

# VMware vSphere Examples and Scenarios

ESXi 5.1  
vCenter Server 5.1  
vSphere 5.1

This document supports the version of each product listed and supports all subsequent versions until the document is replaced by a new edition. To check for more recent editions of this document, see <http://www.vmware.com/support/pubs>.

EN-000801-00

**vmware**<sup>®</sup>

You can find the most up-to-date technical documentation on the VMware Web site at:

<http://www.vmware.com/support/>

The VMware Web site also provides the latest product updates.

If you have comments about this documentation, submit your feedback to:

[docfeedback@vmware.com](mailto:docfeedback@vmware.com)

Copyright © 2011, 2012 VMware, Inc. All rights reserved. This product is protected by U.S. and international copyright and intellectual property laws. VMware products are covered by one or more patents listed at <http://www.vmware.com/go/patents>.

VMware is a registered trademark or trademark of VMware, Inc. in the United States and/or other jurisdictions. All other marks and names mentioned herein may be trademarks of their respective companies.

**VMware, Inc.**  
3401 Hillview Ave.  
Palo Alto, CA 94304  
[www.vmware.com](http://www.vmware.com)

# Contents

- 1 About vSphere Examples and Scenarios 5
- 2 Getting Started with ESXi 7
  - Network Environment 8
  - Install ESXi and Deploy Your First Virtual Machine 9
- 3 Getting Started with vCenter Server and the vSphere Web Client 15
  - vSphere and vCenter Server 16
  - Install vCenter Server by Using vCenter Simple Install 18
- 4 Configuring iSCSI Adapters for Hosts to Access vSphere Shared Storage 23
  - Configure Software iSCSI Adapters 24
- 5 Configuring Hosts to Use vMotion for Increased Service Availability 29
  - Configure Hosts for vMotion and Migrate Powered-On Virtual Machines 30
- 6 Setting an Alarm Action for Datastore Usage on a Disk 37
  - Configure and Act on a Triggered Datastore Usage Alarm 39
- 7 Creating a Role That Permits Completion of a Limited Task 43
  - Creating and Configuring a Role That Limits Users to Deploying Virtual Machines from Templates 44
- 8 Licensing vSphere 49
  - License ESXi Hosts and vCenter Server and View License Usage 50
- Index 55



# About vSphere Examples and Scenarios

---

# 1

The examples and scenarios in this publication identify tasks in vSphere and suggest ways to accomplish them.

For instance, for the first-time user who wants to evaluate vCenter Server, *vSphere Examples and Scenarios* contains [Chapter 2, “Getting Started with ESXi,”](#) on page 7 and [Chapter 3, “Getting Started with vCenter Server and the vSphere Web Client,”](#) on page 15. These sections guide the user through tasks that result in having a virtual machine on an ESXi host, both of which are managed with vCenter Server through the vSphere Web Client.

In a different scenario, someone who wants to see how vSphere can be configured to send email notifications when alarm thresholds are crossed can review [Chapter 6, “Setting an Alarm Action for Datastore Usage on a Disk,”](#) on page 37. Other scenarios deal with networking, virtual machine deployment, and so on.

Scenarios should be performed in the order that they appear in the book. For example, you must install ESXi before you continue to vCenter Server installation and configuration.

Flowcharts in the beginning of each scenario illustrate the sequence of steps you must perform in order to accomplish the scenario's objective. There are multiple approaches to accomplish a goal in vSphere, and the flowcharts might visually represent an alternative way to accomplish the same goal. Typically, you will follow the workflow represented by the steps in the vertical sequence.

Everyone's environment and policy set is different. VMware recommends that you first experiment with the procedures presented in *vSphere Examples and Scenarios* on test instances in your datacenter.

Each scenario assumes that you have completed the previous one and followed the steps to build an environment with specific configuration details.

This document is not for troubleshooting. For problems that you might be experiencing, see *vSphere Troubleshooting*.



## Getting Started with ESXi

---

Get started with ESXi quickly with information about installation and initial setup. The procedures show you how to install and set up a basic inventory for a single-host virtualization environment.

In this scenarios, you are a system administrator who will be installing VMware ESXi to deploy virtualization for the first time. Specifically, the scenario targets users who meet the following requirements:

- Have at least one physical server that meets ESXi requirements
- Do not yet have the ESXi software installed
- Do not yet have the vSphere Client or VMware vCenter Server installed

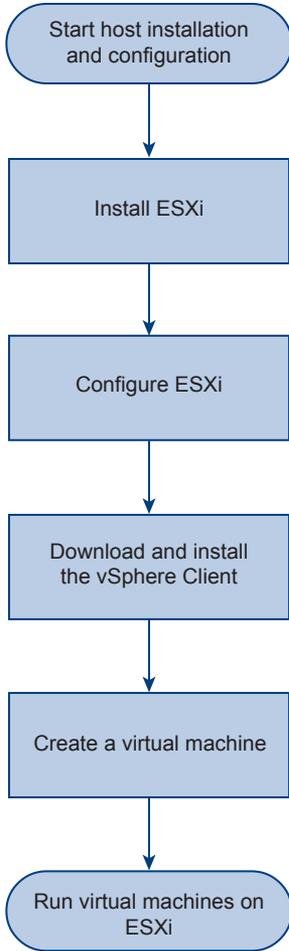
After your host is set up, you can install the vSphere Client, deploy virtual machines, and explore a multiple-host virtualization environment with vCenter Server.

To perform some of the scenarios in this publication, you must have two running ESXi hosts. The convention used in this book refers to those hosts as *ESXi-A* and *ESXi-B*. Their respective IP addresses are listed in “[Network Environment](#),” on page 8.

### Workflow for installing and managing a single ESXi host

You can deploy ESXi by using the interactive installer. After the installation and configuration of ESXi, download and install the vSphere Client to manage a single host without a vCenter Server instance.

**Figure 2-1.** Workflow for ESXi Installation



This chapter includes the following topics:

- [“Network Environment,”](#) on page 8
- [“Install ESXi and Deploy Your First Virtual Machine,”](#) on page 9

## Network Environment

Set up your network so that you ensure IPv4 traffic between vSphere components. You can use the network configuration information in this topic in later scenarios.

All scenarios take place in a 192.168.0.0/25 private network without a DHCP server present on the network. To ensure Internet connectivity, you must use a network address translator gateway or a proxy server. You must have a running Windows machine with access to the example network.

In a production environment, vSphere components can be deployed in a wide variety of IPv4 and IPv6 network configurations. The network details listed below represent only one example.

**Table 2-1.** Network adapters

Network adapter	IP address
ESXi-A	192.168.0.2
ESXi-B	192.168.0.4
vCenter Server virtual machine	192.168.0.10
iSCSI storage	192.168.0.100

**Table 2-1.** Network adapters (Continued)

Network adapter	IP address
vMotion adapter on host ESXi-A	192.168.0.111
vMotion adapter on host ESXi-A	192.168.0.112
Default gateway	192.168.0.1

**Table 2-2.** Network Details

Network Component	IP address
Network	192.168.0.0
Broadcast address	192.168.0.127
Mask	255.255.255.128
IP address range	192.168.0.1-192.168.0.126

## Install ESXi and Deploy Your First Virtual Machine

You can install ESXi interactively on the local hard disk of the host machine. Use the vSphere Client to manage hosts directly and deploy virtual machines without a vCenter Server instance.

