Server inventory. Removing a managed host removes the managed host and all its associated virtual machines from the vCenter Server inventory.

Prerequisites

Required privilege: **Host.Configuration.Connection**

Procedure

1 In the vSphere Web Client, navigate to the host in the vSphere inventory.

2 Right-click the host and select **Connection > Disconnect**.

3 In the confirmation dialog box that appears, click **Yes**.

If the managed host disconnects successfully, the disconnected designation is appended to the object name in parentheses, and the object is dimmed. All associated virtual machines are similarly dimmed and labeled.

Reconnect a Managed Host

A host that a vCenter Server system manages might disconnect from vCenter Server because of network problems or other reasons. If this happens, you can reconnect the host.

Prerequisites

Required privilege: **Host.Configuration.Connection**

Procedure

1 In the vSphere Web Client, navigate to the disconnected host.

2 Right-click the host and select **Connection > Connect**.

When the host reconnects to vCenter Server, the statuses of the virtual machines on that host are updated to reflect the change.

When the managed host is connected, the disconnected designation is removed and the object name is displayed in bold. All associated virtual machines are similarly labeled.

Reconnecting Hosts After Changes to the vCenter Server SSL Certificate

vCenter Server uses an SSL certificate to encrypt and decrypt host passwords stored in the vCenter Server database. If the certificate is replaced or changed, vCenter Server cannot decrypt host passwords, and therefore cannot connect to managed hosts.

If vCenter Server fails to decrypt a host password, the host is disconnected from vCenter Server. You must reconnect the host and supply the login credentials, which will be encrypted and stored in the database using the new certificate.

Remove a Host from a Cluster

When you remove a host from a cluster, its resources are deducted from the total resources of the cluster. The state of the virtual machines deployed on the host determines whether they are migrated to other hosts within the cluster, or remain on the host and are removed from the cluster.

Prerequisites

Verify that all virtual machines on the host are powered off, or migrate the running virtual machines to a new host by using vMotion.

Required privileges:

- **Host.Inventory.Remove host**
- **Host.Inventory.Move host**
- **Host.Inventory.Maintain**

Procedure

1 In the vSphere Web Client, navigate to the host that you want to remove from a cluster.

2 Right-click the host and select **Maintenance Mode > Enter Maintenance Mode**.

   All virtual machines on the host must be powered off so that the host can enter maintenance mode.

   If the host is inside a DRS-enabled cluster, DRS attempts to automatically migrate powered-on virtual machines from the host by using vMotion.

3 In the confirmation dialog box that appears, click **Yes**.

   When the task for entering maintenance mode completes, the icon beside the host name changes.

4 Right-click the host and select **Move To**.

5 Select a data center, folder, or another cluster to move the host to.

   vCenter Server moves the host to the new location.

6 Right-click the host and select **Maintenance Mode > Exit Maintenance Mode**.

7 (Optional) Power on virtual machines on the host.

Understanding Managed Host Removal

Removing a managed host from vCenter Server breaks the connection and stops all monitoring and managing functions of that managed host and of all the virtual machines on that managed host. The managed host and its associated virtual machines are removed from the inventory.

Historical data for removed hosts remains in the vCenter Server database.

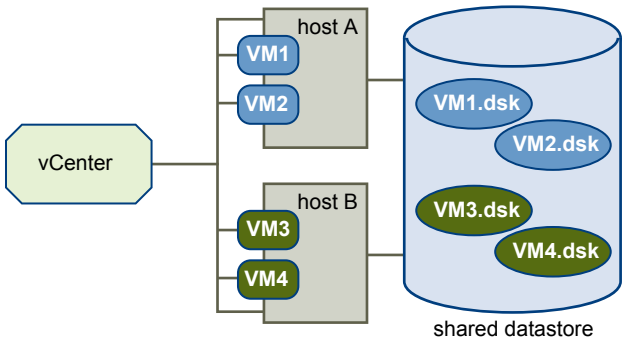
Removing a managed host differs from disconnecting the managed host from vCenter Server. Disconnecting a managed host does not remove it from vCenter Server; it temporarily suspends all vCenter Server monitoring activities. The managed host and its associated virtual machines remain in the vCenter Server inventory.

Removing a managed host from vCenter Server does not remove the virtual machines from the managed host or datastore. It removes only vCenter Server's access to the managed host and virtual machines on that managed host.

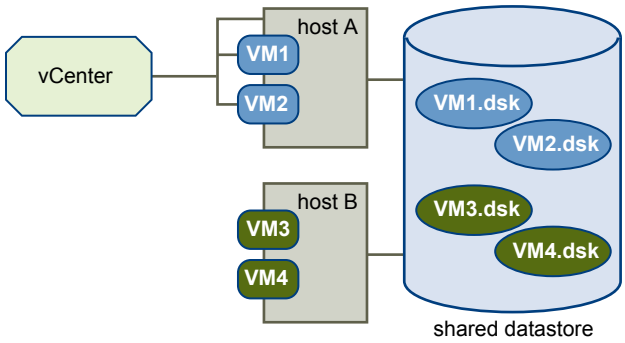
Figure 11-1 illustrates the process for removing a managed host from vCenter Server. In the example here, notice the lost link between vCenter Server and the removed managed host, while the managed host files remain on the datastore.

Figure 11-1. Removing a Host

1. Registered host and virtual machines



2. Remove host. Virtual machines stay on the host's datastore.



Remove a Managed Host from vCenter Server

You can remove a managed host from vCenter Server to stop vCenter Server from monitoring and managing that host.

If possible, remove managed hosts while they are connected. Removing a disconnected managed host does not remove the vCenter Server agent from the managed host.

Prerequisites

Verify that NFS mounts are active. If NFS mounts are unresponsive, the operation fails.

Required privilege: **Host.Configuration.Maintenance**

Procedure

1 In the vSphere Web Client client, navigate to the host in the vSphere inventory.

2 (Optional) If the host is part of a cluster, you must put it in maintenance mode.

   a Right-click the managed host and select **Maintenance Mode > Enter Maintenance Mode**.

   All virtual machines on the host must be powered off so that the host can enter maintenance mode.

   If the host is inside a DRS-enabled cluster, DRS attempts to automatically evacuate powered-on virtual machines from the host by using vMotion.

   b In the confirmation dialog box, click **Yes**.

   The host icon changes and a maintenance mode designation is appended to the name in parentheses.

3 Right-click the host and select **All vCenter Actions > Remove from Inventory**.

4 In the confirmation dialog box that appears, click **Yes** to remove the managed host.

vCenter Server removes the managed host and its virtual machines from the inventory. vCenter Server then frees the amount of license capacity that was allocated for the host. The host retains its assigned license key.

Migrating Virtual Machines 12

You can move virtual machines from one host or storage location to another location using hot or cold migration. For example, with vSphere vMotion you can move powered on virtual machines away from a host to perform maintenance, to balance loads, to collocate virtual machines that communicate with each other, to move virtual machines apart to minimize fault domain, to migrate to new server hardware, and so on.

You can use cold or hot migration to move virtual machines to different hosts or datastores.

Cold Migration You can move a powered off or suspended virtual machine to a new host. Optionally, you can relocate configuration and disk files for powered off or suspended virtual machines to new storage locations. You can also use cold migration to move virtual machines from one data center to another. To perform a cold migration, you can move virtual machines manually or set up a scheduled task.

Hot Migration Depending on the type of migration you are using, vMotion or Storage vMotion, you can move a powered on virtual machine to a different host, and move its disks or folder to a different datastore without any interruption in the availability of the virtual machine. You can also move a virtual machine to a different host and to a different storage location at the same time. vMotion is also referred to as live migration or hot migration.

NOTE Copying a virtual machine creates a new virtual machine. It is not a form of migration. Cloning a virtual machine or copying its disks and configuration file creates a new virtual machine. Cloning is not a form of migration.

You can perform several types of migration according to the virtual machine resource type.

Change compute resource only
Moving a virtual machine but not its storage to another compute resource, such as a host, cluster, resource pool, or vApp. You use vMotion to move a powered on virtual machine to another compute resource. You can move the virtual machine to another host by using cold migration or hot migration.

Change storage only
Moving a virtual machine and its storage, including virtual disks, configuration files, or a combination of these, to a new datastore on the same host. You can change the datastore using cold or hot migration. You use Storage vMotion to move a powered on virtual machine and its storage to a new datastore .

Change both compute resource and storage
Moving a virtual machine to another host and moving its disk or virtual machine folder to another datastore. You can change the host and datastore using cold or hot migration. When you move a virtual machine network between distributed switches, the network configuration and policies that are associated with the network adapters of the virtual machine are transferred to the target switch.

In vSphere 6.0 and later, you can move virtual machines between vSphere sites by using migration between these types of objects.

Migrate to another virtual switch
Moving the network of a virtual machine to a virtual switch of a different type. You can migrate virtual machines without reconfiguring the physical and virtual network. While performing cold or hot migration, you can move the virtual machine from a standard to a standard or distributed switch and from a distributed switch to another distributed switch.

Migrate to another data center
Moving virtual machines between data centers. While performing cold or hot migration, you can change the data center of a virtual machine. For networking in the target data center, you can select a dedicated port group on a distributed switch.

Migrate to another vCenter Server system
Moving virtual machines between two vCenter Server instances that are connected in Enhanced Linked Mode.

You can also move virtual machines between vCenter Server instances that are located across a long distance from each other.

For information about the requirements about vMotion across vCenter Server instances, see "Requirements for Migration Between vCenter Server Instances," on page 126.

To migrate virtual machines with disks larger than 2 TB, the source and destination ESXi hosts must be version 5.5 and later.

This chapter includes the following topics:

- "Cold Migration," on page 119
- "Migration with vMotion," on page 120
- "Migration with Storage vMotion," on page 127
- "CPU Compatibility and EVC," on page 128
- "Migrate a Powered-Off or Suspended Virtual Machine," on page 135
- "Migrate a Virtual Machine to a New Compute Resource," on page 137
- "Migrate a Virtual Machine to a New Compute Resource and Storage," on page 138

- "Migrate a Virtual Machine to New Storage," on page 140
- "Place vMotion Traffic on the vMotion TCP/IP Stack of an ESXi Host," on page 141
- "Place Traffic for Cold Migration, Cloning, and Snapshots on the Provisioning TCP/IP Stack," on page 143
- "Limits on Simultaneous Migrations," on page 144
- "About Migration Compatibility Checks," on page 145

Cold Migration

Cold migration is the migration of powered off or suspended virtual machines between hosts across clusters, data centers, and vCenter Server instances. By using cold migration you can also move associated disks from one datastore to another.

You can use cold migration to have the target host checked against less requirements than when you use vMotion. For example, use cold migration when a virtual machine contains a complex application setup, the compatibility checks during vMotion might prevent the virtual machine from moving to another host.

You must power off or suspend the virtual machines before you begin the cold migration process. Migrating a suspended virtual machine is considered a cold migration because although the virtual machine is powered on, it is not running.

CPU Compatibility Check During Cold Migration

If you attempt to migrate a powered off virtual machine that is configured with a 64-bit operating system, vCenter Server generates a warning if you migrate the virtual machine to a host that does not support 64-bit operating system. Otherwise, CPU compatibility checks do not apply when you migrate powered off virtual machines with cold migration.

When you migrate a suspended virtual machine, the new host for the virtual machine must meet CPU compatibility requirements, because the virtual machine must be able to resume execution on the new host.

Operations During Cold Migration

A cold migration consists of the following operations:

1. If you select the option to move to a different datastore, the configuration files, including the NVRAM file (BIOS settings), log files, and the suspend file, are moved from the source host to the destination host's associated storage area. You can choose to move the virtual machine's disks as well.
2. The virtual machine is registered with the new host.
3. After the migration is completed, the old version of the virtual machine is deleted from the source host and datastore if you selected the option to move to a different datastore.

Network Traffic for Cold Migration

By default, data for VM cold migration, cloning, and snapshots is transferred through the management network. This traffic is called provisioning traffic. It is not encrypted but uses run-length encoding of data.

On a host, you can dedicate a separate VMkernel network adapter to the provisioning traffic, for example, to isolate this traffic on another VLAN. On a host, you can assign no more than one VMkernel adapter for provisioning traffic. For information about enabling provisioning traffic on a separate VMkernel adapter, see the *vSphere Networking* documentation.

If you plan to transfer high volumes of virtual machine data that the management network cannot accommodate or if you want to isolate cold migration traffic in a subnet different from the management network, for example, for migration over a long distance, redirect the cold migration traffic on a host to the TCP/IP stack that is dedicated to cold migration and cloning of powered off virtual machines. See "Place Traffic for Cold Migration, Cloning, and Snapshots on the Provisioning TCP/IP Stack," on page 143.

Migration with vMotion

If you need to take a host offline for maintenance, you can move the virtual machine to another host. Migration with vMotion™ allows virtual machine processes to continue working throughout a migration.

When you migrate a virtual machine with vMotion, the new host for the virtual machine must meet compatibility requirements so that the migration can proceed.

vMotion Migration Types

With vMotion, you can change the compute resource on which a virtual machine is running, or you can change both the compute resource and the storage of the virtual machine.

When you migrate virtual machines with vMotion and choose to change only the host, the entire state of the virtual machine is moved to the new host. The associated virtual disk remains in the same location on storage that must be shared between the two hosts.

When you choose to change both the host and the datastore, the virtual machine state is moved to a new host and the virtual disk is moved to another datastore. vMotion migration to another host and datastore is possible in vSphere environments without shared storage.

After the virtual machine state is migrated to the alternate host, the virtual machine runs on the new host. Migrations with vMotion are completely transparent to the running virtual machine.

When you choose to change both the compute resource and the storage, you can use vMotion to migrate virtual machines across vCenter Server instances, data centers, and subnets.

Transferred State Information

The state information includes the current memory content and all the information that defines and identifies the virtual machine. The memory content includes transaction data and the bits of the operating system and applications that are in the memory. The defining and identification information stored in the state includes all the data that maps to the virtual machine hardware elements, such as BIOS, devices, CPU, MAC addresses for the Ethernet cards, chip set states, registers, and so forth.

Stages in vMotion

Migration with vMotion occurs in three stages:

1. When the migration with vMotion is requested, vCenter Server verifies that the existing virtual machine is in a stable state with its current host.
2. The virtual machine state information (memory, registers, and network connections) is copied to the target host.
3. The virtual machine resumes its activities on the new host.

If errors occur during migration, the virtual machine reverts to its original state and location.

Host Configuration for vMotion

Before using vMotion, you must configure your hosts correctly.

Ensure that you have correctly configured your hosts.

- Each host must be correctly licensed for vMotion.
- Each host must meet shared storage requirements for vMotion.
- Each host must meet the networking requirements for vMotion.

IMPORTANT The ESXi firewall in ESXi 5.0 and later does not allow per-network filtering of vMotion traffic. Therefore, you must apply rules on your external firewall to ensure that no incoming connections can be made to the vMotion socket on TCP port 8000.

vMotion Across Long Distances

You can perform reliable migrations between hosts and sites that are separated by high network round-trip latency times. vMotion across long distances is enabled when the appropriate license is installed. No user configuration is necessary.