ESXi is the virtualization layer of vSphere that runs on physical hardware and abstracts system resources into multiple virtual machines.

### Prerequisites

- Verify that your host machine hardware is supported. See the VMware Compatibility Guide at <http://www.vmware.com/resources/compatibility>.
- Back up or migrate important data on the host machine.
- Verify that your network environment meets the example requirements specified in “[Network Environment](#),” on page 8.
- Verify that you have ESXi 5.1 installation media.
- Verify that you have the installation media required to install a supported version of Windows.
- Verify that you have administrative access to a Windows machine that has access to the scenario network.
- Verify that you have connected a keyboard and monitor to the host to use the direct console, or that you can use a virtual direct console provided by a remote access card on the host machine.

### Procedure

- 1 [Install ESXi Interactively](#) on page 10  
You install the ESXi bare-metal hypervisor as the first step to creating a vSphere environment. In a typical interactive installation, you boot the ESXi installer and respond to the installer prompts to install ESXi to the local host disk.
- 2 [Configure the ESXi Host](#) on page 10  
You have installed ESXi on one of your machines, designated *ESXi-A*. After you finish the interactive installation of ESXi, use the direct console to configure your host. Assign the host a specific IP address and review the configuration options that the direct console provides.
- 3 [Install the vSphere Client](#) on page 11  
You have installed and configured ESXi. To deploy virtual machines and perform administrative tasks, you must install the vSphere Client and use it to manage the host. You can download the vSphere Client installer binary from your host.

- 4 [Log in to Your ESXi Host and Deploy a Virtual Machine](#) on page 12

You have installed and configured ESXi. You can deploy the first virtual machine on your ESXi host by using the vSphere Client.

## Install ESXi Interactively

You install the ESXi bare-metal hypervisor as the first step to creating a vSphere environment. In a typical interactive installation, you boot the ESXi installer and respond to the installer prompts to install ESXi to the local host disk.

Interactive installation is the preferred way to install ESXi in small environments. Interactive installation does not require the use of scripts or an existing VMware Auto Deploy infrastructure. If you have not installed ESXi on the target disk, all data located on the drive is overwritten, including hardware vendor partitions, operating system partitions, and associated data.

### Procedure

- 1 Load the ESXi installer media in a physical or virtual drive on your host machine and restart the host machine.
- 2 Set the BIOS to boot from the CD-ROM device.  
See your hardware vendor documentation for information about changing boot order.
- 3 Select the ESXi 5.1 installer in the boot menu and press Enter.
- 4 To accept the EULA, press F11.
- 5 Select the drive on which to install ESXi and press Enter.

If you are installing ESXi on a disk that contains a previous installation of ESXi or ESX, or a VMFS datastore, the installer provides you with options for upgrading.

- 6 To select the default keyboard layout for the host, press Enter.
- 7 To set the host password, type `my_esx_password` and retype the password to confirm it.
- 8 To begin installation, press F11.
- 9 After the installation finishes, remove the installation media and press Enter to restart the host.
- 10 (Optional) Repeat steps [Step 1-Step 9](#) to install ESXi on another machine.

Two ESXi hosts are required for some of the scenarios in this publication.

You have successfully installed ESXi in evaluation mode. You can use all ESXi features for 60 days. You can later use the vSphere Web Client or the vSphere Client to enter a valid license key. In the absence of a DHCP server, the host has been assigned an IP address in the address block 169.254.0.0/16.

### What to do next

Log in to the ESXi direct console and configure the host.

## Configure the ESXi Host

You have installed ESXi on one of your machines, designated *ESXi-A*. After you finish the interactive installation of ESXi, use the direct console to configure your host. Assign the host a specific IP address and review the configuration options that the direct console provides.

As part of the Getting Started with ESXi scenario, you must configure your host with a specific IP address. The direct console lets you configure networking on individual hosts without using the vSphere Client.

After the host finishes the autoconfiguration phase, the direct console appears on the host monitor. Key operations available to you in the direct console include configuring hosts, setting up administrative access, and troubleshooting.

### Procedure

- 1 Start the direct console (DCUI) on the host *ESXi-A*.
- 2 Press F2 to access the configuration screen.
- 3 Type your administrative login credentials.
  - a In the **Login Name** text box, type **root**.
  - b In the **Password** text box, type **my\_esx\_password**.

You set the administrative password in “[Install ESXi Interactively](#),” on page 10.

- 4 Use the keyboard to select **Configure Management Network** and press Enter.
- 5 Select **IP Configuration** and press Enter.
- 6 Verify that **Set static IP address and network configuration** is selected, and type the network configuration details.

Option	Value
<b>IP Address</b>	192.168.0.2
<b>Subnet Mask</b>	255.255.255.128
<b>Default Gateway</b>	192.168.0.1

The network details are specific to the scenario. In a production environment, the IP configuration depends on your network settings.

- 7 Press Enter to accept the IP configuration changes.
 

The management network restarts.
- 8 (Optional) Repeat the steps for the host *ESXi-B* and assign to the host the IP address 192.168.0.4.

You configured a new IP address for your host.

### What to do next

Download and install the vSphere Client to manage your ESXi host and deploy virtual machines.

## Install the vSphere Client

You have installed and configured ESXi. To deploy virtual machines and perform administrative tasks, you must install the vSphere Client and use it to manage the host. You can download the vSphere Client installer binary from your host.

Use the standalone vSphere Client application to manage your host directly before you move on to more complex environments. You can use vCenter Server and the browser-based vSphere Web Client to manage multihost environments.

### Procedure

- 1 Log in to a Windows system that can access the host network.
- 2 Open a Web browser window and type the IP address of your host.

Type **https://192.168.0.2**.

You set the IP address of the host during host configuration.

- 3 Click **Download vSphere Client** and save the installer to a local directory.
- 4 Double-click the installer executable.
- 5 Accept all default settings in the installer, and click **Finish**.

You have installed the vSphere Client on your local Windows machine.

### What to do next

Use the vSphere Client to connect to your host and deploy a virtual machine.

## Log in to Your ESXi Host and Deploy a Virtual Machine

You have installed and configured ESXi. You can deploy the first virtual machine on your ESXi host by using the vSphere Client.

In an environment without vCenter Server, you can use the vSphere Client to connect directly to the host and perform administrative tasks.

A single host can run multiple virtual machines. ESXi supports a wide range of guest operating systems. To create a Windows virtual machine, you need a Windows installation disk.

### Procedure

- 1 Start the vSphere Client and type the login details for your host.
  - a In the **IP address / Name** text box, type **192.168.0.2**.
  - b In the **User name** text box, type **root**.
  - c In the **Password** text box, type **my\_esx\_password**.
- 2 Click **Install this certificate and do not display any security warnings**, and click **Ignore**.
- 3 Click **New Virtual Machine**.
- 4 Follow the Create New Virtual Machine wizard to create a Windows virtual machine.
  - a Click **Typical**, and click **Next**.
  - b Type **My\_Windows\_VM**, and click **Next**.
  - c To place the virtual machine files on the existing datastore, click **Next**.
  - d Select a Windows version that corresponds to the installation media that you own.
  - e Accept all default settings to finish the wizard.

To install vCenter Server in the virtual machine, assign at least 4GB of RAM to the virtual machine.