For long-distance migration, verify the network latency between the hosts and your license.

- The round-trip time between the hosts must be up to 150 milliseconds.
- Your license must cover vMotion across long distances.
- You must place the traffic related to virtual machine files transfer to the destination host on the provisioning TCP/IP stack. See "Place Traffic for Cold Migration, Cloning, and Snapshots on the Provisioning TCP/IP Stack," on page 143.

vMotion Shared Storage Requirements

Configure hosts for vMotion with shared storage to ensure that virtual machines are accessible to both source and target hosts.

During a migration with vMotion, the migrating virtual machine must be on storage accessible to both the source and target hosts. Ensure that the hosts configured for vMotion use shared storage. Shared storage can be on a Fibre Channel storage area network (SAN), or can be implemented using iSCSI and NAS.

If you use vMotion to migrate virtual machines with raw device mapping (RDM) files, make sure to maintain consistent LUN IDs for RDMs across all participating hosts.

See the *vSphere Storage* documentation for information on SANs and RDMs.

vSphere vMotion Networking Requirements

Migration with vMotion requires correctly configured network interfaces on source and target hosts.

Configure each host with at least one network interface for vMotion traffic. To ensure secure data transfer, the vMotion network must be a secure network, accessible only to trusted parties. Additional bandwidth significantly improves vMotion performance. When you migrate a virtual machine with vMotion without using shared storage, the contents of the virtual disk is transferred over the network as well.

NOTE vMotion network traffic is not encrypted. You should provision secure private networks for use by vMotion only.

Requirements for Concurrent vMotion Migrations

You must ensure that the vMotion network has at least 250 Mbps of dedicated bandwidth per concurrent vMotion session. Greater bandwidth lets migrations complete more quickly. Gains in throughput resulting from WAN optimization techniques do not count towards the 250 Mbps limit.

To determine the maximum number of concurrent vMotion operations possible, see "Limits on Simultaneous Migrations," on page 144. These limits vary with a host's link speed to the vMotion network.

Round-Trip Time for Long-Distance vMotion Migration

If you have the proper license applied to your environment, you can perform reliable migrations between hosts that are separated by high network round-trip latency times. The maximum supported network round-trip time for vMotion migrations is 100 milliseconds. This round-trip time lets you migrate virtual machines to another geographical location at a longer distance.

Multiple-NIC vMotion

You can configure multiple NICs for vMotion by adding two or more NICs to the required standard or distributed switch. For details, see the VMware knowledge base article at http://kb.vmware.com/kb/2007467.

Network Configuration

Configure the virtual networks on vMotion enabled hosts as follows:

- On each host, configure a VMkernel port group for vMotion.

  To have the vMotion traffic routed across IP subnets, enable the vMotion TCP/IP stack on the host. See "Place vMotion Traffic on the vMotion TCP/IP Stack of an ESXi Host," on page 141.

- If you are using standard switches for networking, ensure that the network labels used for virtual machine port groups are consistent across hosts. During a migration with vMotion, vCenter Server assigns virtual machines to port groups based on matching network labels.

  Note By default, you cannot use vMotion to migrate a virtual machine that is attached to a standard switch with no physical uplinks configured, even if the destination host also has a no-uplink standard switch with the same label.

  To override the default behavior, set the `config.migrate.test.CompatibleNetworks.VMOnVirtualIntranet` advanced settings of vCenter Server to **`false`**. The change takes effect immediately. For details about the setting, see VMware knowledge base article at http://kb.vmware.com/kb/1003832. For information about configuring advanced settings of vCenter Server, see "Configure Advanced Settings," on page 48.

For information about configuring vMotion network resources, see "Networking Best Practices for vSphere vMotion," on page 123.

Networking Best Practices for vSphere vMotion

Consider certain best practices for configuring the network resources for vMotion on an ESXi host.

- Provide the required bandwidth in one of the following ways:

Physical Adapter Configuration	Best Practices
Dedicate at least one adapter for vMotion.	Use at least one 1 GbE adapter for workloads that have a small number of memory operations. Use at least one 10 GbE adapter if you migrate workloads that have many memory operations. If only two Ethernet adapters are available, configure them for security and availability. ■ For best security, dedicate one adapter to vMotion, and use VLANs to divide the virtual machine and management traffic on the other adapter. ■ For best availability, combine both adapters into a team, and use VLANs to divide traffic into networks: one or more for virtual machine traffic and one for vMotion
Direct vMotion traffic to one or more physical NICs that have high bandwidth capacity and are shared between other types of traffic as well	■ To distribute and allocate more bandwidth to vMotion traffic across several physical NICs, use multiple-NIC vMotion. ■ On a vSphere Distributed Switch 5.1 and later, use vSphere Network I/O Control shares to guarantee bandwidth to outgoing vMotion traffic. Defining shares also prevents from contention as a result from excessive vMotion or other traffic. ■ Use traffic shaping in egress direction on the vMotion port group on the destination host to avoid saturation of the physical NIC link as a result of intense incoming vMotion traffic. By using traffic shaping you can limit the average and peak bandwidth available to vMotion traffic, and reserve resources for other traffic types.

- Provision at least one additional physical NIC as a failover NIC.
- Use jumbo frames for best vMotion performance.

  Ensure that jumbo frames are enabled on all network devices that are on the vMotion path including physical NICs, physical switches and virtual switches.
- Place vMotion traffic on the vMotion TCP/IP stack for migration across IP subnets that have a dedicated default gateway that is different from the gateway on the management network. See "Place vMotion Traffic on the vMotion TCP/IP Stack of an ESXi Host," on page 141.

For information about the configuring networking on an ESXi host, see the *vSphere Networking* documentation.

Virtual Machine Conditions and Limitations for vMotion

To migrate virtual machines with vMotion, the virtual machine must meet certain network, disk, CPU, USB, and other device requirements.

The following virtual machine conditions and limitations apply when you use vMotion:

- The source and destination management network IP address families must match. You cannot migrate a virtual machine from a host that is registered to vCenter Server with an IPv4 address to a host that is registered with an IPv6 address.
- You cannot use migration with vMotion to migrate virtual machines that use raw disks for clustering.
- If virtual CPU performance counters are enabled, you can migrate virtual machines only to hosts that have compatible CPU performance counters.

- You can migrate virtual machines that have 3D graphics enabled. If the 3D Renderer is set to Automatic, virtual machines use the graphics renderer that is present on the destination host. The renderer can be the host CPU or a GPU graphics card. To migrate virtual machines with the 3D Renderer set to Hardware, the destination host must have a GPU graphics card.
- You can migrate virtual machines with USB devices that are connected to a physical USB device on the host. You must enable the devices for vMotion.
- You cannot use migration with vMotion to migrate a virtual machine that uses a virtual device backed by a device that is not accessible on the destination host. For example, you cannot migrate a virtual machine with a CD drive backed by the physical CD drive on the source host. Disconnect these devices before you migrate the virtual machine.
- You cannot use migration with vMotion to migrate a virtual machine that uses a virtual device backed by a device on the client computer. Disconnect these devices before you migrate the virtual machine.
- You can migrate virtual machines that uses Flash Read Cache if the destination host also provides Flash Read Cache. During the migration, you can select whether to migrate the virtual machine cache or drop it, for example, when the cache size is large.

Swap File Location Compatibility

Virtual machine swap file location affects vMotion compatibility in different ways depending on the version of ESXi running on the virtual machine's host.

You can configure ESX 3.5 or ESXi 3.5 or later hosts to store virtual machine swap files with the virtual machine configuration file, or on a local swap file datastore specified for that host.

The location of the virtual machine swap file affects vMotion compatibility as follows:

- For migrations between hosts running ESX/ESXi version 3.5 and later, vMotion and migrations of suspended and powered-off virtual machines are allowed.
- During a migration with vMotion, if the swapfile location specified on the destination host differs from the swapfile location specified on the source host, the swap file is copied to the new location. This activity can result in slower migrations with vMotion. If the destination host cannot access the specified swap file location, it stores the swap file with the virtual machine configuration file.

See the *vSphere Resource Management* documentation for information about configuring swap file policies.

Migration with vMotion in Environments Without Shared Storage

You can use vMotion to migrate virtual machines to a different compute resource and storage simultaneously. In addition, unlike Storage vMotion, which requires a single host to have access to both the source and destination datastore, you can migrate virtual machines across storage accessibility boundaries.

vMotion does not require environments with shared storage. This is useful for performing cross-cluster migrations, when the target cluster machines might not have access to the source cluster's storage. Processes that are working on the virtual machine continue to run during the migration with vMotion.

You can use vMotion to migrate virtual machines across vCenter Server intances.

You can place the virtual machine and all of its disks in a single location or select separate locations for the virtual machine configuration file and each virtual disk. In addition, you can change virtual disks from thick-provisioned to thin-provisioned or from thin-provisioned to thick-provisioned. For virtual compatibility mode RDMs, you can migrate the mapping file or convert from RDM to VMDK.

vMotion without shared storage is useful for virtual infrastructure administration tasks similar to vMotion with shared storage or Storage vMotion tasks.

- Host maintenance. You can move virtual machines off of a host to allow maintenance of the host.

- Storage maintenance and reconfiguration. You can move virtual machines off of a storage device to allow maintenance or reconfiguration of the storage device without virtual machine downtime.
- Storage load redistribution. You can manually redistribute virtual machines or virtual disks to different storage volumes to balance capacity or improve performance.

Requirements and Limitations for vMotion Without Shared Storage

A virtual machine and its host must meet resource and configuration requirements for the virtual machine files and disks to be migrated with vMotion in the absence of shared storage.

vMotion in an environment without shared storage is subject to the following requirements and limitations:

- The hosts must be licensed for vMotion.
- The hosts must be running ESXi 5.1 or later.
- The hosts must meet the networking requirement for vMotion. See "vSphere vMotion Networking Requirements," on page 121.
- The virtual machines must be properly configured for vMotion. See "Virtual Machine Conditions and Limitations for vMotion," on page 123
- Virtual machine disks must be in persistent mode or be raw device mappings (RDMs). See "Storage vMotion Requirements and Limitations," on page 127.
- The destination host must have access to the destination storage.
- When you move a virtual machine with RDMs and do not convert those RDMs to VMDKs, the destination host must have access to the RDM LUNs.
- Consider the limits for simultaneous migrations when you perform a vMotion migration without shared storage. This type of vMotion counts against the limits for both vMotion and Storage vMotion, so it consumes both a network resource and 16 datastore resources. See "Limits on Simultaneous Migrations," on page 144.

Migration Between vCenter Server Systems

vSphere 6.0 or later lets you migrate virtual machines between vCenter Server instances.

Migration of virtual machines across vCenter Server systems is helpful in certain VM provisioning cases.

- Balance workloads across clusters and vCenter Server instances.
- Elastically grow or shrink capacity across resources in different vCenter Server instances in the same site or in another geographical area .
- Move virtual machines between environments that have different purposes, for example, from a development to production.
- Move virtual machines to meet different Service Level Agreements (SLAs) regarding storage space, performance, and so on.

NOTE During the migration of a virtual machine to another vCenter Server system, the performance data that has been collected about the virtual machine is lost.

- Requirements for Migration Between vCenter Server Instances on page 126

  To enable migration across vCenter Server instances, your system must meet certain requirements.

- Network Compatibility Checks During vMotion Between vCenter Server Instances on page 126

  Migration of VMs between vCenter Server instances moves VMs to new networks. The migration process performs checks to verify that the source and destination networks are similar.

- MAC Address Management During Migration Between vCenter Server Systems on page 126

  When you move a virtual machine between vCenter Server instances, the environment specifically handles MAC address migration to avoid address duplication and loss of data in the network.

Requirements for Migration Between vCenter Server Instances

To enable migration across vCenter Server instances, your system must meet certain requirements.

- The source and destination vCenter Server instances and ESXi hosts must be 6.0 or later.
- Both vCenter Server instances must be in Enhanced Linked Mode and must be in the same vCenter Single Sign-On domain so that the source vCenter Server can authenticate to the destination vCenter Server.

  For information about installing vCenter Server in Enhanced Linked Mode, see the *vSphere Installation and Setup* documentation.
- Both vCenter Server instances must be time-synchronized with each other for correct vCenter Single Sign-On token verification.
- For migration of compute resources only, both vCenter Server instances must be connected to the shared virtual machine storage.

Network Compatibility Checks During vMotion Between vCenter Server Instances

Migration of VMs between vCenter Server instances moves VMs to new networks. The migration process performs checks to verify that the source and destination networks are similar.

vCenter Server performs a number of network compatibility checks to prevent the following configuration problems:

- MAC address compatibility on the destination host
- vMotion from a distributed switch to a standard switch
- vMotion between distributed switches of different versions
- vMotion to an internal network, for example, a network without a physical NIC
- vMotion to a distributed switch that is not working properly

vCenter Server does not perform checks for and notify you about the following problems:

- If the source and destination distributed switches are not in the same broadcast domain, virtual machines lose network connectivity after migration.
- If the source and destination distributed switches do not have the same services configured, virtual machines might lose network connectivity after migration.

MAC Address Management During Migration Between vCenter Server Systems

When you move a virtual machine between vCenter Server instances, the environment specifically handles MAC address migration to avoid address duplication and loss of data in the network.

In an environment with multiple vCenter Server instances, when a virtual machine is migrated, its MAC addresses are transferred to the target vCenter Server. The source vCenter Server adds the MAC addresses to a black list so that it does not assign them to newly created virtual machines.

To reclaim unused MAC addresses from the black list, contact VMware Technical Support for assistance.

Migration with Storage vMotion

With Storage vMotion, you can migrate a virtual machine and its disk files from one datastore to another while the virtual machine is running. With Storage vMotion, you can move virtual machines off of arrays for maintenance or to upgrade. You also have the flexibility to optimize disks for performance, or to transform disk types, which you can use to reclaim space.

You can choose to place the virtual machine and all its disks in a single location, or select separate locations for the virtual machine configuration file and each virtual disk. The virtual machine does not change execution host during a migration with Storage vMotion.

During a migration with Storage vMotion, you can change the disk provisioning type.

Migration with Storage vMotion changes virtual machine files on the destination datastore to match the inventory name of the virtual machine. The migration renames all virtual disk, configuration, snapshot, and `.nvram` files. If the new names exceed the maximum filename length, the migration does not succeed.

Storage vMotion has several uses in administering virtual infrastructure, including the following examples of use.

- Storage maintenance and reconfiguration. You can use Storage vMotion to move virtual machines off of a storage device to allow maintenance or reconfiguration of the storage device without virtual machine downtime.
- Redistributing storage load. You can use Storage vMotion to manually redistribute virtual machines or virtual disks to different storage volumes to balance capacity or improve performance.

Storage vMotion Requirements and Limitations

A virtual machine and its host must meet resource and configuration requirements for the virtual machine disks to be migrated with Storage vMotion.

Storage vMotion is subject to the following requirements and limitations:

- Virtual machine disks must be in persistent mode or be raw device mappings (RDMs). For virtual compatibility mode RDMs, you can migrate the mapping file or convert to thick-provisioned or thin-provisioned disks during migration as long as the destination is not an NFS datastore. If you convert the mapping file, a new virtual disk is created and the contents of the mapped LUN are copied to this disk. For physical compatibility mode RDMs, you can migrate the mapping file only.
- Migration of virtual machines during VMware Tools installation is not supported.
- Because VMFS3 datastores do not support large capacity virtual disks, you cannot move virtual disks greater than 2TB from a VMFS5 datastore to a VMFS3 datastore.
- The host on which the virtual machine is running must have a license that includes Storage vMotion.
- ESX/ESXi 4.0 and later hosts do not require vMotion configuration in order to perform migration with Storage vMotion.
- The host on which the virtual machine is running must have access to both the source and target datastores.
- For limits on the number of simultaneous migrations with vMotion and Storage vMotion, see "Limits on Simultaneous Migrations," on page 144.

CPU Compatibility and EVC

vCenter Server performs compatibility checks before it allows migration of running or suspended virtual machines to ensure that the virtual machine is compatible with the target host.

vMotion transfers the running state of a virtual machine between underlying ESXi systems. Live migration requires that the processors of the target host provide the same instructions to the virtual machine after migration that the processors of the source host provided before migration. Clock speed, cache size, and number of cores can differ between source and target processors. However, the processors must come from the same vendor class (AMD or Intel) to be vMotion compatible.

NOTE Do not add virtual ESXi hosts to an EVC cluster. ESXi virtual machines are not supported in EVC clusters.

Migrations of suspended virtual machines also require that the virtual machine be able to resume execution on the target host using equivalent instructions.

When you initiate a migration with vMotion or a migration of a suspended virtual machine, the Migrate Virtual Machine wizard checks the destination host for compatibility and produces an error message if compatibility problems will prevent migration.

The CPU instruction set available to the operating system and to applications running in a virtual machine is determined at the time that a virtual machine is powered on. This CPU feature set is based on the following items:

- Host CPU family and model
- Settings in the BIOS that might disable CPU features
- ESX/ESXi version running on the host
- The virtual machine's compatibility setting
- The virtual machine's guest operating system

To improve CPU compatibility between hosts of varying CPU feature sets, some host CPU features can be hidden from the virtual machine by placing the host in an Enhanced vMotion Compatibility (EVC) cluster.

NOTE You can hide Host CPU features from a virtual machine by applying a custom CPU compatibility mask to the virtual machine, but this is not recommended. VMware, in partnership with CPU and hardware vendors, is working to maintain vMotion compatibility across the widest range of processors. For additional information, search the VMware Knowledge Base for the *vMotion and CPU Compatibility FAQ*.

CPU Compatibility Scenarios

vCenter Server's CPU compatibility checks compare the CPU features available on the source host, the subset of features that the virtual machine can access, and the features available on the target host. Without the use of EVC, any mismatch between two hosts' user-level features will block migration, whether or not the virtual machine itself has access to those features. A mismatch between two hosts' kernel-level features, however, blocks migration only when the virtual machine has access to a feature that the target host does not provide.

User-level features are non-privileged instructions that might be used by virtual machine applications. These include SSE3, SSSE3, SSE4.1, SSE4.2, and AES. Because they are user-level instructions that bypass the virtualization layer, these instructions could cause application instability if mismatched after a migration with vMotion.

Kernel-level features are privileged instructions that might be used by the virtual machine operating system. These include the AMD No eXecute (NX) and the Intel eXecute Disable (XD) security features.

When you attempt to migrate a virtual machine with vMotion, one of the following scenarios applies:

- The destination host feature set matches the virtual machine's CPU feature set. CPU compatibility requirements are met, and migration with vMotion proceeds.
- The virtual machine's CPU feature set contains features not supported by the destination host. CPU compatibility requirements are not met, and migration with vMotion cannot proceed.

  NOTE EVC overcomes such incompatibility by providing a "baseline" feature set for all virtual machines running in a cluster and that hides the differences among the clustered hosts' CPUs from the virtual machines.

- The destination host supports the virtual machine's feature set, plus additional user-level features (such as SSE4.1) not found in the virtual machine's feature set. CPU compatibility requirements are not met, and migration with vMotion cannot proceed.

  NOTE This type of incompatibility is ignored for migrations among hosts in EVC clusters.

- The destination host supports the virtual machine's feature set, plus additional kernel-level features (such as NX or XD) not found in the virtual machine's feature set. CPU compatibility requirements are met, and migration with vMotion proceeds. The virtual machine retains its CPU feature set as long as it remains powered on, allowing it to migrate freely back to the original host. However, if the virtual machine is rebooted, it acquires a new feature set from the new host, which might cause vMotion incompatibility if you attempt to migrate the virtual machine back to the original host.

CPU Families and Feature Sets

Processors are grouped into families. Processors within a given family generally have similar feature sets.

Processor families are defined by the processor vendors. You can distinguish different processor versions within the same family by comparing the processors' model, stepping level, and extended features. In some cases, processor vendors have introduced significant architectural changes within the same processor family, such as the SSSE3 and SSE4.1 instructions, and NX/XD CPU security features.

By default, vCenter Server identifies mismatches on features accessible to applications as incompatible to guarantee the stability of virtual machines after migrations with vMotion.

Server hardware's CPU specifications will usually indicate whether or not the CPUs contain the features that affect vMotion compatibility.

For more information on identifying Intel processors and their features, see *Application Note 485: Intel® Processor Identification and the CPUID Instruction*, available from Intel. For more information on identifying AMD processors and their features, see *CPUID Specification*, available from AMD.

About Enhanced vMotion Compatibility

You can use the Enhanced vMotion Compatibility (EVC) feature to help ensure vMotion compatibility for the hosts in a cluster. EVC ensures that all hosts in a cluster present the same CPU feature set to virtual machines, even if the actual CPUs on the hosts differ. Using EVC prevents migrations with vMotion from failing because of incompatible CPUs.

Configure EVC from the cluster settings dialog box. When you configure EVC, you configure all host processors in the cluster to present the feature set of a baseline processor. This baseline feature set is called the EVC mode. EVC leverages AMD-V Extended Migration technology (for AMD hosts) and Intel FlexMigration technology (for Intel hosts) to mask processor features so that hosts can present the feature set of an earlier generation of processors. The EVC mode must be equivalent to, or a subset of, the feature set of the host with the smallest feature set in the cluster.

EVC masks only those processor features that affect vMotion compatibility. Enabling EVC does not prevent a virtual machine from taking advantage of faster processor speeds, increased numbers of CPU cores, or hardware virtualization support that might be available on newer hosts.

EVC cannot prevent virtual machines from accessing hidden CPU features in all circumstances. Applications that do not follow CPU vendor recommended methods of feature detection might behave unexpectedly in an EVC environment. VMware EVC cannot be supported with ill-behaved applications that do not follow the CPU vendor recommendations. For more information about creating well-behaved applications, search the VMware Knowledge Base for the article *Detecting and Using New Features in CPUs*.

EVC Requirements for Hosts

To improve CPU compatibility between hosts that have varying CPU feature sets, you can hide some host CPU features from the virtual machine by placing the host in an Enhanced vMotion Compatibility (EVC) cluster. Hosts in an EVC cluster and hosts that you add to an existing EVC cluster must meet EVC requirements.

- Power off all virtual machines in the cluster that are running on hosts with a feature set greater than the EVC mode that you intend to enable, or migrate out of the cluster.
- All hosts in the cluster must meet the following requirements.

Requirements	Description
Supported ESX/ESXi version	ESX/ESXi 3.5 Update 2 or later.
vCenter Server	The host must be connected to a vCenter Server system.
CPUs	A single vendor, either AMD or Intel.
Advanced CPU features enabled	Enable these CPU features in the BIOS if they are available: ■ Hardware virtualization support (AMD-V or Intel VT) ■ AMD No eXecute(NX) ■ Intel eXecute Disable (XD) **Note** Hardware vendors sometimes disable particular CPU features in the BIOS by default. This can cause problems in enabling EVC, because the EVC compatibility checks detect the absence of features that are expected to be present for a particular CPU. If you cannot enable EVC on a system with a compatible processor, ensure that all features are enabled in the BIOS.
Supported CPUs for the EVC mode that you want to enable	To check EVC support for a specific processor or server model, see the *VMware Compatibility Guide* at http://www.vmware.com/resources/compatibility/search.php.

Create an EVC Cluster

Create an EVC cluster to ensure vMotion CPU compatibility between the hosts in the cluster.

To create an EVC cluster with minimal disruption to your existing infrastructure, create an empty EVC cluster and move hosts into the cluster. To enable EVC on an existing cluster, see "Enable EVC on an Existing Cluster," on page 131.

Other cluster features such as vSphere DRS and vSphere HA are fully compatible with EVC. You can enable these features when you create the cluster.

Prerequisites

Verify that the hosts you intend to add to the cluster meet the requirements listed in "EVC Requirements for Hosts," on page 130.

Procedure

1 Right-click a data center in the inventory and select **New Cluster**.

2 Type a name for the cluster.

3 Expand **EVC** and select a baseline CPU feature set from the **EVC mode** drop-down menu.

   Select a CPU vendor and EVC mode appropriate for the hosts that you intend to add to the cluster.

4 (Optional) Enable DRS.

5 (Optional) Enable vSphere HA.

6 Click **OK.**

7 Select a host to move into the cluster.

   If the host feature set is greater than the EVC mode that you enabled for the EVC cluster, power off all the virtual machines on the host, or use vMotion to migrate them to another host.

8 Move the host into the cluster.

   You can power on the virtual machines that are on the host, or migrate virtual machines into the cluster with vMotion. The virtual machines must meet CPU compatibility requirements for the EVC mode of the cluster.

You can now use vMotion to migrate virtual machines between different hosts in the cluster without encountering CPU incompatibility issues.

Enable EVC on an Existing Cluster

Enable EVC on an existing cluster to ensure vMotion CPU compatibility between the hosts in the cluster.

Prerequisites

Verify that the hosts in the cluster meet the requirements listed in "EVC Requirements for Hosts," on page 130.

Procedure

1 Select the cluster in the inventory.

2 Power off all the virtual machines on the hosts with feature sets greater than the EVC mode.

3 Ensure that the cluster contains hosts with CPUs from only one vendor, either Intel or AMD.

4 Click the **Manage** tab, select VMware EVC and click **Edit**.

5 Enable EVC for the CPU vendor and feature set appropriate for the hosts in the cluster, and click **OK**.

6 Power on the virtual machines in the cluster to apply the EVC.

Change the EVC Mode for a Cluster

Configure EVC to ensure that virtual machine migrations between hosts in the cluster do not fail because of CPU feature incompatibilities.

Several EVC approaches are available to ensure CPU compatibility:

- If all the hosts in a cluster are compatible with a newer EVC mode, you can change the EVC mode of an existing EVC cluster.
- You can enable EVC for a cluster that does not have EVC enabled.
- You can raise the EVC mode to expose more CPU features.
- You can lower the EVC mode to hide CPU features and increase compatibility.

Prerequisites

- Verify that all hosts in the cluster have supported CPUs for the EVC mode you want to enable. See http://kb.vmware.com/kb/1003212 for a list of supported CPUs.
- Verify that all hosts in the cluster are connected and registered on vCenter Server. The cluster cannot contain a disconnected host.
- Virtual machines must be in the following power states, depending on whether you raise or lower the EVC mode.

EVC Mode	Virtual Machine Power Action
Raise the EVC mode to a CPU baseline with more features.	Running virtual machines can remain powered on. New EVC mode features are not available to the virtual machines until they are powered off and powered back on again. A full power cycling is required. Rebooting the guest operating system or suspending and resuming the virtual machine is not sufficient.
Lower the EVC mode to a CPU baseline with fewer features.	Power off virtual machines if they are powered on and running at a higher EVC Mode than the one you intend to enable.

To verify the EVC mode for virtual machines, see "Determine EVC Modes for Virtual Machines," on page 132.

Procedure

1 Select a cluster in the inventory.

2 Click the **Manage** tab and click **Settings**.

3 Select **VMware EVC** and click **Edit**.

4 Select whether to enable or disable EVC.

Option	Description
Disable EVC	The EVC feature is disabled. CPU compatibility is not enforced for the hosts in this cluster.
Enable EVC for AMD Hosts	The EVC feature is enabled for AMD hosts.
Enable EVC for Intel Hosts	The EVC feature is enabled for Intel hosts.

5 From the **VMware EVC Mode** drop-down menu, select the baseline CPU feature set that you want to enable for the cluster.

If you cannot select the EVC Mode, the Compatibility pane displays the reason, and the relevant hosts for each reason.

6 Click **OK**.

Determine EVC Modes for Virtual Machines

The EVC mode of a virtual machine defines the CPU features that the virtual machine can access. The virtual machine's EVC mode is determined when it is powered on in an EVC-enabled cluster.

When a virtual machine is powered on, it determines the EVC mode of the cluster in which it is running. If the EVC mode of the cluster is subsequently raised, the virtual machine does not change its EVC mode until it is powered off and powered on again. This means that the virtual machine does not use of any CPU features exposed by the cluster's new EVC mode until the virtual machine has been powered off and powered on again.

For example, consider a cluster containing hosts with Intel Xeon 45nm Core 2 processors that have been set to the Intel Merom Generation (Xeon Core 2) EVC mode. A virtual machine powered on in this cluster runs in the Intel Merom Generation (Xeon Core 2) EVC mode. If the cluster's EVC mode is raised to Intel Penryn Generation (Xeon 45nm Core 2), the virtual machine remains at the lower Intel Merom Generation (Xeon Core 2) EVC mode. To use any of the features exposed by the higher cluster EVC mode, such as SSE4.1, you must power off the virtual machine and power it on again.

Procedure

1 Select the cluster or host in the inventory.

2 Click the **Related Objects** tab and click **Virtual Machines**.

3 If the EVC Mode column does not appear, right-click any column title, select **Show/Hide Columns** and select **EVC Mode**.

   The EVC modes of all running or suspended virtual machines appear in the **EVC Mode** column. Powered off virtual machines and virtual machines that are not in EVC clusters show N/A as the EVC mode.

Determine the EVC Mode that a Host Supports

By determining the EVC modes that the host can support, you can determine whether the host is compatible with other hosts in an EVC cluster. For hosts to be included in the same EVC cluster, all the hosts must support at least one common mode.

Procedure

1 Select a host in the inventory.

2 Click the **Summary** tab.

3 In the Configuration panel, expand **EVC Mode**.

   The supported EVC modes are listed in order from the fewest to the greatest number of supported features.

Prepare Clusters for AMD Processors Without 3DNow!