- 5 Select the *My\_Windows\_VM* virtual machine.
- 6 Place your Windows installation disk in the optical media drive of your local machine.
- 7 Click the **Connect/disconnect CD/DVD devices of the virtual machine** icon, and select the letter drive that corresponds to your DVD device.
- 8 Click the **Launch Virtual Machine Console** icon.
- 9 Select the *My\_Windows\_VM* console window, and click the **Power on** icon.
- 10 Complete the Windows installation wizard.

In a later scenario, you use the windows administrative account as the administrative account for vCenter Server. Assign the password *My\_windows\_password* to the *administrator* user.

You have a running Windows virtual machine on your ESXi host.

**What to do next**

You can install vCenter Server in a Microsoft Windows virtual machine that runs on an ESXi host. To use the virtual machine as a host system for your vCenter Server instance with the network conventions of this scenario, assign to the virtual machine the IP address 192.168.0.10. In the next scenario, the administrative account of the Windows virtual machine is set as your vCenter Server account.



# Getting Started with vCenter Server and the vSphere Web Client

---

# 3

Get started with vCenter Server and the vSphere Web Client quickly with information about installation and initial setup. You can review how to install and set up a basic inventory for a multiple-host virtualization environment.

In this scenario, you are a system administrator who has at least one running ESXi host, and you want to use the advanced management capabilities of vCenter Server. You will use vCenter Simple Install to set up a basic single-node vCenter Server instance. You will install the vSphere Web Client and use its in-browser interface to add ESXi hosts to your vSphere inventory.

This scenario is a continuation of the vSphere familiarization that you began in *Getting Started with ESXi*, where you set up a single-host virtualization environment and deployed a Windows virtual machine.

You can manage multiple hosts at the same time with vCenter Server. Using vCenter Server to manage multiple hosts enables you to experiment with advanced management options, such as resource sharing, and all of the other options available within a virtual infrastructure.

## vCenter Simple Install

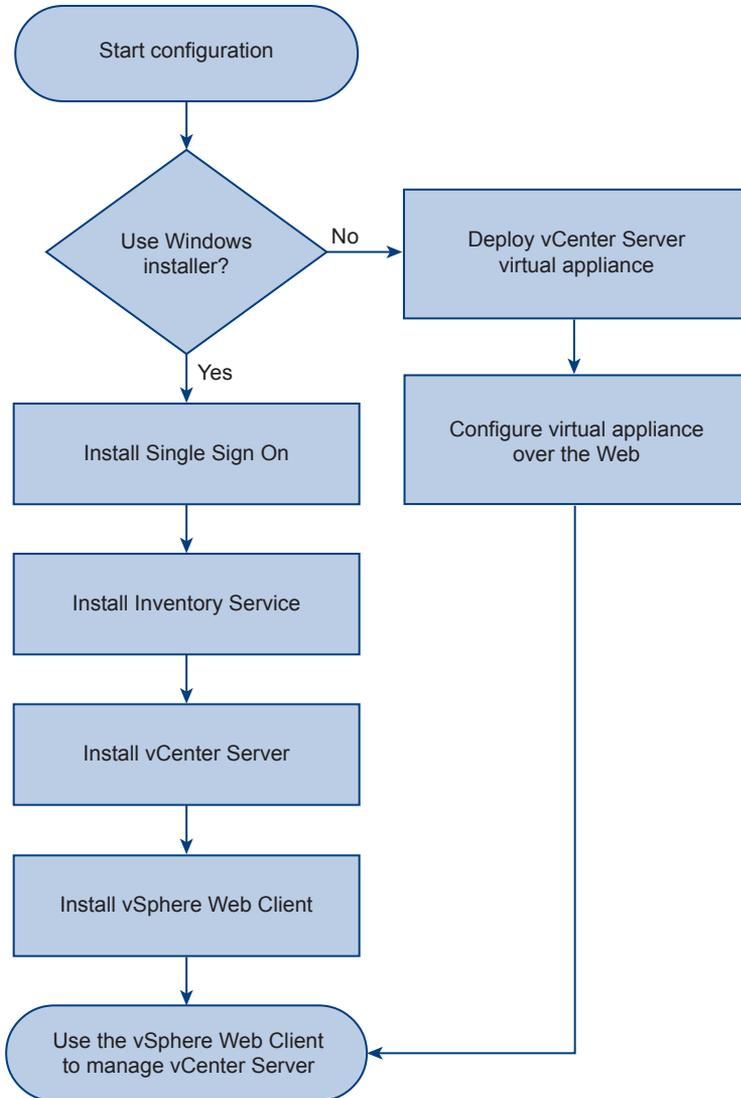
For small vSphere deployments, vCenter Server 5.1 provides a vCenter Server Simple Install option that installs vCenter Single Sign On, Inventory Service, and vCenter Server on the same Windows system. You start vCenter Simple Install and the application runs the set of vCenter Service installers in the correct order.

## The vSphere Web Client

The vSphere Web Client 5.1 provides you with the full set of capabilities you need to manage both simple and complex vSphere environments. After you install the server component of the vSphere Web Client, you can access the administrative interface in a Web browser.

## Workflows for Installing vCenter Server

You can deploy vCenter Server by using either the Windows installers or the preconfigured Linux-based vCenter Server Virtual Appliance. In this scenario, you install vCenter Server on the Windows operating system.

**Figure 3-1.** Workflows for Installation of vCenter Server and the vSphere Web Client

This chapter includes the following topics:

- [“vSphere and vCenter Server,”](#) on page 16
- [“Install vCenter Server by Using vCenter Simple Install,”](#) on page 18

## vSphere and vCenter Server

VMware vSphere is a suite of virtualization applications that includes ESXi and vCenter Server.

vSphere uses virtualization to do the following tasks:

- Run multiple operating systems on a single physical machine simultaneously.
- Reclaim idle resources and balance workloads across multiple physical machines.
- Work around hardware failures and scheduled maintenance.

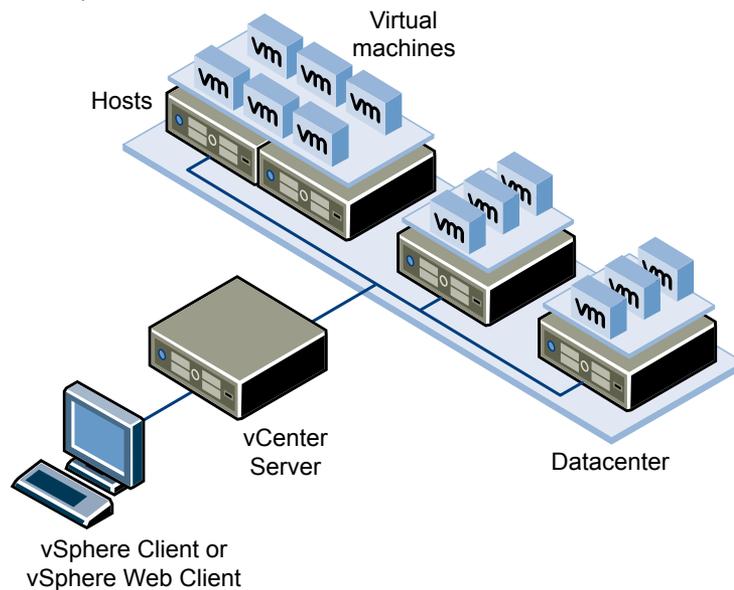
Familiarity with the components that make up a vSphere environment helps you understand the setup process and, ultimately, the process of using VMware vCenter Server to manage hosts and run virtual machines.