Newer generations of AMD processors do not include 3DNow! processor instructions. If hosts in a cluster have different generations of AMD processors, some with 3DNow! instruction sets and some without, you cannot successfully migrate virtual machines between the hosts. You must use an EVC mode or CPU compatibility mask to hide the instructions.

The vCenter Server **AMD Opteron Gen. 3 (no 3DNow!)** EVC mode masks the 3DNow! instructions from virtual machines. You can apply this EVC mode to EVC clusters containing only AMD Opteron Generation 3 hosts to allow the clusters to maintain vMotion compatibility with AMD Opteron hosts that do not have 3DNow! instructions. Clusters containing AMD Opteron Generation 1 or AMD Opteron Generation 2 hosts cannot be made vMotion-compatible with hosts that do not have 3DNow! instructions.

Prerequisites

Ensure that the cluster contains only hosts with AMD Opteron Generation 3 or newer processors.

Procedure

- Enable the **AMD Opteron Gen. 3 (no 3DNow!)** EVC mode for your EVC cluster.

  The steps to enable the EVC mode differ depending on whether you are creating a cluster or enabling the mode on an existing cluster, and on whether the existing cluster contains powered-on virtual machines.

Option	Description
Creating a new cluster	In the New Cluster wizard, enable EVC for AMD hosts and select the **AMD Opteron Gen. 3 (no 3DNow!)** EVC mode.
Editing a cluster without powered-on virtual machines	In the Cluster Settings dialog box, edit the **VMware EVC** settings and select the **AMD Opteron Gen. 3 (no 3DNow!)** EVC mode.
Editing a cluster with powered-on virtual machines	The **AMD Opteron Gen. 3 (no 3DNow!)** EVC mode cannot be enabled while there are powered-on virtual machines in the cluster. a Power-off any running virtual machines in the cluster, or migrate them out of the cluster using vMotion. Migrating the virtual machines out of the cluster with vMotion allows you to delay powering off the virtual machines until a more convenient time. b In the Cluster Settings dialog box, edit the **VMware EVC** settings and select the **AMD Opteron Gen. 3 (no 3DNow!)** EVC mode. c If you migrated virtual machines out of the cluster, power them off and cold migrate them back into the cluster. d Power on the virtual machines.

You can now add hosts with AMD processors without 3DNow! instructions to the cluster and preserve vMotion compatibility between the new hosts and the existing hosts in the cluster.

CPU Compatibility Masks

CPU compatibility masks allow per-virtual machine customization of the CPU features visible to a virtual machine.

vCenter Server compares the CPU features available to a virtual machine with the CPU features of the destination host to determine whether to allow or not migrations with vMotion.

Default values for the CPU compatibility masks are set by VMware to guarantee the stability of virtual machines after a migration with vMotion.

In some cases, where a choice between CPU compatibility or guest operating system features (such as NX/XD) exists, VMware provides check-box options to configure individual virtual machines through the Advanced Settings option for the CPU of the virtual machine. For more control over the visibility of CPU features, you can edit CPU compatibility mask of the virtual machine at the bit level.

Caution Changing the CPU compatibility masks can result in an unsupported configuration. Do not manually change the CPU compatibility masks unless instructed to do so by VMware Support or a VMware Knowledge base article.

CPU compatibility masks cannot prevent virtual machines from accessing masked CPU features in all circumstances. In some circumstances, applications can detect and use masked features even though they are hidden from the guest operating system. In addition, on any host, applications that use unsupported methods of detecting CPU features rather than using the CPUID instruction can access masked features. Virtual machines running applications that use unsupported CPU detection methods might experience stability problems after migration.

View CPUID Details for an EVC Cluster

The feature set that is exposed by an EVC cluster corresponds to the feature set of a particular type of processor. Processor feature sets are described by a set of feature flags that you examine using the CPUID instruction.

You can view the CPUID feature flags currently exposed by the hosts in an EVC cluster.

Procedure

1 Select a cluster in the inventory.

2 Click the **Manage** tab and click **Settings**.

3 Under **Configuration**, click **VMware EVC** and expand **Current CPUID Details**.

This VMware EVC panel displays the CPUID feature flags that EVC enforces for the hosts in this cluster. For information about CPUID feature flags, see the Intel and AMD Web sites.

Migrate a Powered-Off or Suspended Virtual Machine

You can use cold migration to move a virtual machine and its associated disks from one datastore to another. The virtual machines are not required to be on shared storage.

Prerequisites

- Make sure that you are familiar with the requirements for cold migration. See "Cold Migration," on page 119.
- Required privilege: **Resource.Migrate powered off virtual machine**

Procedure

1 Power off or suspend the virtual machine.

2 Right-click the virtual machine and select **Migrate**.

   a To locate a virtual machine, select a data center, folder, cluster, resource pool, host, or vApp.

   b Click the **Related Objects** tab and click **Virtual Machines**.

3 Select the migration type and click **Next**.

Option	Description
Change compute resource only	Move the virtual machine to another host.
Change storage only	Move the virtual machine's configuration file and virtual disks.
Change both compute resource and storage	Move the virtual machine to another host and move its configuration file and virtual disks.
Migrate virtual machine(s) to a specific datacenter	Move the virtual machine to a virtual data center, where you can assign policies to VMs.

4 If you change the compute resource of the virtual machine, select the destination compute resource for this virtual machine migration and click **Next**.

   Any compatibility problem appears in the Compatibility panel. Fix the problem, or select another host or cluster.

   Possible targets include hosts and DRS clusters with any level of automation. If a cluster has no DRS enabled, select a specific host in the cluster rather than selecting the cluster.

5 Select the format for the virtual machine's disks.

Option	Action
Same format as source	Use the same format as the source virtual machine.
Thick Provision Lazy Zeroed	Create a virtual disk in a default thick format. Space required for the virtual disk is allocated during creation. Any data remaining on the physical device is not erased during creation, but is zeroed out on demand at a later time on first write from the virtual machine.
Thick Provision Eager Zeroed	Create a thick disk that supports clustering features such as Fault Tolerance. Space required for the virtual disk is allocated at creation time. In contrast to the thick provision lazy zeroed format, the data remaining on the physical device is zeroed out during creation. It might take longer to create disks in this format than to create other types of disks.
Thin Provision	Use the thin provisioned format. At first, a thin provisioned disk uses only as much datastore space as the disk initially needs. If the thin disk needs more space later, it can grow to the maximum capacity allocated to it.

6 Select a virtual machine storage policy from the **VM Storage Policy** drop-down menu.

Storage policies specify storage requirements for applications that run on the virtual machine. You can also select the default policy for Virtual SAN or Virtual Volumes datastores.

7 Select the datastore location where you want to store the virtual machine files.

Option	Action
Store all virtual machine files in the same location on a datastore.	Select a datastore and click **Next**.
Store all virtual machine files in the same Storage DRS cluster.	a Select a Storage DRS cluster. b (Optional) To not use Storage DRS with this virtual machine, select **Disable Storage DRS for this virtual machine** and select a datastore within the Storage DRS cluster. c Click **Next**.
Store virtual machine configuration files and disks in separate locations.	a Click **Advanced**. b For the virtual machine configuration file and for each virtual disk, select **Browse**, and select a datastore or Storage DRS cluster. c (Optional) If you selected a Storage DRS cluster and do not want to use Storage DRS with this virtual machine, select **Disable Storage DRS for this virtual machine** and select a datastore within the Storage DRS cluster. d Click **Next**.

8 Select a destination network for all VM network adapters and click **Next**.

You can click **Advanced** to select a new destination network for each VM network adapter.

You can migrate a virtual machine networks to another distributed switch in the same or to another data center or vCenter Server.

9 Review the information on the Review Selections page and click **Finish**.

vCenter Server moves the virtual machine to the new host or storage location.

Event messages appear in the **Events** tab. The data displayed on the **Summary** tab shows the status and state throughout the migration. If errors occur during migration, the virtual machines revert to their original states and locations.

Migrate a Virtual Machine to a New Compute Resource

You can use the Migration wizard to migrate a powered-on virtual machine from one compute resource to another by using vMotion. To relocate only the disks of a powered-on virtual machine, migrate the virtual machine to a new datastore by using Storage vMotion.

Prerequisites

Verify that your hosts and virtual machines meet the requirements for migration with vMotion with shared storage.

- Verify that your hosts and virtual machines meet the requirements for migration with vMotion. See "Host Configuration for vMotion," on page 121 and "Virtual Machine Conditions and Limitations for vMotion," on page 123.
- Verify that the storage that contains the virtual machine disks is shared between the source and target hosts. See "vMotion Shared Storage Requirements," on page 121.
- For migration across vCenter Server instances verify whether your system meets additional requirements. See "Requirements for Migration Between vCenter Server Instances," on page 126.
- Required privilege: **Resource.Migrate powered on virtual machine**

Procedure

1. Right-click the virtual machine and select **Migrate**.
   a. To locate a virtual machine, select a data center, folder, cluster, resource pool, host, or vApp.
   b. Click the **Related Objects** tab and click **Virtual Machines**.
2. Click **Change compute resource only** and click **Next**.
3. Select a host, cluster, resource pool, or vApp ro run the virtual machine, and click **Next**.

   Any compatibility problem appears in the Compatibility panel. Fix the problem, or select another host or cluster.

   Possible targets include hosts and fully automated DRS clusters in the same or another vCenter Server system. If your target is a non-automated cluster, select a host within the non-automated cluster.
4. Select a destination network for all VM network adapters and click **Next**.

   You can click **Advanced** to select a new destination network for each VM network adapter.

   You can migrate a virtual machine networks to another distributed switch in the same or to another data center or vCenter Server.
5. Select the migration priority level and click **Next**.

Option	Description
Schedule vMotion with high priority	vCenter Server attempts to reserve resources on both the source and destination hosts to be shared among all concurrent migrations with vMotion. vCenter Server grants a larger share of host CPU resources. if sufficient CPU resources are not immediately available, vMotion is not initiated.
Schedule regular vMotion	vCenter Server reserves resources on both the source and destination hosts to be shared among all concurrent migration with vMotion. vCenter Server grants a smaller share of host CPU resources. If there is a lack of CPU resources, the duration of vMotion can be extended.

6. Review the page and click **Finish**.

vCenter Server moves the virtual machine to the new host or storage location.

Event messages appear in the **Events** tab. The data displayed on the **Summary** tab shows the status and state throughout the migration. If errors occur during migration, the virtual machines revert to their original states and locations.

Migrate a Virtual Machine to a New Compute Resource and Storage

You can move a virtual machine to another compute resource and move its disks or virtual machine folder to another datastore. With vMotion, you can migrate a virtual machine and its disks and files while the virtual machine is powered on.

Simultaneous migration to a new compute resource and datastore provides greater mobility for virtual machines by eliminating the vCenter Server boundary. Virtual machine disks or content of the virtual machine folder are transferred over the vMotion network to reach the destination host and datastores.

To make disk format changes and preserve them, you must select a different datastore for the virtual machine files and disks. You cannot preserve disk format changes if you select the same datastore on which the virtual machine currently resides.

Prerequisites

- Verify that your hosts and virtual machines meet the requirements for live migration. See "Requirements and Limitations for vMotion Without Shared Storage," on page 125.
- For migration across vCenter Server instances verify whether your system meets additional requirements. See "Requirements for Migration Between vCenter Server Instances," on page 126.
- Required privilege: **Resource.Migrate powered on virtual machine**

Procedure

1. Right-click the virtual machine and select **Migrate**.
   a. To locate a virtual machine, select a data center, folder, cluster, resource pool, host, or vApp.
   b. Click the **Related Objects** tab and click **Virtual Machines**.
2. Select **Change both compute resource and storage** and click **Next**.
3. Select a destination resource for the virtual machine, and click **Next**.

   Any compatibility problems appear in the Compatibility panel. Fix the problem, or select another host or cluster.

   Possible targets include hosts and fully automated DRS clusters. If your target is a non-automated cluster, select a host within the non-automated cluster.

   If you environment has more than one vCenter Server instances, you can move virtual machines from one vCenter Server inventory to another.
4. Select the format for the virtual machine's disks.

Option	Action
Same format as source	Use the same format as the source virtual machine.
Thick Provision Lazy Zeroed	Create a virtual disk in a default thick format. Space required for the virtual disk is allocated during creation. Any data remaining on the physical device is not erased during creation, but is zeroed out on demand at a later time on first write from the virtual machine.

Option	Action
Thick Provision Eager Zeroed	Create a thick disk that supports clustering features such as Fault Tolerance. Space required for the virtual disk is allocated at creation time. In contrast to the thick provision lazy zeroed format, the data remaining on the physical device is zeroed out during creation. It might take longer to create disks in this format than to create other types of disks.
Thin Provision	Use the thin provisioned format. At first, a thin provisioned disk uses only as much datastore space as the disk initially needs. If the thin disk needs more space later, it can grow to the maximum capacity allocated to it.

5 Assign a storage policy from the **VM Storage Policy** drop-down menu.

Storage policies define the storage capabilities that are required by the applications running on the virtual machine.

6 Select the datastore location where you want to store the virtual machine files.

Option	Action
Store all virtual machine files in the same location on a datastore.	Select a datastore and click **Next**.
Store all virtual machine files in the same Storage DRS cluster.	a Select a Storage DRS cluster. b (Optional) To not use Storage DRS with this virtual machine, select **Disable Storage DRS for this virtual machine** and select a datastore within the Storage DRS cluster. c Click **Next**.
Store virtual machine configuration files and disks in separate locations.	a Click **Advanced**. b For the virtual machine configuration file and for each virtual disk, select **Browse**, and select a datastore or Storage DRS cluster. c (Optional) If you selected a Storage DRS cluster and do not want to use Storage DRS with this virtual machine, select **Disable Storage DRS for this virtual machine** and select a datastore within the Storage DRS cluster. d Click **Next**.

7 Select a destination network for all VM network adapters and click **Next**.

You can click **Advanced** to select a new destination network for each VM network adapter.

You can migrate a virtual machine networks to another distributed switch in the same or to another data center or vCenter Server.

8 Select the migration priority level and click **Next**.

Option	Description
Schedule vMotion with high priority	vCenter Server attempts to reserve resources on both the source and destination hosts to be shared among all concurrent migrations with vMotion. vCenter Server grants a larger share of host CPU resources. if sufficient CPU resources are not immediately available, vMotion is not initiated.
Schedule regular vMotion	vCenter Server reserves resources on both the source and destination hosts to be shared among all concurrent migration with vMotion. vCenter Server grants a smaller share of host CPU resources. If there is a lack of CPU resources, the duration of vMotion can be extended.

9 Review the information on the Review Selections page and click **Finish**.

vCenter Server moves the virtual machine to the new host or storage location.

Event messages appear in the **Events** tab. The data displayed on the **Summary** tab shows the status and state throughout the migration. If errors occur during migration, the virtual machines revert to their original states and locations.

Migrate a Virtual Machine to New Storage

Use migration with Storage vMotion to relocate the configuration file of a virtual machine and virtual disks while the virtual machine is powered on.

You can change the virtual machine host during a migration with Storage vMotion.

Prerequisites

- Verify that your system satisfies the requirements for Storage vMotion. See "Storage vMotion Requirements and Limitations," on page 127.
- Required privilege: **Resource.Migrate powered on virtual machine**

Procedure

1 Right-click the virtual machine and select **Migrate**.

   a To locate a virtual machine, select a data center, folder, cluster, resource pool, host, or vApp.

   b Click the **Related Objects** tab and click **Virtual Machines**.

2 Click **Change storage only** and click **Next**.

3 Select the format for the virtual machine's disks.

Option	Action
Same format as source	Use the same format as the source virtual machine.
Thick Provision Lazy Zeroed	Create a virtual disk in a default thick format. Space required for the virtual disk is allocated during creation. Any data remaining on the physical device is not erased during creation, but is zeroed out on demand at a later time on first write from the virtual machine.
Thick Provision Eager Zeroed	Create a thick disk that supports clustering features such as Fault Tolerance. Space required for the virtual disk is allocated at creation time. In contrast to the thick provision lazy zeroed format, the data remaining on the physical device is zeroed out during creation. It might take longer to create disks in this format than to create other types of disks.
Thin Provision	Use the thin provisioned format. At first, a thin provisioned disk uses only as much datastore space as the disk initially needs. If the thin disk needs more space later, it can grow to the maximum capacity allocated to it.

4 Select a virtual machine storage policy from the **VM Storage Policy** drop-down menu.

   Storage policies specify storage requirements for applications that run on the virtual machine. You can also select the default policy for Virtual SAN or Virtual Volumes datastores.

5 Select the datastore location where you want to store the virtual machine files.

Option	Action
Store all virtual machine files in the same location on a datastore.	Select a datastore and click **Next**.
Store all virtual machine files in the same Storage DRS cluster.	a Select a Storage DRS cluster. b (Optional) To not use Storage DRS with this virtual machine, select **Disable Storage DRS for this virtual machine** and select a datastore within the Storage DRS cluster. c Click **Next**.
Store virtual machine configuration files and disks in separate locations.	a Click **Advanced**. b For the virtual machine configuration file and for each virtual disk, select **Browse**, and select a datastore or Storage DRS cluster. c (Optional) If you selected a Storage DRS cluster and do not want to use Storage DRS with this virtual machine, select **Disable Storage DRS for this virtual machine** and select a datastore within the Storage DRS cluster. d Click **Next**.

6 Review the information on the Review Selections page and click **Finish**.

vCenter Server moves the virtual machine to the new storage location. Names of migrated virtual machine files on the destination datastore match the inventory name of the virtual machine.

Event messages appear in the **Events** tab. The data displayed on the **Summary** tab shows the status and state throughout the migration. If errors occur during migration, the virtual machines revert to their original states and locations.

Place vMotion Traffic on the vMotion TCP/IP Stack of an ESXi Host

Use the vMotion TCP/IP stack to isolate traffic for vMotion and to assign a dedicated default gateway, routing table, and DNS configuration for this traffic. To enable the vMotion TCP/IP stack, assign a new VMkernel adapter to it.

By using a separate TCP/IP stack, you can handle vMotion and cold migration traffic according to the topology of the network and as required for your organization:

- Route the traffic for migration of powered on or powered off virtual machines by using a default gateway that is different from the gateway assigned to the default stack on the host.

  By using a separate default gateway, you can use DHCP for IP address assignment to the VMkernel adapters for migration in a flexible way.
- Assign a separate set of buffers and sockets.
- Avoid routing table conflicts that might otherwise appear when many features are using a common TCP/IP stack.
- Isolate traffic to improve security.

Prerequisites

Verify that the host is running ESXi 6.0 or later

Procedure

1 In the vSphere Web Client, navigate to the host.

2 Under **Manage**, select **Networking** and then select **VMkernel adapters**.

3 Click **Add host networking**.

4 On the Select connection type page, select **VMkernel Network Adapter** and click **Next**.

5 On the Select target device page, select the switch for the VMkernel adapter, and click **Next**.

Option	Description
Select an existing network	Use the physical adapter configuration of an existing distributed port group to send data from the VMkernel adapter to the external network.
Select an existing standard switch	Use the physical adapter configuration for the VMkernel adapter of an existing standard switch.
New vSphere standard switch	Assign a new physical adapter configuration for the VMkernel adapter on a new standard switch.

6 On the Port properties page, select **vMotion** from the **TCP/IP stack** drop-down menu.

The vMotion traffic becomes the only enabled service. You cannot use this VMkernel adapter for traffic types other than vMotion.

7 Set the label, VLAN ID, and IP mode of the VMkernel adapter, and click **Next**.

8 (Optional) On the IPv4 settings page, select an option for obtaining IP addresses.

Option	Description
Obtain IP settings automatically	Use DHCP to obtain IP settings. A DHCP server must be present on the network.
Use static IP settings	Type the IPv4 IP address and subnet mask for the VMkernel adapter. The VMkernel Default Gateway and DNS server addresses for IPv4 are obtained from the selected TCP/IP stack.

9 (Optional) On the IPv6 settings page, select an option for obtaining IPv6 addresses.

Option	Description
Obtain IPv6 addresses automatically through DHCP	Use DHCP to obtain IPv6 addresses. A DHCPv6 server must be present on the network.
Obtain IPv6 addresses automatically through Router Advertisement	Use router advertisement to obtain IPv6 addresses.
Static IPv6 addresses	a Click **Add** to add a new IPv6 address. b Type the IPv6 address and subnet prefix length, and click **OK**. c To change the VMkernel default gateway, click **Edit**.

10 Review your setting selections in the Ready to complete page and click **Finish**.

After you create a VMkernel adapter on the vMotion TCP/IP stack, you can use only this stack for vMotion on this host. The VMkernel adapters on the default TCP/IP stack are disabled for the vMotion service. If a live migration uses the default TCP/IP stack while you are configuring VMkernel adapters with the vMotion TCP/IP stack, the migration completes successfully. However, the involved VMkernel adapters on the default TCP/IP stack are disabled for future vMotion sessions.

What to do next

Assign a default gateway, and configure the DNS settings, congestion control, and maximum number of connections for the vMotion TCP/IP stack.

Place Traffic for Cold Migration, Cloning, and Snapshots on the Provisioning TCP/IP Stack

Use the provisioning TCP/IP stack to isolate traffic for cold migration, VM clones, and snapshots, and to assign a dedicated default gateway, routing table, and DNS configuration for this traffic. To enable the Provisioning TCP/IP stack, assign it a new VMkernel adapter.

By using a separate TCP/IP stack, you can handle vMotion and cold migration traffic according to the topology of the network and as required for your organization:

- Route the traffic for migration of powered on or powered off virtual machines by using a default gateway that is different from the gateway assigned to the default stack on the host.

  By using a separate default gateway, you can use DHCP for IP address assignment to the VMkernel adapters for migration in a flexible way.
- Assign a separate set of buffers and sockets.
- Avoid routing table conflicts that might otherwise appear when many features are using a common TCP/IP stack.
- Isolate traffic to improve security.

Prerequisites

Verify that the host is running ESXi 6.0 or later

Procedure

1 In the vSphere Web Client, navigate to the host.

2 Under **Manage**, select **Networking** and then select **VMkernel adapters**.

3 Click **Add host networking**.

4 On the Select connection type page, select **VMkernel Network Adapter** and click **Next**.

5 On the Select target device page, select the switch for the VMkernel adapter, and click **Next**.

Option	Description
Select an existing network	Use the physical adapter configuration of an existing distributed port group to send data from the VMkernel adapter to the external network.
Select an existing standard switch	Use the physical adapter configuration for the VMkernel adapter of an existing standard switch.
New vSphere standard switch	Assign a new physical adapter configuration for the VMkernel adapter on a new standard switch.

6 On the Port properties page, select **Provisioning** from the **TCP/IP stack** drop-down menu.

   The provisioning traffic becomes the only enabled service. You cannot use this VMkernel adapter for traffic types other than provisioning.

7 Set the label, VLAN ID, and IP mode of the VMkernel adapter, and click **Next**.

8 (Optional) On the IPv4 settings page, select an option for obtaining IP addresses.

Option	Description
Obtain IP settings automatically	Use DHCP to obtain IP settings. A DHCP server must be present on the network.
Use static IP settings	Type the IPv4 IP address and subnet mask for the VMkernel adapter. The VMkernel Default Gateway and DNS server addresses for IPv4 are obtained from the selected TCP/IP stack.

9 (Optional) On the IPv6 settings page, select an option for obtaining IPv6 addresses.

Option	Description
Obtain IPv6 addresses automatically through DHCP	Use DHCP to obtain IPv6 addresses. A DHCPv6 server must be present on the network.
Obtain IPv6 addresses automatically through Router Advertisement	Use router advertisement to obtain IPv6 addresses.
Static IPv6 addresses	a Click **Add** to add a new IPv6 address. b Type the IPv6 address and subnet prefix length, and click **OK**. c To change the VMkernel default gateway, click **Edit**.

10 Review your setting selections in the Ready to complete page and click **Finish**.

After you create a VMkernel adapter on the provisioning TCP/IP stack, you can use only this stack for cold migration, cloning, and snapshots on this host. The VMkernel adapters on the default TCP/IP stack are disabled for the provisioning service. If a live migration uses the default TCP/IP stack while you configure VMkernel adapters with the provisioning TCP/IP stack, the data transfer completes successfully. However, the involved VMkernel adapters on the default TCP/IP stack are disabled for future cold migration, cross-host cloning, and snapshot sessions.

Limits on Simultaneous Migrations

vCenter Server places limits on the number of simultaneous virtual machine migration and provisioning operations that can occur on each host, network, and datastore.

Each operation, such as a migration with vMotion or cloning a virtual machine, is assigned a resource cost. Each host, datastore, or network resource, has a maximum cost that it can support at any one time. Any new migration or provisioning operation that causes a resource to exceed its maximum cost does not proceed immediately, but is queued until other operations complete and release resources. Each of the network, datastore, and host limits must be satisfied for the operation to proceed.

vMotion without shared storage, migrating virtual machines to a different host and datastore simultaneously, is a combination of vMotion and Storage vMotion. This migration inherits the network, host, and datastore costs associated with those operations. vMotion without shared storage is equivalent to a Storage vMotion with a network cost of 1.

Network Limits

Network limits apply only to migrations with vMotion. Network limits depend on the version of ESXi and the network type. All migrations with vMotion have a network resource cost of 1.

Table 12-1. Network Limits for Migration with vMotion

Operation	ESXi Version	Network Type	Maximum Cost
vMotion	5.0, 5.1, 5.5	1GigE	4
vMotion	5.0, 5.1, 5.5	10GigE	8

Datastore Limits

Datastore limits apply to migrations with vMotion and with Storage vMotion. A migration with vMotion has a resource cost of 1 against the shared virtual machine's datastore. A migration with Storage vMotion has a resource cost of 1 against the source datastore and 1 against the destination datastore.

Table 12-2. Datastore Limits and Resource Costs for vMotion and Storage vMotion

Operation	ESXi Version	Maximum Cost Per Datastore	Datastore Resource Cost
vMotion	5.0, 5.1, 5.5	128	1
Storage vMotion	5.0, 5.1, 5.5	128	16

Host Limits

Host limits apply to migrations with vMotion, Storage vMotion, and other provisioning operations such as cloning, deployment, and cold migration. All hosts have a maximum cost per host of 8. For example, on an ESXi 5.0 host, you can perform 2 Storage vMotion operations, or 1 Storage vMotion and 4 vMotion operations.

Table 12-3. Host Migration Limits and Resource Costs for vMotion, Storage vMotion, and Provisioning Operations

Operation	ESXi Version	Derived Limit Per Host	Host Resource Cost
vMotion	5.0, 5.1, 5.5	8	1
Storage vMotion	5.0, 5.1, 5.5	2	4
vMotion Without Shared Storage	5.1, 5.5	2	4
Other provisioning operations	5.0, 5.1, 5.5	8	1

About Migration Compatibility Checks

During migration, the Migrate Virtual Machine wizard checks the destination host for compatibility with the migrating virtual machine using a number of criteria.

When you select a host or a cluster, the Compatibility panel at the bottom of the Migrate Virtual Machine wizard displays information about the compatibility of the selected host or cluster with the virtual machine’s configuration.

Compatibility Check Results

If the virtual machine is compatible, the panel displays the message `Compatibility checks succeeded`. If the virtual machine is not compatible with either the host’s or cluster’s configured networks or datastores, the compatibility window might display both warnings and errors:

- Warning messages do not disable migration. Often the migration is justified and you can continue with the migration despite the warnings.
- Errors might disable migration if no error-free destination hosts are available among the selected destination hosts. In this case, if you click **Next**, the wizard displays the compatibility errors again, and you cannot proceed to the next step.

Compatibility Checks During Migration Setup

When you attempt to move only the compute resource, the Migrate Virtual Machine wizard examines the source and destination hosts, the target resource pool, the datastore, and the network. When you attempt to move only the storage, the wizard checks the compatibility of the same objects except for the network.

When you move compute resources and storage together, the Migrate Virtual Machine wizard runs fewer compatibility checks. For example, if you move the compute resource, you select the target host or cluster under a vCenter Server instance. The wizard performs all necessary validation only against the selected host, and does not check the datastores available on the destination host. When you attempt to move the virtual machine to a cluster, the Migrate Virtual Machine wizard examines the compatibility against the host recommendation from vSphere DRS. The wizard directly validates the compatibility of the target datastore when you select it later.

Another compatibility check is whether vMotion is enabled on the source and target hosts.

Compatibility Checks for Virtual Hardware

Effects of a specific host CPU feature on compatibility are dependent on whether ESXi exposes or hides them from virtual machines.

- Features that are exposed to virtual machines are not compatible when they are do not match on the source and target hosts.
- Features that are not exposed to virtual machines are considered as compatible regardless of whether they match on the hosts.

Specific items of virtual machine hardware can also cause compatibility problems. For example, a virtual machine using an Enhanced VMXNET virtual NIC cannot be migrated to a host running a version of ESXi that does not support Enhanced VMXNET.

Automating Management Tasks by Using vRealize Orchestrator 13

VMware™ vRealize Orchestrator is a development- and process-automation platform that provides a library of extensible workflows. By using the workflow library you can create and run automated, configurable processes to manage the vSphere infrastructure as well as other VMware and third-party technologies.

Orchestrator exposes every operation in the vCenter Server API and so that you can integrate all of these operations into your own automated processes.

To run and schedule workflows on the objects in your vSphere infrastructure by using the vSphere Web Client, make sure that you configure the Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client point. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring vRealize Orchestrator*.

This chapter includes the following topics:

- "Concepts of Workflows," on page 147
- "Performing Administration Tasks on the vSphere Objects," on page 148
- "Configure the Default vRealize Orchestrator," on page 149
- "Managing Associations of Workflows with vSphere Inventory Objects," on page 149
- "Managing Workflows," on page 152
- "Workflows for Managing Inventory Objects," on page 158

Concepts of Workflows

A workflow is a series of actions and decisions that you run sequentially. Orchestrator provides a library of workflows that perform common management tasks according to best practices.