vSphere includes the following components in addition to the ESXi host and vSphere Client that you have already set up:

- The vSphere Web Client** The vSphere Web Client is the interface to vCenter Server and multi-host environments. It also provides console access to virtual machines. The vSphere Web Client lets you perform all administrative tasks by using an in-browser interface.
- VMware vCenter Server** vCenter Server unifies resources from individual hosts so that those resources can be shared among virtual machines in the entire datacenter. It accomplishes this by managing the assignment of virtual machines to the hosts and the assignment of resources to the virtual machines within a given host based on the policies that the system administrator sets.
- vCenter Server allows the use of advanced vSphere features such as vSphere Distributed Resource Scheduler (DRS), vSphere High Availability (HA), vSphere vMotion, and vSphere Storage vMotion.
- Datacenter** A datacenter is a structure under which you add hosts and their associated virtual machines to the inventory.
- Host** A host is a computer that uses ESXi virtualization software to run virtual machines. Hosts provide CPU and memory resources, access to storage, and network connectivity for virtual machines that reside on them.
- Virtual Machine** A virtual machine is a software computer that, like a physical computer, runs an operating system and applications. Multiple virtual machines can run on the same host at the same time. Virtual machines that vCenter Server manages can also run on a cluster of hosts.

The following graphic shows the relationships among the basic components of vSphere and how vCenter Server can be used to manage hosts and run virtual machines.

**Figure 3-2.** vSphere Components



## Install vCenter Server by Using vCenter Simple Install

vCenter Simple Install provides you with a streamlined way to set up a single-node vCenter Server installation that you can use to manage a small vSphere environment. Run the vCenter Server Install application to install all required vCenter Server components in the correct order.

You can use a remote desktop session or the vSphere Client console to install vCenter Server on the Windows virtual machine that you created in the Getting Started with ESXi scenario. This scenario assumes that the IP address of the virtual machine that you created is 198.162.0.10, in accordance with the conventions defined in “[Network Environment](#),” on page 8.

For the full list of hardware and software requirements for vCenter Server, see *vSphere Installation and Setup*.

### Prerequisites

Download the vCenter Server installer.

Verify that your network environment meets the requirements specified in “[Network Environment](#),” on page 8.

Verify that you have a running ESXi 5.1 host. See [Chapter 2, “Getting Started with ESXi,”](#) on page 7.

### Procedure

- 1 [Install vCenter Single Sign On](#) on page 18  
The first step in the vCenter Simple Install process is to install vCenter Single Sign On. Authentication by vCenter Single Sign On makes the VMware cloud infrastructure platform more secure by allowing vSphere software components to communicate with each other through a secure token exchange mechanism.
- 2 [Install vCenter Inventory Service](#) on page 19  
You install vCenter Inventory Service as part of a simple installation. You installed vCenter Single Sign On in the previous task. Inventory Service stores vCenter Server application and inventory data, which lets you search and access inventory objects across linked vCenter Server instances.
- 3 [Install vCenter Server](#) on page 19  
You install vCenter Server as part of a simple installation. You have already installed vCenter Server Sign On and vCenter Inventory Service in the previous tasks.
- 4 [Install the vSphere Web Client](#) on page 20  
You installed vCenter Server. You can install the server component of the vSphere Web Client on the same machine as vCenter Server. The vSphere Web Client runs in your browser and lets you manage your vSphere environment.
- 5 [Add an ESXi Host to the vCenter Server Inventory by Using the vSphere Web Client](#) on page 21  
You installed vCenter Server and the vSphere Web Client. You can start managing your vSphere environment in the vSphere Web Client.

## Install vCenter Single Sign On

The first step in the vCenter Simple Install process is to install vCenter Single Sign On. Authentication by vCenter Single Sign On makes the VMware cloud infrastructure platform more secure by allowing vSphere software components to communicate with each other through a secure token exchange mechanism.

### Procedure

- 1 In the software installer directory, double-click the autorun.exe file to start the installer.
- 2 Select **VMware vCenter Simple Install**, and click **Install**.

- 3 Follow the prompts in the installation wizard to choose the installer language and agree to the end user patent and license agreements.
- 4 Set the password for the vCenter Single Sign On administrator account.  
The password must be longer than eight characters and include at least one uppercase character and at least one number.
  - a In the **Password** text box, type **My\_password1**.
  - b Retype the password to confirm.
  - c Click **Next**.
- 5 Select **Install a local Microsoft SQL Server 2008 R2 Express instance**, and click **Next**.  
The bundled Microsoft SQL Server 2008 R2 Express database is best suited for small deployments with five or fewer hosts.
- 6 Verify that the IP address of the local Windows system appears in the **Fully Qualified Domain or IP address** text box, and click **Next**.  
In this scenario, the IP address of the Windows system is **192.168.0.10**.
- 7 Leave the installation directory to the default, and click **Next**.
- 8 Leave the HTTPS port to the default, and click **Next**.
- 9 Click **Install** and wait for the installation to finish.

#### What to do next

The simple installation process runs the individual installers of vCenter Server components in sequence. After the installation of vCenter Single Sign On finishes, continue the vCenter Server setup by installing vCenter Inventory Service.

## Install vCenter Inventory Service

You install vCenter Inventory Service as part of a simple installation. You installed vCenter Single Sign On in the previous task. Inventory Service stores vCenter Server application and inventory data, which lets you search and access inventory objects across linked vCenter Server instances.

#### Prerequisites

Verify that the VMware vCenter Simple Install application has started the vCenter Inventory Service installer.

#### Procedure

- ◆ In the VMware vCenter Simple Install window, click **Install** and wait for the installation to finish.

#### What to do next

You have installed the required vCenter components, and can continue with the installation of vCenter Server.

## Install vCenter Server

You install vCenter Server as part of a simple installation. You have already installed vCenter Server Sign On and vCenter Inventory Service in the previous tasks.

In vSphere 5.1, you can install vCenter Server only after you have running instances of vCenter Server Sign On and vCenter Inventory Service.

#### Prerequisites

Verify that the VMware vCenter Simple Install application has started the vCenter Server installation.

**Procedure**

- 1 Leave the **License key** text box empty to install in evaluation mode, and click **Next**.  
You can use all vCenter Server features for 60 days. You can later use the vSphere Web Client to enter a valid license key.
- 2 Click **Install a Microsoft SQL Server 2008 Express instance (for small deployments: up to 5 hosts and 50 virtual machines)**, and click **Next**.
- 3 Leave **Use SYSTEM Account** selected, and click **Next**.  
The administrative account for vCenter Server will have the same user name and password as your Windows administrative account.
- 4 Leave all port settings to their default values, and click **Next**.
- 5 Click **Small (less than 100 hosts or 1000 virtual machines)**, and click **Next**.
- 6 Review your settings, click **Install**.
- 7 Wait for the installation to finish, and click **Finish**.

**What to do next**

Installation of vCenter Single Sign On, vCenter Inventory Service, and vCenter Server has completed successfully. To manage your new vCenter Server system, install the vSphere Web Client.