Basics of Workflows

Workflows consist of a schema, attributes, and parameters. The workflow schema is the main component of a workflow as it defines all the workflow elements and the logical connections between them. The workflow attributes and parameters are the variables that workflows use to transfer data. Orchestrator saves a workflow token every time a workflow runs, recording the details of that specific run of the workflow. This token contains all parameters related to the running of the workflow. For example, if you run a workflow three times, three workflow tokens are created.

The vSphere Web Client allows you run and schedule workflows on selected objects from your vSphere inventory. You cannot create, delete, edit and manage workflows in the vSphere Web Client. You develop and manage workflows in the Orchestrator client. For more information about the Orchestrator client, see *Using the VMware vRealize Orchestrator Client*. For information about developing workflows, see *Developing with VMware vRealize Orchestrator*.

Input Workflow Parameters

Most workflows require a certain set of input parameters to run. An input parameter is an argument that the workflow processes when it starts. The user, an application, or another workflow or an action passes input parameters to a workflow, for the workflow to process when it starts.

For example, if a workflow resets a virtual machine, the workflow requires as an input parameter the name of the virtual machine to reset.

Output Workflow Parameters

Workflow's output parameters represent the result from the workflow run. Output parameters can change when a workflow or a workflow element runs. While they run, workflows can receive the output parameters of other workflows as input parameters.

For example, if a workflow creates a snapshot of a virtual machine, the output parameter for the workflow is the resulting snapshot.

Workflow Presentation

When you start a workflow in the vSphere Web Client, the client loads the workflow presentation. You provide the input parameters of the workflow in the workflow presentation.

User Interaction

Some workflows require interactions from users during their run and suspend either until the user provides the required information or until the workflow times out.

Performing Administration Tasks on the vSphere Objects

By using the Orchestrator view in the vSphere Web Client you can perform your administration tasks such as running and scheduling workflows, and viewing the list of available workflows.

From the Orchestrator view in the vSphere Web Client, you can perform the following tasks:

- Select a default Orchestrator server.
- Manage workflows. Managing workflows includes the following tasks:
  - Associating workflows with selected vSphere inventory objects such as virtual machines, ESXi hosts, clusters, resource pools, and folders.
  - Exporting and importing current associations of workflows with vSphere inventory objects for backup purposes or to import them in another vSphere Web Client instance.
  - Editing associations of workflows with vSphere inventory objects such as virtual machines, ESXi hosts, clusters, resource pools, folders, and so on.
  - Viewing information about workflow runs, as well as about workflows waiting for user interaction.
  - Running and scheduling workflows on vSphere objects.

To run workflows on selected vSphere inventory objects, you must select a default Orchestrator server. You should also associate the workflows of the default Orchestrator server with vSphere inventory objects that you want to manage.

Configure the Default vRealize Orchestrator

If you have configured more than one Orchestrator server to work with a vCenter Server instance that is connected with your vSphere Web Client, you must configure the default Orchestrator server to use with the vCenter Server instance.

You cannot run workflows on the objects in a vCenter Server instance if it is not added as a vCenter Server host to the Orchestrator server.

Prerequisites

Log in as a member of the Administrators group to be able to configure the default Orchestrator server.

Procedure

1 Log in to the vSphere Web Client.

2 In the object navigator, click **vRealize Orchestrator**.

3 In the **Manage** tab, click the **Servers** subtab.

   A table appears that lists the available vCenter Server instances. Each row of the table contains a vCenter Server and the Orchestrator server that manages it.

4 Right-click a row of the table with the available vCenter Server instances and select **Edit configuration**.

5 In the Edit vRealize Orchestrator connections dialog box, select the default Orchestrator server to manage your vCenter Server instance.

   - Select the **Fixed IP/host name** check box and type the IP address of the Orchestrator server.
   - Select the **Registered as VC extension** check box and from the drop-down menu, select the URL address of the Orchestrator server.

6 Click **OK**.

You successfully configured a default vRealize Orchestrator server in the vSphere Web Client.

Managing Associations of Workflows with vSphere Inventory Objects

If you want to see more workflows displayed in the pop-up menu when you right-click a vSphere inventory object, and run these workflows on more object types, you can associate workflows with the different vSphere object types.

You can add and edit associations, as well as export and import XML files containing the associations of workflows with vSphere objects.

Workflows associated with inventory object types are listed in the pop-up menu that appears when you right-click the inventory objects and in the **Actions** menu.

Only users from the Orchestrator Administrator group have the rights to manage the associations of workflows with vSphere inventory objects.

Associate Workflows with vSphere Inventory Object Types

You can associate workflows with a vSphere object type to run the workflows directly on the inventory objects of that type.

Workflows associated with inventory object types are listed in the pop-up menu that appears when you right-click an inventory object, and in the **Actions** menu.

Prerequisites

- Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.
- Log in as a member of the Administrators group to be able to configure the default Orchestrator server.

Procedure

1. In the object navigator, click **vRealize Orchestrator**.
2. Click the **Manage** tab.
3. Click the **Context Actions** subtab.
4. Click the **Add** icon to add a new workflow.
5. Select the Orchestrator server from the vRO Servers tree, and navigate through the workflow library to find the workflow to add.
6. Click **Add**.

   The workflow appears in the list of selected workflows on the right.
7. (Optional) Enable multi-selection.

   Multi-selection allows you to select multiple vSphere objects of the same type when you run the workflow.
8. Under Available types, select the vSphere object types with which you want to associate the workflow.
9. Click **OK**.

Edit the Associations of Workflows with vSphere Objects

You can associate a workflow with different objects from the vSphere inventory and also edit the associations of workflows with the objects from the vSphere inventory.

Prerequisites

- Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.
- Log in as a member of the Administrators group to be able to configure the default Orchestrator server.

Procedure

1. In the object navigator, click **vRealize Orchestrator**.
2. Click the **Manage** tab.
3. Click the **Context Actions** subtab.
4. Right-click the workflow to edit and select **Edit**.
5. Change the association properties.
6. Click **OK**.

Export the Associations of Workflows with vSphere Objects

You can transfer the associations of workflows with objects in the vSphere inventory from one vSphere Web Client to another by using an XML file.

Prerequisites

- Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.
- Log in as a member of the Administrators group to be able to configure the default Orchestrator server.

Procedure

1. In the object navigator, click **vRealize Orchestrator**.
2. Click the **Manage** tab.
3. Click the **Context Actions** subtab.
4. Click the **Export** icon .
5. Select a location where you want to save the XML file, and click **Save**.

Import the Association of Workflows with vSphere Objects

You can import an XML file that contains the association of workflows with objects in the vSphere inventory.

Prerequisites

- Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.
- Log in as a member of the Administrators group to be able to configure the default Orchestrator server.

Procedure

1. In the object navigator, click **vRealize Orchestrator**.
2. Click the **Manage** tab.
3. Click the **Context Actions** subtab.
4. Click the **Import** icon .
5. Browse to select the XML file to import and click **Open**.

Orchestrator compares the two associated workflow sets and imports the missing workflow associations.

Managing Workflows

You can view different information about Orchestrator workflows, run and schedule workflows and manage them by using the vSphere Web Client.

You can perform some management tasks on the Orchestrator workflows from the vRealize Orchestrator view in the vSphere Web Client. You can also perform some of the tasks by right-clicking a vSphere inventory object and selecting **All vRealize Orchestrator plugin Actions**.

Workflow management tasks include:

- Running workflows on vSphere inventory objects, such as virtual machines, ESXi hosts, clusters, resource pools, and folders.
- Viewing information about workflow runs.
- Viewing information about workflows waiting for user interaction.
- Searching for a specific workflow from the list of available workflows.
- Scheduling workflows.

Run Workflows on vSphere Inventory Objects

You can automate management tasks in vSphere by running Orchestrator workflows directly on objects from the vSphere inventory.

Prerequisites

- Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.
- Verify that you have workflows associated with the vSphere inventory objects. See "Associate Workflows with vSphere Inventory Object Types," on page 149.

Procedure

1. Click **vCenter**.
2. Under Inventory Lists, click an inventory category.
3. Right-click the object that you want to run the workflow on, and navigate to **All vRealize Orchestrator plugin Actions**.

   All available workflows that you can run on the selected inventory object are listed.
4. Click the workflow that you want to run.
5. Provide the required workflow parameters.
6. (Optional) Schedule the workflow to run at a specified time.
   a. In the **Task name** text box, type the name of the scheduled task.
   b. (Optional) In the **Description** text box, type a description of the scheduled task.
   c. Schedule the date and time of the workflow run.
   d. Specify the recurrence options.
7. Click **Finish**.

View Information About Workflow Runs

You can view information about the workflow runs for each connected Orchestrator server. The available information includes the workflow name, start and end date, state of the workflow, and user who started the workflow.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Click **vRO Servers**.

   A list of the available vRealize Orchestrator servers appears.

3 Click a vRealize Orchestrator server, and click the **Monitor** tab.

   The list of workflow runs appears.

What to do next

You can review the list of workflow runs, cancel a running workflow, or respond to a workflow that requires interaction.

View Information About the Runs of a Specific Workflow

You can view information about the runs of a single workflow such as start and end date, state of the workflow, and user who has started the workflow.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Under Inventory Lists, click **Workflows**.

   A list of the available workflows appears.

3 Click the name of a workflow, and click the **Monitor** tab.

   A list of workflow runs appears.

What to do next

You can review the list of workflow runs, cancel a running workflow, or respond to a workflow that requires interaction.

View Workflows that Are Waiting for User Interaction

You can view the workflows that are waiting for a user interaction.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Under Inventory lists, click **Waiting for interaction**.

A list of workflows that are waiting for a user interaction appears.

What to do next

You can provide values for the required parameters of workflows that are waiting for a user interaction.

Searching for Workflows

You can browse for workflows in the inventory of the Orchestrator server or filter the available workflows by a search keyword to find a particular workflow.

Browse the Inventory of the Orchestrator Server

You can view the available workflows in the inventory of each connected Orchestrator server. You can search for a particular type of workflow by browsing the workflow categories.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Click **vRO Servers**.

   A list of the available vRealize Orchestrator servers appears.

3 Double-click a vRealize Orchestrator server.

4 Click **Categories**.

5 Double-click **Library**.

> **NOTE** **Library** is the default main workflow category. An Orchestrator server can have additional custom workflow categories.

6 Click **Categories**.

A list of available workflow categories appears.

7 Double-click a workflow category to browse the available workflows and its subcategories.

Find a Workflow

If you have a large number of workflows, you can filter them by a search keyword to find a specific workflow.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Click **Workflows**.

3 In the **Filter** text box, type a search term or the name of the workflow that you are searching for.

A list displays the workflows that contain the search term in the workflow name or description.

Scheduling Workflows

You can create tasks to schedule workflows, edit scheduled tasks, suspend scheduled tasks, and resume suspended scheduled tasks.

Schedule a Workflow

You can schedule a workflow to run at a specified time. You can also set the recurrence for a scheduled workflow.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Under Inventory Lists click **Workflows**.

3 Right-click the workflow that you want to schedule and select **Schedule a workflow**.

4 Provide the required workflow parameters.

5 Click **Start/Schedule**.

6 In the **Task name** text box, type the name of the scheduled task.

7 (Optional) In the **Description** text box, type a description of the scheduled task.

8 Schedule the date and time of the workflow run.

9 Specify the recurrence options.

10 Click **Finish**.

Edit the Schedule of a Workflow

You can modify the schedule of a workflow and set it to run at an earlier or later time.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Click **Scheduled workflows**.

   A list of the scheduled workflows appears.

3 Right-click the workflow whose schedule you want to edit and select **Edit**.

4 In the **Task name** text box, type the new name of the scheduled task.

5 (Optional) In the **Description** text box, type a description of the scheduled task.

6 Edit the scheduled date and time of the workflow run.

7 Specify the recurrence options.

8 Click **Finish**.

Run a Scheduled Workflow

You can manually run a scheduled workflow before it runs automatically.

When you run a workflow manually, the schedule is not affected. After the manual run, the workflow runs again at the scheduled time.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Click **Scheduled workflows**.

   A list of the scheduled workflows appears.

3 Click **Scheduled workflows**.

4 Right-click the workflow that you want to run and select **Run now**.

What to do next

You can view information about the workflow run in the Recent Tasks pane or in the Orchestrator server menu. See "View Information About Workflow Runs," on page 153.

Suspend a Scheduled Task

You can suspend a scheduled workflow run. You can also resume suspended scheduled tasks.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Click **Scheduled workflows**.

   A list of the scheduled workflows appears.

3 Right-click a workflow and select **Suspend**.

   The workflow schedule is suspended.

The state of the scheduled task changes to Suspended.

Resume a Suspended Scheduled Task

You can resume a scheduled task that has been suspended.

Prerequisites

Verify that you have configured at least one Orchestrator server to work with the same Single Sign-On instance to which both the vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

Procedure

1 In the object navigator, click **vRealize Orchestrator**.

2 Click **Scheduled workflows**.

   A list of the scheduled workflows appears.

3 Right-click a workflow and select **Resume**.

   The workflow schedule is resumed from suspension.

The state of the scheduled task changes to Pending.

Workflows for Managing Inventory Objects

The default workflows for managing vSphere inventory objects are the workflows included in the vCenter Server 5.5 plug-in workflow library. The vCenter Server 5.5 plug-in workflow library contains workflows that you can use to run automated processes related to the vCenter Server and host management.

To access workflows in the vSphere Web Client, make sure that you configure at least one running Orchestrator server to work with the same Single Sign-On instance to which both vCenter Server and vSphere Web Client are pointing. You must also ensure that Orchestrator is registered as a vCenter Server extension. You register Orchestrator as a vCenter Server extension when you specify a user (by providing the user name and password), who has the privileges to manage vCenter Server extensions. For more information, see *Installing and Configuring VMware vRealize Orchestrator*.

The common workflow to access the available workflows is the following:

1. Configure the Orchestrator server with the same Single Sign-On insance to which both vCenter Server and vSphere Web Client point.
2. Ensure that Orchestrator is registered as a vCenter Server extension.
3. In the vSphere Web Client, configure the default Orchestrator server to use.

   For instructions about configuring the default Orchestrator server, see "Configure the Default vRealize Orchestrator," on page 149.
4. (Optional) To see more workflows when you right-click an object from your vSphere inventory, you can associate workflows with different object types.

   For instructions, see "Associate Workflows with vSphere Inventory Object Types," on page 149.
5. Right-click a vSphere inventory object, such as a virtual machine, host, cluster, folder, datastore, resource pool, and so on, and select **All vRealize Orchestrator plugin Actions**.

NOTE Only a predefined set of vCenter Server workflows are available by default in the pop-up menu. You can associate additional workflows with each vSphere object. See "Associate Workflows with vSphere Inventory Object Types," on page 149.