**Install the vSphere Web Client**

You installed vCenter Server. You can install the server component of the vSphere Web Client on the same machine as vCenter Server. The vSphere Web Client runs in your browser and lets you manage your vSphere environment.

In a production environment, you can choose to install the vSphere Web client server component on a separate machine.

**Procedure**

- 1 In the VMware vCenter Installer window, select **VMware vSphere Web Client**, and click **Install**.
- 2 Select the language for the installation, and click **OK**.
- 3 Click **Next**.
- 4 Accept the end user patent agreement and the end user license agreements.
- 5 To install the vSphere Web Client in the default directory, click **Next**.
- 6 Leave the port settings to their default values, and click **Next**.
- 7 In the vCenter Single Sign On administrator password text box, type **My\_password1**.  
You set the vCenter Single Sign On administrator password in [“Install vCenter Single Sign On,”](#) on page 18.
- 8 Verify that the installer application has populated the text boxes with correct information about vCenter Single Sign On.
  - a Verify that the administrator user is **admin@System-Domain**.
  - b Verify that the Lookup Service URL is **https://192.168.0.10:7444/lookupservice/sdk**.
- 9 Click **Next**.
- 10 Click **Install** and wait for the installation to complete.
- 11 Click **Finish**.

**What to do next**

Manage your vCenter Server in the vSphere Web Client.

**Add an ESXi Host to the vCenter Server Inventory by Using the vSphere Web Client**

You installed vCenter Server and the vSphere Web Client. You can start managing your vSphere environment in the vSphere Web Client.

You must add ESXi hosts to the vCenter Server inventory, in order to create a vSphere environment and use vSphere features.

**Procedure**

- 1 In the address bar of the Web browser, type **https://192.168.0.10:9443/vsphere-client**.
- 2 Type the login credentials for your vCenter Server system.  
You configured vCenter Server to use the administrative account of the host Windows machine in an earlier task from the scenario.
- 3 In the vSphere Web Client navigator to the left, select your vCenter Server system.
- 4 On the **Getting Started** tab, click **Create Datacenter**.  
You can add hosts to datacenter objects and not directly to vCenter Server objects.
- 5 Type **New Datacenter** as a name for the datacenter, and click **OK**.
- 6 Right-click the **New Datacenter** object, and select **Add Host**.
- 7 In the **Host name or IP** text box, type **198.162.0.2**, and click **Next**.  
You set the IP addresses and root passwords of your hosts during installation of ESXi. See [Chapter 2, "Getting Started with ESXi,"](#) on page 7.
- 8 Type the user name and password for the ESXi host, and click **Next**.
  - a In the **User name** text box, type **root**.
  - b In the **Password** text box, type **my\_esx\_password**.
- 9 Complete the Add Host wizard by accepting the default values.  
You can monitor the progress of the Add standalone host task in the Recent tasks panel to the right.

Your host appears in the inventory.

**What to do next**

You can add multiple hosts to your vSphere inventory and perform additional scenarios from this book. Navigate to the vCenter Server settings and change the name of your system to **My vCenter Server 5.1**.



# Configuring iSCSI Adapters for Hosts to Access vSphere Shared Storage

---

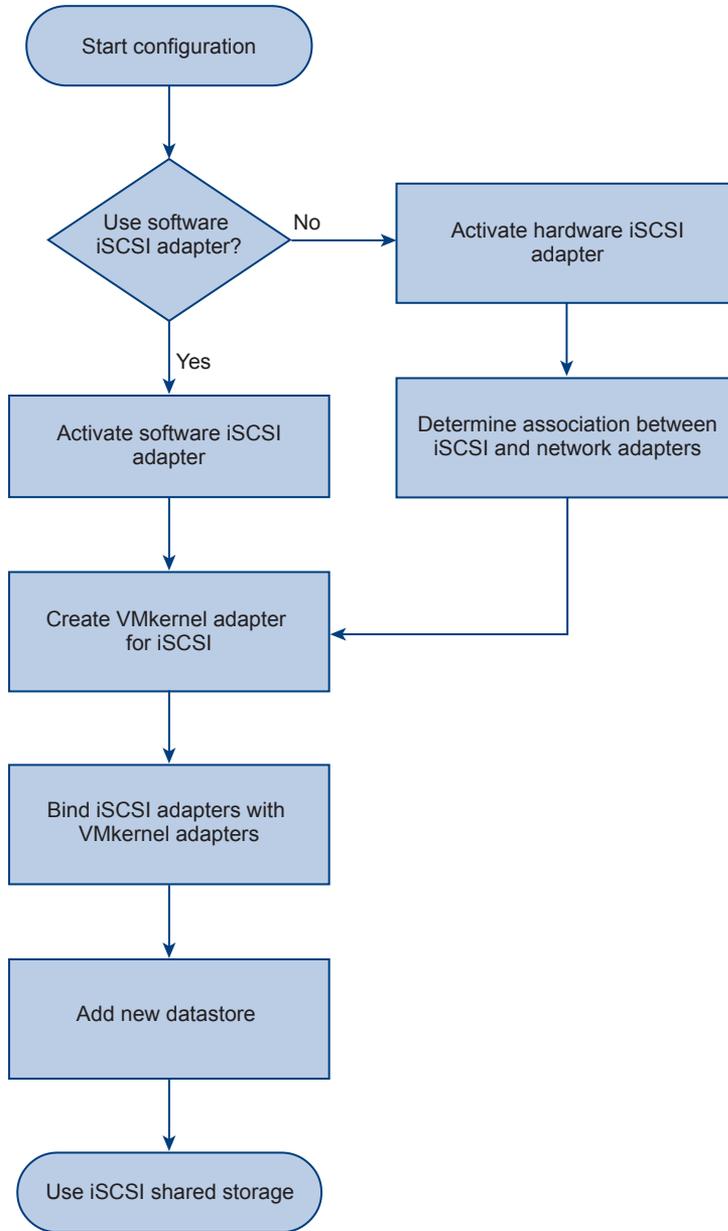
# 4

ESXi supports iSCSI technology that enables a host to use an IP network to access remote storage. With shared networked storage in vSphere you can aggregate storage resources to be more flexible when provisioning the resources to virtual machines.

In this scenario, you are the system administrator of a small vSphere environment. You have an iSCSI storage device in your network and want to use it with your ESXi hosts. You can use software iSCSI adapter included in ESXi to establish a connection to iSCSI storage and make it available for use in your environment. The iSCSI device has raw partitions, which you can format and add as datastores to your inventory.

iSCSI shared storage might be an enterprise-level hardware system or a software solution using commodity hardware.

Without access to shared storage, the virtual machines on a host are limited to the host's physical hard disk to contain the virtual machines' virtual disks. If you have centralized and aggregated storage resources, it releases virtual machines from depending on local storage. Multiple hosts can access datastores on networked storage concurrently.

**Figure 4-1.** Workflows for Adding iSCSI Storage

For information about the storage options in vSphere, see the *vSphere Storage* documentation.

## Configure Software iSCSI Adapters

With the software-based iSCSI implementation, you can use standard NICs to connect your host to a remote iSCSI target on the IP network. The software iSCSI adapter that is built into ESXi allows this connection by communicating with the physical NICs through the network stack.

### Prerequisites

Verify that you have a iSCSI device that is running on the same network as your hosts.

Use iSCSI only on 100Mbps or faster adapters.