Cluster and Compute Resource Workflows

With cluster and compute resource workflows, you can create, rename or delete a cluster, and enable or disable high availability on a cluster.

Add DRS virtual machine group to cluster	Adds a DRS virtual machine group to a cluster.
Add virtual machines to DRS group	Adds a virtual machine list to an existing DRS virtual machine group.
Create cluster	Creates a new cluster in a host folder.
Delete cluster	Deletes a cluster.
Disable DRS on cluster	Disables DRS on a cluster.
Disable HA on cluster	Disables high availability on a cluster.
Disable vCloud Distributed Storage on cluster	Disables vCloud Distributed Storage on a cluster.

Enable DRS on cluster	Enables DRS on a cluster.
Enable HA on cluster	Enables high availability on a cluster.
Enable vCloud Distributed Storage on cluster	Enables vCloud Distributed Storage on a cluster.
Remove virtual machine DRS group from cluster	Removes a DRS virtual machine group from a cluster.
Remove virtual machines from DRS group	Removes virtual machines from a cluster DRS group.
Rename cluster	Renames a cluster.

Guest Operation Files Workflows

With guest operation files workflows, you can manage files in a guest operating system.

Check for directory in guest	Verifies that a directory exists in a guest virtual machine.
Check for file in guest	Verifies that a file exists in a guest virtual machine.
Copy file from guest to Orchestrator	Copies a specified file from a guest file system to an Orchestrator server.
Copy file from Orchestrator to guest	Copies a specified file from an Orchestrator server to a guest file system.
Create directory in guest	Creates a directory in a guest virtual machine.
Create temporary directory in guest	Creates a temporary directory in a guest virtual machine.
Create temporary file in guest	Creates a temporary file in a guest virtual machine.
Delete directory in guest	Deletes a directory from a guest virtual machine.
Delete file in guest	Deletes a file from a guest virtual machine.
List path in guest	Shows a path in a guest virtual machine.
Move directory in guest	Moves a directory in a guest virtual machine.
Move file in guest	Moves a file in a guest virtual machine.

Guest Operation Processes Workflows

With guest operation processes workflows, you can get information and control the running processes in a guest operating system.

Get environment variables from guest	Returns a list with environmental variables from a guest. An interactive session returns the variables of the user who is currently logged in.
Get processes from guest	Returns a list with the processes running in the guest operating system and the recently completed processes started by the API.

Run program in guest	Starts a program in a guest operating system.
Kill process in guest	Treminates a process in a guest operating system.

Custom Attributes Workflows

With custom attributes workflows, you can add custom attributes to virtual machines or get a custom attribute for a virtual machine.

Add custom attribute to a virtual machine	Adds a custom attribute to a virtual machine.
Add custom attribute to multiple virtual machines	Adds a custom attribute to a selection of virtual machines.
Get custom attribute	Gets a custom attribute for a virtual machine in vCenter Server.

Data Center Workflows

With data center workflows, you can create, delete, reload, rename, or rescan a data center.

Create datacenter	Creates a new data center in a data center folder.
Delete datacenter	Deletes a data center.
Reload datacenter	Forces vCenter Server to reload data from a data center.
Rename datacenter	Renames a data center and waits for the task to complete.
Rescan datacenter HBAs	Scans the hosts in a data center and initiates a rescan on the host bus adapters to discover new storage.

Datastore and Files Workflows

With datastore and files workflows, you can delete a list of files, find unused files in a datastore, and so on.

Delete all files	Deletes a list of files.
Delete all unused datastore files	Searches all datastores in the vCenter Server environment and deletes all unused files.
Export unused datastore files	Searches all datastores and creates an XML descriptor file that lists all unused files.
Find unused files in datastores	Searches the vCenter Server environment for all unused disks (`*.vmdk`), virtual machines (`*.vmx`), and template (`*.vmtx`) files that are not associated with any vCenter Server instances registered with Orchestrator.
Get all configuration, template, and disk files from virtual machines	Creates a list of all virtual machine descriptor files and a list of all virtual machine disk files, for all datastores.
Log all datastore files	Creates a log for every virtual machine configuration file and every virtual machine file found in all datastores.

Log unused datastore files	Searches the vCenter Server environment for unused files that are registered on virtual machines and exports a log of the files in a text file.
Upload file to datastore	Uploads a file to an existing folder on a specific datastore. The uploaded file will overwrite any existing file with the same name in the same destination folder.

Data Center Folder Management Workflows

With data center folder management workflows, you can create, delete, or rename a data center folder.

Create datacenter folder	Creates a data center folder.
Delete datacenter folder	Deletes a data center folder and waits for the task to complete.
Rename datacenter folder	Renames a data center folder and waits for the task to complete.

Host Folder Management Workflows

With host folder management workflows, you can create, delete, or rename a host folder.

Create host folder	Creates a host folder.
Delete host folder	Deletes a host folder and waits for the task to complete.
Rename host folder	Renames a host folder and waits for the task to complete.

Virtual Machine Folder Management Workflows

With virtual machine folder management workflows, you can create, delete, or rename a virtual machine folder.

Create virtual machine folder	Creates a virtual machine folder.
Delete virtual machine folder	Deletes a virtual machine folder and waits for the task to complete.
Rename virtual machine folder	Renames a virtual machine folder and waits for the task to complete.

Basic Host Management Workflows

With basic host management workflows, you can put a host into maintenance mode, make a host exit maintenance mode, move a host to a folder or a cluster, and reload data from a host.

Enter maintenance mode	Puts the host into maintenance mode. You can cancel the task.
Exit maintenance mode	Exits maintenance mode. You can cancel the task.
Move host to cluster	Moves an existing host into a cluster. The host must be part of the same data center, and if the host is part of a cluster, the host must be in maintenance mode.

Move host to folder	Moves a host into a folder as a standalone host. The host must be part of a ClusterComputeResource in the same data center and the host must be in maintenance mode.
Reload host	Forces vCenter Server to reload data from a host.

Host Power Management Workflows

With host power management workflows you can reboot or shut down a host.

Reboot host	Reboots a host. If the Orchestrator client is connected directly to the host, it does not receive an indication of success in the returned task, but rather loses the connection to the host if the operation succeeds.
Shut down host	Shuts down a host. If the Orchestrator client is connected directly to the host, it does not receive an indication of success in the returned task, but rather loses the connection to the host if the operation succeeds.

Host Registration Management Workflows

With host registration management workflows, you can add a host to a cluster, disconnect or reconnect a host from a cluster, and so on.

Add host to cluster	Adds a host to the cluster. This workflow fails if it cannot authenticate the SSL certificate of the host.
Add standalone host	Registers a host as a standalone host.
Disconnect host	Disconnects a host from vCenter Server.
Reconnect host	Reconnects a disconnected host by providing only the host information.
Reconnect host with all information	Reconnects a disconnected host by providing all information about the host.
Remove host	Removes a host and unregisters it from vCenter Server. If the host is part of a cluster, you must put it in maintenance mode before attempting to remove it.

Networking Workflows

With networking workflows you can add a port group to distributed virtual switch, create a distributed virtual switch with a port group, and so on.

Add port group to distributed virtual switch	Adds a new distributed virtual port group to a specified distributed virtual switch.
Attach host system to distributed virtual switch	Adds a host to a distributed virtual switch.
Create distributed virtual switch with port group	Creates a new distributed virtual switch with a distributed virtual port group.

Distributed Virtual Port Group Workflows

With distributed virtual port group workflows you can update or delete a port group, and reconfigure the port group.

Connect virtual machine NIC number to distributed virtual port group	Reconfigures the network connection of the specified virtual machine NIC number to connect to the specified distributed virtual port group. If no NIC number is specified, the number zero is used.
Delete distributed virtual port group	Deletes a specified distributed virtual port group.
Set teaming options	Provides an interface to manage the teaming options for a distributed virtual port group.
Update distributed virtual port group	Updates the configuration of a specified distributed virtual port group.

Distributed Virtual Switch Workflows

With distributed virtual switch workflows, you can create, update or delete a distributed virtual switch, and create, delete, or update a private VLAN.

Create distributed virtual switch	Creates a distributed virtual switch in the specified network folder with a name and uplink port names that you specify. You must specify at least one uplink port name.
Create private VLAN	Creates a VLAN on the specified distributed virtual switch.
Delete distributed virtual switch	Deletes a distributed virtual switch and all associated elements.
Delete private VLAN	Deletes a VLAN from a specified distributed virtual switch. If a secondary VLAN exists, you should first delete the secondary VLAN.
Update distributed virtual switch	Updates the properties of a distributed virtual switch.
Update private VLAN	Updates a VLAN on the specified distributed virtual switch.

Standard Virtual Switch Workflows

With standard virtual switch workflows you can create, update, or delete a standard virtual switch, and create, delete, or update port groups in standard virtual switches.

Add port group in standard virtual switch	Adds a port group in a standard virtual switch.
Create standard virtual switch	Creates a standard virtual switch.
Delete port group from standard virtual switch	Deletes a port group from a standard virtual switch.
Delete standard virtual switch	Deletes a standard virtual switch from a host's network configuration.

Retrieve all standard virtual switches	Retrieves all standard virtual switches from a host.
Update port group in standard virtual switch	Updates the properties of a port group in a standard virtual switch.
Update standard virtual switch	Updates the properties of a standard virtual switch.
Update VNIC for port group in standard virtual switch	Updates a VNIC associated with a port group in a standard virtual switch.

Resource Pool Workflows

With resource pool workflows you can create, rename, reconfigure or delete a resource pool, and get resource pool information.

Create resource pool	Creates a resource pool with the default CPU and memory allocation values. To create a resource pool in a cluster, the cluster must have VMware DRS enabled.
Create resource pool with specified values	Creates a resource pool with CPU and memory allocation values that you specify. To create a resource pool in a cluster, the cluster must have VMware DRS enabled.
Delete resource pool	Deletes a resource pool and waits for the task to complete.
Get resource pool information	Returns CPU and memory information about a given resource pool.
Reconfigure resource pool	Reconfigures CPU and memory allocation configuration for a given resource pool.
Rename resource pool	Renames a resource pool and waits for the task to complete.

Storage Workflows

With storage workflows you can perform storage-related operations.

Add datastore on iSCSI/FC/local SCSI	Creates a datastore on a Fibre Channel, iSCSI or local SCSI disk. Only disks that are not currently in use by an existing VMFS are applicable to new datastore creation. The new datastore allocates the maximum available space of the specified disk.
Add datastore on NFS	Adds a datastore on an NFS server.
Add iSCSI target	Adds iSCSI targets to a vCenter Server host. The targets can be of the type `Send` or `Static`.
Create VMFS for all available disks	Creates a VMFS volume for all available disks of a specified host.
Delete datastore	Deletes datastores from a vCenter Server host.
Delete iSCSI target	Deletes already configured iSCSI targets. The targets can be of type `Send` or `Static`.
Disable iSCSI adapter	Disables the software iSCSI adapter of a specified host.

Display all datastores and disks	Displays the existing datastores and available disks on a specified host.
Enable iSCSI adapter	Enables an iSCSI adapter.
List all storage adapters	Lists all storage adapters of a specified host.

Storage DRS Workflows

With storage DRS workflows you perform storage-related operations, such as creating and configuring a datastore cluster, removing a datastore from cluster, adding storage to a cluster, and so on.

Add datastore to cluster	Adds datastores to a datastore cluster. Datastores must be able to connect to all hosts to be included in the datastore cluster. Datastores must have the same connection type to reside within a datastore cluster.
Change Storage DRS per virtual machine configuration	Sets Storage DRS settings for each virtual machine.
Configure datastore cluster	Configures datastore cluster setting values for automation and runtime rules.
Create simple datastore cluster	Creates a simple datastore cluster with default configuration. The new datastore cluster contains no datastores.
Create Storage DRS scheduled task	Creates a scheduled task for reconfiguring a datastore cluster. Only automation and runtime rules can be set.
Create virtual machine anti-affinity rule	Creates an anti-affinity rule to indicate that all virtual disks of certain virtual machines must be kept on different datastores.
Create VMDK anti-affinity rule	Creates a VMDK anti-affinity rule for a virtual machine that indicates which of its virtual disks must be kept on different datastores. The rule applies to the virtual disks of the selected virtual machine.
Remove datastore cluster	Removes a datastore cluster. Removing a datastore cluster also removes all of the settings and the alarms for the cluster from the vCenter Server system.
Remove datastore from cluster	Removes a datastore from a datastore cluster and puts the datastore in a datastore folder.
Remove Storage DRS scheduled task	Removes a scheduled Storage DRS task.
Remove virtual machine anti-affinity rule	Removes a virtual machine anti-affinity rule for a given datastore cluster.
Remove VMDK anti-affinity rule	Removes a VMDK anti-affinity rule for a given datastore cluster.

Basic Virtual Machine Management Workflows

With basic virtual machine management workflows you can perform basic operations on virtual machines, for example, create, rename or delete a virtual machine, upgrade virtual hardware, and so on.

Create custom virtual machine	Creates a virtual machine with the specified configuration options and additional devices.
Create simple dvPortGroup virtual machine	Creates a simple virtual machine. The network used is a Distributed Virtual Port Group.
Create simple virtual machine	Creates a virtual machine with the most common devices and configuration options.
Delete virtual machine	Removes a virtual machine from the inventory and datastore.
Get virtual machines by name	Returns a list of virtual machines from all registered vCenter Server instances that match the provided expression.
Mark as template	Converts an existing virtual machine to a template, not allowing it to start. You can use templates to create virtual machines.
Mark as virtual machine	Converts an existing template to a virtual machine, allowing it to start.
Move virtual machine to folder	Moves a virtual machine to a specified virtual machine folder.
Move virtual machine to resource pool	Moves a virtual machine to a resource pool. If the target resource pool is not in the same cluster, you must use the migrate or relocate workflows.
Move virtual machines to folder	Moves several virtual machines to a specified virtual machine folder.
Move virtual machines to resource pool	Moves several virtual machines to a resource pool.
Register virtual machine	Registers a virtual machine. The virtual machine files must be placed in an existing datastore and must not be already registered.
Reload virtual machine	Forces vCenter Server to reload a virtual machine.
Rename virtual machine	Renames an existing virtual machine on the vCenter Server system or host and not on the datastore.
Set virtual machine performance	Changes performance settings such as shares, minimum and maximum values, shaping for network, and disk access of a virtual machine.
Unregister virtual machine	Removes an existing virtual machine from the inventory.
Upgrade virtual machine hardware (force if required)	Upgrades the virtual machine hardware to the latest revision that the host supports. This workflow forces the upgrade to continue, even if VMware Tools is out of date. If the VMware Tools is out of date, forcing the upgrade to continue reverts the guest network settings to the default settings. To avoid this situation, upgrade VMware Tools before running the workflow.

Upgrade virtual machine	Upgrades the virtual hardware to the latest revision that the host supports. An input parameter allows a forced upgrade even if VMware Tools is out of date.
Wait for task and answer virtual machine question	Waits for a vCenter Server task to complete or for the virtual machine to ask a question. If the virtual machine requires an answer, accepts user input and answers the question.