**Procedure**

- 1 [Activate the Software iSCSI Adapter](#) on page 25  
You must activate your software iSCSI adapter so that your host can use it to access iSCSI storage. A software iSCSI adapters is VMware code that is built into the VMkernel. With the software iSCSI adapter, you can use iSCSI technology without specialized hardware.
- 2 [Create a VMkernel Adapter for iSCSI](#) on page 25  
You create a VMkernel adapter to access the iSCSI array. You enabled the iSCSI software adapter in the previous task. You must connect the VMkernel, which runs services for iSCSI storage, to a physical network adapter.
- 3 [Bind the iSCSI Adapter with the VMkernel Adapter](#) on page 26  
You will bind the iSCSI software adapter with the VMkernel adapter that you created. Your host can connect to the iSCSI storage device over an IP network by using standard network adapters.
- 4 [Add a Datastore to Verify That You Can Use the iSCSI Device](#) on page 27  
You have activated the iSCSI software adapter, configured networking, and bound the storage adapter to the VMkernel network adapter. The iSCSI device is now accessible from the host *ESXi-A* and you can create a new datastore on the iSCSI device.

**Activate the Software iSCSI Adapter**

You must activate your software iSCSI adapter so that your host can use it to access iSCSI storage. A software iSCSI adapters is VMware code that is built into the VMkernel. With the software iSCSI adapter, you can use iSCSI technology without specialized hardware.

You can activate only one software iSCSI adapter.

**Procedure**

- 1 Log in to the vSphere Web Client.
- 2 Select the ESXi-A host in the inventory.
- 3 Click the **Manage** tab, and click **Storage**.
- 4 Click **Storage Adapters**, and click the **Add new storage adapter** icon.
- 5 Select **Software iSCSI Adapter** and confirm that you want to add the adapter.
- 6 In the Adapter Details panel, click **Enable**.

The software iSCSI adapter appears on the list of storage adapters. After enabling the adapter, the host assigns a default iSCSI name to it, such as *vmhba#*.

**What to do next**

Create a VMkernel adapter and a standard switch to associate with the iSCSI software adapter. The iSCSI adapter handles iSCSI processing while communicating with the network adapter.

**Create a VMkernel Adapter for iSCSI**

You create a VMkernel adapter to access the iSCSI array. You enabled the iSCSI software adapter in the previous task. You must connect the VMkernel, which runs services for iSCSI storage, to a physical network adapter.

**Procedure**

- 1 Select the host ESXi-A in the inventory.
- 2 Click the **Manage** tab.
- 3 Click **Networking** and click **Virtual adapters**.

- 4 Click the **Add host networking** icon.
- 5 Click **VMkernel Network Adapter**, and click **Next**.
- 6 Click **New standard switch** and click **Next**.
- 7 Click the **Add adapters** icon to assign an adapter to the Active Adapters group and click **Next**.  
Designate a separate network adapter for iSCSI.
- 8 In the **Network label** text box, type **iSCSI Network**.  
A network label is a name that identifies to users the VMkernel adapter that you are creating.
- 9 Select **Use static IPv4 settings**, type the port network settings, and click **Next**.  
Example network settings are listed in "[Network Environment](#)," on page 8.  
In a production environment, the iSCSI device might be on a separate subnet. In such a case, ensure that the IP settings for the VMkernel adapter are specific to that subnet, but leave the gateway value to its default setting.
- 10 Review your settings and click **Finish**.

#### What to do next

Bind the VMkernel adapter to the iSCSI adapter to enable transfer of data from the iSCSI device over the network.

## Bind the iSCSI Adapter with the VMkernel Adapter

You will bind the iSCSI software adapter with the VMkernel adapter that you created. Your host can connect to the iSCSI storage device over an IP network by using standard network adapters.

#### Procedure

- 1 Select the host *ESX-A* in the inventory.
- 2 Click the **Manage** tab, and click **Storage**.
- 3 Select the iSCSI software adapter.
- 4 Click the **Network Port Binding** tab, and click **Add**.
- 5 Select the adapter named *iSCSI Network* and click **OK**.
- 6 Click **Targets**.
- 7 Click **Dynamic Discovery**, and click **Add**.  
Each time the initiator contacts a specified iSCSI server, the server responds by supplying a list of available targets to the initiator. The names and IP addresses of these targets appear on the **Static Discovery** tab. If you remove a static target added by dynamic discovery, the target might be returned to the list the next time a rescan occurs, the HBA is reset, or the host is restarted.
- 8 In the **iSCSI Server** text box, type **198.162.0.100**.
- 9 In the **Port** text box, type **3260**.
- 10 Click the **Rescan storage adapter** icon.
- 11 Click the **Devices** tab to verify that the iSCSI device is visible.

#### What to do next

The iSCSI storage device is visible from your ESXi host and ready to use. Verify that you can store virtual machine files on the iSCSI device.

## Add a Datastore to Verify That You Can Use the iSCSI Device

You have activated the iSCSI software adapter, configured networking, and bound the storage adapter to the VMkernel network adapter. The iSCSI device is now accessible from the host *ESXi-A* and you can create a new datastore on the iSCSI device.

### Procedure

- 1 Navigate to the My Datacenter object in the inventory.

You created a new datacenter with the default name in [“Add an ESXi Host to the vCenter Server Inventory by Using the vSphere Web Client,”](#) on page 21.

- 2 On the **Getting Started** tab, click **Add a datastore**.

- 3 Type **iSCSI Datastore** and click **Next**.

- 4 Click **VMFS** and click **Next**.

VMFS datastores can store virtual machine files.

- 5 Select your host and the iSCSI device to use for your datastore, and click **Next**.

- 6 Click **VMFS 5** and click **Next**.

- 7 Select **Use all available partitions** and click **Next**.

This option dedicates the entire disk to a single VMFS datastore. All file systems and data currently stored on this device are destroyed.

- 8 In the Ready to Complete page, review the datastore configuration information and click **Finish**.

### What to do next

You created a new datastore. In a production environment, you can use the vSphere Web Client to enable Jumbo Frames for each vSphere standard switch and VMkernel adapter designated for iSCSI traffic. See *vSphere Storage*.



# Configuring Hosts to Use vMotion for Increased Service Availability

---

# 5

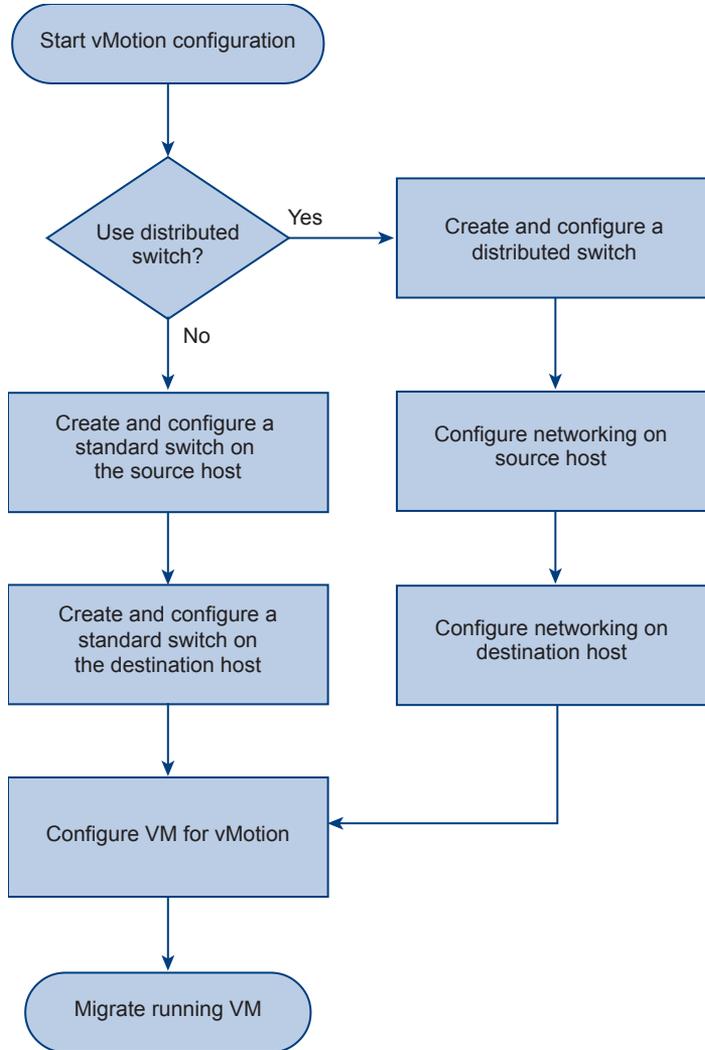
In this example, you are the system administrator in a company that requires virtual machines to run with minimal downtime. With vSphere vMotion, you can move the entire state of a running virtual machine between hosts over a dedicated vMotion network, without service interruption. After you configure ESXi, vCenter Server, and iSCSI shared storage according to the previous scenarios in this publication, you can configure your environment for vMotion.

The entire state of the virtual machine, as well as its configuration file, if necessary, is moved to the new host, while the associated virtual disk remains in the same location on storage that is shared between the two hosts. After the virtual machine state is migrated to the alternate host, the virtual machine runs on the new host.

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 whatever bits of the operating system and applications 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.

In vSphere 5.1, you can migrate running machines without shared storage. This scenario assumes that you are using shared storage.

For more information about migrating virtual machines, see *vSphere Virtual Machine Administration*.

**Figure 5-1.** vMotion Workflow with Standard and Distributed Switches

## Configure Hosts for vMotion and Migrate Powered-On Virtual Machines

This scenario demonstrates how to configure vCenter Server and ESX/ESXi hosts so that you can migrate powered-on virtual machines without downtime. vMotion is a prerequisite for advanced vSphere features such as vSphere Distributed Resource Scheduler (DRS) and vSphere High Availability (HA).

### Prerequisites

- Verify that you have at least two ESXi hosts that are licensed for vMotion or are in evaluation mode.
- Verify that you have running instances of vCenter Server and the vSphere Web Client.
- Verify that hosts have access to shared storage of a supported type, such as Fibre Channel, iSCSI, or NAS.
- Verify that the source and destination hosts have compatible CPUs.
- Verify that hosts have access to the same physical networks.
- Verify that you have at least one active Gigabit Ethernet adapter on each host.
- Virtual machine files must be on shared storage visible by the hosts.
- Virtual machines must run a supported operating system.

- Virtual machines must not have a connection to a virtual media device with a mounted local image.
- Virtual machines must not have a connection to an internal vSwitch that is not connected to a physical network.
- Virtual machines must have access to the same subnets.
- Virtual machines must not have CPU affinity configured.

### Procedure

- 1 [Create a Datacenter and a Cluster](#) on page 31  
To begin with the vMotion example scenario, prepare an EVC-enabled virtual environment for the hosts that you are configuring for vMotion. vSphere environments are typically organized into datacenters and clusters. Using vSphere EVC clusters reduces the risk of incompatible host CPUs that might prevent vMotion migrations.
- 2 [Add Hosts to the EVC-Enabled Cluster](#) on page 32  
Add the hosts *ESXi-A* and *ESXi-B* to your vSphere inventory. Place them in the cluster *My EVC Cluster* to ensure CPU compatibility between hosts.
- 3 [Configure vMotion Networking on the Source and Destination Hosts](#) on page 33  
vMotion migrations use a dedicated network to transfer the virtual machine state between the source and destination hosts. You must configure such a network for each host that you will use for vMotion migrations.
- 4 [Install VMware Tools](#) on page 34  
After you have set up an environment with two hosts and configured vMotion networking, ensure that the virtual machines meet the requirements for vMotion. Install VMware Tools to ensure better virtual machine performance.
- 5 [Migrate Powered-On Virtual Machines by Using vMotion](#) on page 34  
After you configure your vSphere environment for vMotion, you can use the vSphere Web Client to migrate powered-on virtual machines between the hosts *ESXi-A* and *ESXi-B*. In a production environment, vMotion guarantees minimal downtime of critical tasks that run in virtual machines.

## Create a Datacenter and a Cluster

To begin with the vMotion example scenario, prepare an EVC-enabled virtual environment for the hosts that you are configuring for vMotion. vSphere environments are typically organized into datacenters and clusters. Using vSphere EVC clusters reduces the risk of incompatible host CPUs that might prevent vMotion migrations.

This scenario instructs you to use a cluster for your vMotion environment. You can configure vMotion on hosts that are not in a cluster. Add your hosts to a cluster in order to use cluster-specific features such as vSphere EVC, vSphere DRS, vSphere HA, and vSphere distributed switches.

### Procedure

- 1 Connect to the vCenter Server system *My vCenter Server 5.1* by using the vSphere Web Client.
- 2 Right-click the vCenter Server object and select **New Datacenter**.
- 3 Type **My vMotion Datacenter** and click **OK**.
- 4 Navigate to the *My vMotion Datacenter* object.
- 5 Right-click the datacenter, and select **New Cluster**.
- 6 Type **My EVC Cluster** in the **Name** text box.
- 7 Keep the **Turn ON** option deselected for both DRS and vSphere HA.

- 8 Enable EVC for the cluster to maximize vMotion compatibility.

EVC presents only the CPU instruction set of the least capable processor to guest operating systems. You cannot enable EVC on clusters that contain both hosts with AMD processors and hosts with Intel processors.

You can create a cluster without a special license, but you must have a license to enable a cluster for vSphere DRS or vSphere HA.

- 9 Click **OK**.

**What to do next**

Add the hosts *ESXi-A* and *ESXi-B* to the cluster *My EVC Cluster*.

**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 meeting 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	<p>Enable these CPU features in the BIOS if they are available:</p> <ul style="list-style-type: none"> <li>■ Hardware virtualization support (AMD-V or Intel VT)</li> <li>■ MD No eXecute(NX)</li> <li>■ Intel eXecute Disable (XD)</li> </ul> <p><b>NOTE</b> 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.</p>
Supported CPUs for the EVC mode that you want to enable	To check EVC support for a specific processor or server model, see the <i>VMware Compatibility Guide</i> at <a href="http://www.vmware.com/resources/compatibility/search.php">http://www.vmware.com/resources/compatibility/search.php</a> .

**Add Hosts to the EVC-Enabled Cluster**

Add the hosts *ESXi-A* and *ESXi-B* to your vSphere inventory. Place them in the cluster *My EVC Cluster* to ensure CPU compatibility between hosts.