Clone Workflows

With clone workflows you can clone virtual machines with or without customizing the virtual machine properties.

Clone virtual machine from properties	Clones virtual machines by using properties as input parameters.
Clone virtual machine, no customization	Clones a virtual machine without changing anything except the virtual machine UUID.
Customize virtual machine from properties	Customizes a virtual machine by using properties as input parameters.

Linked Clone Workflows

With linked clone workflows, you can perform linked clone operations such as restoring a virtual machine from a linked clone, creating a linked clone, and so on.

Restore virtual machine from linked clone	Removes a virtual machine from a linked clone setup.
Set up virtual machine for linked clone	Prepares a virtual machine to be link cloned.
Create a linked clone of a Linux machine with multiple NICs	Creates a linked clone of a Linux virtual machine, performs the guest operating system customization, and configures up to four virtual network cards.
Create a linked clone of a Linux machine with a single NIC	Creates a linked clone of a Linux virtual machine, performs the guest operating system customization, and configures one virtual network card.
Create a linked clone of a Windows machine with multiple NICs and credential	Creates a linked clone of a Windows virtual machine and performs the guest operating system customization. Configures up to four virtual network cards and a local administrator user account.
Create a linked clone of a Windows machine with a single NIC and credential	Creates a linked clone of a Windows virtual machine and performs the guest operating system customization. Configures one virtual network card and a local administrator user account.
Create a linked clone with no customization	Creates the specified number of linked clones of a virtual machine.

Linux Customization Clone Workflows

With Linux customization workflows you can clone a Linux virtual machine and customize the guest operating system.

Clone a Linux machine with multiple NICs	Clones a Linux virtual machine, performs the guest operating system customization, and configures up to four virtual network cards.
Clone a Linux machine with a single NIC	Clones a Linux virtual machine, performs the guest operating system customization, and configures one virtual network card.

Tools Clone Workflows

With tools clone workflows you can obtain customization information about the operating system of the virtual machine, information needed to update a virtual device, and so on.

Get a virtual Ethernet card to change the network	Returns a new ethernet card to update a virtual device. Contains only the device key of the given virtual device and the new network.
Get Linux customization	Returns the Linux customization preparation.
Get multiple virtual Ethernet card device changes	Returns an array of VirtualDeviceConfigSpec objects for add and remove operations on VirtualEthernetCard objects.
Get NIC setting map	Returns the setting map for a virtual network card by using VimAdapterMapping.
Get Windows customization for Sysprep with credentials	Returns customization information about the Microsoft Sysprep process, with credentials. Workflows for cloning Windows virtual machines use this workflow.
Get Windows customization for Sysprep with Unattended.txt	Returns customization information about the Microsoft Sysprep process by using an Unattended.txt file. Workflows for cloning Windows virtual machines use this workflow.
Get Windows customization for Sysprep	Returns customization information about the Microsoft Sysprep process. Workflows for cloning Windows virtual machines use this workflow.

Windows Customization Clone Workflows

With Windows customization clone workflows you can clone Windows virtual machines and customize the guest operating system.

Customize a Windows machine with single NIC and credential	Performs guest operating system customization, configures one virtual network card and a local administrator user account on a Windows virtual machine.
Clone a thin provisioned Windows machine with single NIC and credential	Clones a Windows virtual machine performing the guest operating system customization. Specifies virtual disk thin provisioning policy and configures one virtual network card and a local administrator user account. Sysprep tools must be available on the vCenter Server system.

Clone a Windows machine Sysprep with single NIC and credential	Clones a Windows virtual machine performing the guest operating system customization. Configures one virtual network card and a local administrator user account. Sysprep tools must be available on vCenter Server.
Clone a Windows machine with multiple NICs and credential	Clones a Windows virtual machine performing the guest operating system customization. Configures the local administrator user account and up to four virtual network cards. Sysprep tools must be available on the vCenter Server system.
Clone a Windows machine with single NIC	Clones a Windows virtual machine performing the guest operating system customization and configures one virtual network card. Sysprep tools must be available on the vCenter Server system.
Clone a Windows machine with single NIC and credential	Clones a Windows virtual machine performing the guest operating system customization. Configures one virtual network card and a local administrator user account. Sysprep tools must be available on the vCenter Server system.

Device Management Workflows

With device management workflows you can manage the devices that are connected to a virtual machine or to a host datastore.

Add CD-ROM	Adds a virtual CD-ROM to a virtual machine. If the virtual machine has no IDE controller, the workflow creates one.
Add disk	Adds a virtual disk to a virtual machine.
Change RAM	Changes the amount of RAM of a virtual machine.
Convert disks to thin provisioning	Converts thick-provisioned disks of virtual machines to thin-provisioned disks.
Convert independent disks	Converts all independent virtual machine disks to normal disks by removing the independent flag from the disks.
Disconnect all detachable devices from a running virtual machine	Disconnects floppy disks, CD-ROM drives, parallel ports, and serial ports from a running virtual machine.
Mount CD-ROM	Mounts the CD-ROM of a virtual machine. If the virtual machine has no IDE controller and/or CD-ROM drive, the workflow creates them.
Mount floppy disk drive	Mounts a floppy disk drive FLP file from the ESX datastore.

Move and Migrate Workflows

With move and migrate workflows, you can migrate virtual machines.

Mass migrate virtual machines with storage vMotion	Uses Storage vMotion to migrate a single virtual machine, a selection of virtual machines, or all available virtual machines.
Mass migrate virtual machines with vMotion	Uses vMotion, Storage vMotion, or both vMotion and Storage vMotion to migrate a single virtual machine, a selection of virtual machines, or all available virtual machines.

Migrate virtual machine with vMotion	Migrates a virtual machine from one host to another by using the `MigrateVM_Task` operation from the vSphere API.
Move virtual machine to another vCenter Server system	Moves a list of virtual machines to another vCenter Server system.
Quick migrate multiple virtual machines	Suspends the virtual machines if they are powered on and migrates them to another host using the same storage.
Quick migrate virtual machine	Suspends the virtual machine if it is powered on and migrates it to another host using the same storage.
Relocate virtual machine disks	Relocates virtual machine disks to another host or datastore while the virtual machine is powered off by using the `RelocateVM_Task` operation from the vSphere API.

Other Workflows

With other workflows, you can enable and disable Fault Tolerance (FT), extract virtual machine information, and find orphaned virtual machines.

Disable FT	Disables Fault Tolerance for a specified virtual machine.
Enable FT	Enables Fault Tolerance for a specified virtual machine.
Extract virtual machine information	Returns the virtual machine folder, host system, resource pool, compute resource, datastore, hard drive sizes, CPU and memory, network, and IP address for a given virtual machine. Might require VMware Tools.
Find orphaned virtual machines	Lists all virtual machines in an orphaned state in the Orchestrator inventory. Lists the VMDK and VMTX files for all datastores in the Orchestrator inventory that have no association with any virtual machines in the Orchestrator inventory. Sends the lists by email (optional).
Get Virtual Machine by Name and BIOS UUID	Searches virtual machines by name and then filters the result with particular universally unique identifier (UUID) in order to identify a unique virtual machine. **NOTE** This workflow is needed when DynamicOps calls vRealize Orchestrator workflows having input parameters of `VC:VirtualMachine` type in order to make the correspondence between a particular DynamicOps and vRealize Orchestrator virtual machine.

Get Virtual Machine by Name and UUID

Searches virtual machines by name and then filters the result with particular universally unique identifier (UUID) in order to identify a unique virtual machine.

NOTE This workflow is needed when DynamicOps calls vRealize Orchestrator workflows having input parameters of `VC:VirtualMachine` type in order to make the correspondence between a particular DynamicOps and vRealize Orchestrator virtual machine.

Get Virtual Machine UUID

Searches virtual machines by name and then filters the result with particular universally unique identifier (UUID) in order to identify a unique virtual machine.

NOTE This workflow is needed when DynamicOps calls vRealize Orchestrator workflows having input parameters of `VC:VirtualMachine` type in order to make the correspondence between a particular DynamicOps and vRealize Orchestrator virtual machine.

Power Management Workflows

With power management workflows, you can power on and off virtual machines, reboot the guest operating system of a virtual machine, suspend a virtual machine, and so on.

Power off virtual machine and wait

Powers off a virtual machine and waits for the process to complete.

Reboot guest OS

Reboots the virtual machine's guest operating system. Does not reset nonpersistent virtual machines. VMware Tools must be running.

Reset virtual machine and wait

Resets a virtual machine and waits for the process to complete.

Resume virtual machine and wait

Resumes a suspended virtual machine and waits for the process to complete.

Set guest OS to standby mode

Sets the guest operating system to standby mode. VMware Tools must be running.

Shut down and delete virtual machine

Shuts down a virtual machine and deletes it from the inventory and disk.

Shut down guest OS and wait

Shuts down a guest operating system and waits for the process to complete.

Start virtual machine and wait

Starts a virtual machine and waits for VMware Tools to start.

Suspend virtual machine and wait

Suspends a virtual machine and waits for the process to complete.

Snapshot Workflows

With snapshot workflows, you can perform snapshot-related operations.

Create a snapshot	Creates a snapshot.
Create snapshots of all virtual machines in a resource pool	Creates a snapshot of each virtual machine in a resource pool.
Remove all snapshots	Removes all existing snapshots without reverting to a previous snapshot.
Remove excess snapshots	Finds virtual machines with more than a given number of snapshots and optionally deletes the oldest snapshots. Sends the results by email.
Remove old snapshots	Gets all snapshots that are older than a given number of days and prompts the user to select which ones to delete.
Remove snapshots of a given size	Gets all snapshots that are larger than a given size and prompts the user to confirm deletion.
Revert to current snapshot	Reverts to the current snapshot.
Revert to snapshot and wait	Reverts to a specific snapshot. Does not delete the snapshot.

VMware Tools Workflows

With VMware Tools workflows, you can perform VMware Tools-related tasks on virtual machines.

Mount VMware tools installer	Mounts the VMware Tools installer on the virtual CD-ROM.
Set console screen resolution	Sets the console window's resolution. The virtual machine must be powered on.
Turn on time synchronization	Turns on time synchronization between the virtual machine and the ESX server in VMware Tools.
Unmount VMware tools installer	Unmounts the VMware Tools CD-ROM.
Upgrade VMware tools	Upgrades VMware Tools on a virtual machine.
Upgrade VMware tools at next reboot	Upgrades VMware Tools on a virtual machine without performing an automatic reboot.

About Headless Systems 14

ESXi supports the detection and configuration of headless systems.

A headless system is a system that can be operated without a monitor, keyboard or mouse. Network Appliance boxes do not have VGA, the primary interface is a single serial port. You can leverage your existing headless systems to use ESXi. You can add ESXi appliances to a datacenter where virtual machines are managed with vSphere Virtual Center. All existing ESXi features can be used with a headless system that is configured with either embedded flash or minimal local storage. ESXi allows for dynamic switching between different serial modes, which is useful for diagnosing and debugging problems. You can switch between modes to view or modify system parameters.

This chapter includes the following topics:

- "Detecting a Headless System," on page 173
- "About Serial Mode Dynamic Switching," on page 173

Detecting a Headless System

ESXi automatically detects headless systems.

ESXi automatically redirects the DCUI over a serial port connection to improve headless detection. When ESXi automatically detects a headless system, ESXi will setup the serial port as COM1, 115200 baud, and redirects the DCUI over this serial port. The specific settings of com port and baud rate are read from the SPCR (Serial Port Console Redirection) table, if it exists. This behavior can be disabled using new boot parameters if the default settings are not acceptable. You can set the **`headless`** flag in the ACPI FADT table to mark a system as headless.

About Serial Mode Dynamic Switching

ESXi supports dynamically switching between four different serial port modes.

ESXi supports serial mode dynamic switching in order to provide maximum platform flexibility, and to allow debugging and supportability in the field. ESXi examines the input characters for any serial port mode and switches the modes based on the input key sequence. DCUI, Shell, GDB and Logging modes are supported. If you have two serial ports, only one of the 4 modes is allowed on each port. This means both serial ports cannot be in the same mode. If you attempt to dynamically switch to a mode in use by the other serial port, the request is ignored. Dynamic switching eliminates the need to interrupt the boot process manually or to create a custom image in order to redirect to a serial port. It also addresses supportability issues regarding headless systems that only have one serial port, by making it possible to switch the serial port between different modes of operation.

ESXi Serial Port Modes

ESXi supports four serial port modes.

There are four serial port modes in ESXi:

Logging mode – Logging mode is the default mode in a debug build. Logging mode sends the vmkernel.log over the serial port.

GDB mode – Use GDB mode for dedicated debugging.

Shell mode – Shell mode is the shell port access, which is similar to SSH.

DCUI mode – DCUI mode is a Direct Console User Interface. This is the user interface that is displayed when you boot ESXi using a monitor.

Note Only COM1 and COM2 ports are supported. USB serial or PCI serial cards are not supported.

Dynamic Switching Keystrokes

ESXi includes a unique keystroke sequence that allows dynamic serial mode switching.

Dynamic Switching Keytrokes

Once the correct keystroke sequence is entered, the system switches the serial port to the desired mode.

Logging mode: `Ctrl+G, Ctrl+B, 1`

Shell mode: `Ctrl+G, Ctrl+B, 2`

DCUI mode: `Ctrl+G, Ctrl+B, 3`

GDB mode: `Ctrl+G, Ctrl+B, ?`

Note Once in GDB mode, you cannot switch modes again using a key sequence. You must use the CLI to switch modes.

Serial Port Dynamic Switching using the CLI

You can switch serial modes using the CLI.

Dynamic Switching using the CLI

Use esxcfg-advcfg to set the current mode to **none**. Then set the new desired mode using the CLI.

Logging mode: `esxcfg-advcfg -s com1 /Misc/LogPort`

Shell mode: `esxcfg-advcfg -s com1 /Misc/ShellPort`

DCUI mode: `esxcfg-advcfg -s com1 /Misc/ConsolePort`

GDB mode: `esxcfg-advcfg -s com1 /Misc/GDBPort`

Example: Example

If the serial mode is set to logging mode, it would require 2 commands to switch it to DCUI mode.

```
§. > esxcfg-advcfg -s none /Misc/LogPort
§. > esxcfg-advcfg -s com1 /Misc/ConsolePort
```

Controlling the Serial DCUI

You can use alternate keystrokes to control the DCUI over a serial port. This is useful when F2 or other function keys cannot be used.

Controlling the Serial DCUI

Alternate keystroke mappings for DCUI mode:

- Esc + 1 -> F1
- Esc + 2 -> F2
- Esc + 3 -> F3
- Esc + 4 -> F4
- Esc + 5 -> F5
- Esc + 6 -> F6
- Esc + 7 -> F7
- Esc + 8 -> F8
- Esc + 9 -> F9
- Esc + 0 -> F10
- Esc + ! -> F11
- Esc + @ -> F12

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