**Procedure**

- 1 Select *My EVC Cluster* in the navigator.
- 2 Right-click the cluster and select **Add Host**.

This scenario demonstrates how to add the hosts to your vSphere inventory. If the hosts are already managed by your vCenter Server system, you can move them to the EVC-enabled cluster that you created. See the procedure for adding managed hosts to a cluster in *vSphere Resource Management*.

- 3 Type the host name or IP address of the host *ESXi-A*, and click **Next**.

The example scenarios in the beginning of this publication demonstrate how to configure your ESXi hosts with specific IP address, user name, and password.

- 4 Type the user name and password for the host, and click **Next**.

- 5 View the summary information and click **Next**.

- 6 Assign a license, and click **Next**.

For the example scenario, you can use Evaluation Mode, which lets you use all vSphere features for a limited period of time.

- 7 Keep **Enable lockdown mode** deselected, and click **Next**.

- 8 Click **Finish**.

- 9 Repeat the procedure for the host *ESXi-B*.

You have added your two hosts to the cluster *My EVC Cluster*.

### What to do next

vMotion requires a dedicated network over which to migrate the virtual machine data. Configure networking on your ESXi hosts.

## Configure vMotion Networking on the Source and Destination Hosts

vMotion migrations use a dedicated network to transfer the virtual machine state between the source and destination hosts. You must configure such a network for each host that you will use for vMotion migrations.

You must perform the network configuration steps on both the source and the destination host. The source host is running the virtual machine that you will migrate to the destination host by using vMotion.

### Procedure

- 1 Select the host *ESXi-A* in the inventory.
- 2 Click the **Manage** tab.
- 3 Click **Networking** and click **Virtual adapters**.
- 4 Click the **Add host networking** icon.
- 5 Click **VMkernel Network Adapter**, and click **Next**.

The VMkernel TCP/IP stack handles traffic for several ESXi services, including vMotion.

- 6 Click **New standard switch**, and click **Next**.

This scenario instructs you to use vSphere standard switches for vMotion networking. In a production environment, you can choose to configure vMotion networking by using a vSphere distributed switch. See *vSphere Networking*.

- 7 Click the **Add adapters** icon (+) to assign an adapter to the Active Adapters group and click **Next**.
- 8 In the **Network label** text box, type **vMotion Network**.
- 9 Click **vMotion traffic** to enable this port group to advertise itself to another host as the network connection through which vMotion traffic should be sent, and click **Next**.

Leave the rest of the port settings to their default values.

- 10 Select **Use static IPv4 settings**, type the port network settings, and click **Next**.

Example network settings are listed in [“Network Environment,”](#) on page 8.

vMotion migrations are also possible over DHCP networks.

In a production environment, you should use a subnet for vMotion only, because the migration generates intensive traffic. Assign unique IP addresses from the same subnet to all VMkernel interfaces.

- 11 Review your settings and click **Finish**.
- 12 Repeat the procedure for the host *ESXi-B* and assign to the second vMotion adapter a unique IP.

### What to do next

The virtual machines in your environment can now be migrated over the newly-created virtual network adapters.

## Install VMware Tools

After you have set up an environment with two hosts and configured vMotion networking, ensure that the virtual machines meet the requirements for vMotion. Install VMware Tools to ensure better virtual machine performance.

### Procedure

- 1 Select a virtual machine on host *ESXi-A*.
- 2 Right-click the virtual machine and select **All Virtual Infrastructure Actions > Install/Upgrade VMware Tools**.
- 3 Click **Automatic Upgrade** and click **Yes**.
- 4 Wait for the task to finish.
- 5 Ensure that VMware Tools is up-to-date on the virtual machine by reviewing the **Summary** tab.

### What to do next

You have complete all configuration steps. You can migrate the powered-on virtual machine to from host *ESXi-A* to host *ESXi-B*.

## Migrate Powered-On Virtual Machines by Using vMotion

After you configure your vSphere environment for vMotion, you can use the vSphere Web Client to migrate powered-on virtual machines between the hosts *ESXi-A* and *ESXi-B*. In a production environment, vMotion guarantees minimal downtime of critical tasks that run in virtual machines.

Before migration, you can open a console to the virtual machine and start a continuous task, such as running the `ping` command in a command-line window or playing streaming video from the Internet. During the vMotion process, the machine is migrated to another host while the task continues with only minimal interruption. This is a useful way to monitor the migration process if you are migrating running virtual machines for the first time.

### Procedure

- 1 In the vSphere Web Client, select a powered-on virtual machine that is running on host *ESXi-A*.
- 2 Right-click the virtual machine and select **Migrate** from the pop-up menu.

If you have compatibility problems with your vMotion environment, messages appear in the Migrate wizard that describe the problems.

- 3 Click **Change host** and click **Next**.
- 4 Select the My EVC Cluster object that you created for your vMotion environment and click **Next**.
- 5 Select *ESXi-B* as the destination host to which to migrate the virtual machine and click **Next**.

- 6 Select **Reserve CPU for optimal vMotion performance** and click **Next**.

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 to standard priority migrations than to high priority migrations. Migrations proceed regardless of the resources that have been reserved.

- 7 Review your settings and click **Finish**.

vCenter Server migrates the virtual machine to another host without service interruption. You can track the progress of the migration in the Recent Tasks panel.

### **What to do next**

You can enable, on the cluster level, advanced vSphere features such as vSphere HA and vSphere DRS.

## **Migration with vMotion**

Migration with vMotion™ allows virtual machine working processes to continue throughout a migration.

The entire state of the virtual machine, as well as its configuration file, if necessary, is moved to the new host, while the associated virtual disk remains in the same location on storage that is shared between the two hosts. After the virtual machine state is migrated to the alternate host, the virtual machine runs on the new host.

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 whatever bits of the operating system and applications 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.

When you migrate a virtual machine with vMotion, the new host for the virtual machine must meet compatibility requirements in order for the migration to proceed.

Migration with vMotion happens 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 any error occurs during migration, the virtual machines revert to their original states and locations.

Migration of a suspended virtual machine and migration with vMotion can be referred to as hot migration, because they allow migration of a virtual machine without powering it off.



# Setting an Alarm Action for Datastore Usage on a Disk

---

# 6

This example scenario demonstrates a type of alarm action that you configure for an object in the vSphere inventory, including responding to the alarm when it triggers. This example demonstrates how to modify the **Datastore usage on disk** alarm to send emails when certain thresholds are reached, and describes how to respond to the alarm when it is triggered. You are the administrator of a small vSphere environment. You configure alarms to monitor the datastore usage on one of your hosts, named *ESXi-A*. *ESXi-A* is managed by the vCenter Server system *My vCenter Server 5.1*.

With thin provisioning, it is possible to oversubscribe storage space if the virtual machines grow unattended. An alarm set on the datastore can notify you when the space issues threaten to become critical.

Dozens of default alarm definitions are provided by the vSphere Web Client, which you can locate in the **Manage** tab for an inventory object. One of these default alarms is **Datastore usage on disk**, which you use to monitor the percentage of disk usage. This kind of alarm is important if the virtual machines in the datastore have virtual disks in the thin provisioned format. At first, a thin provisioned disk uses only as much datastore space as the disk initially needs. However, if the thin disk needs more space, it can grow to the maximum capacity allocated to it.

To configure alarms to send email notifications, you must have a running SMTP server on your network.

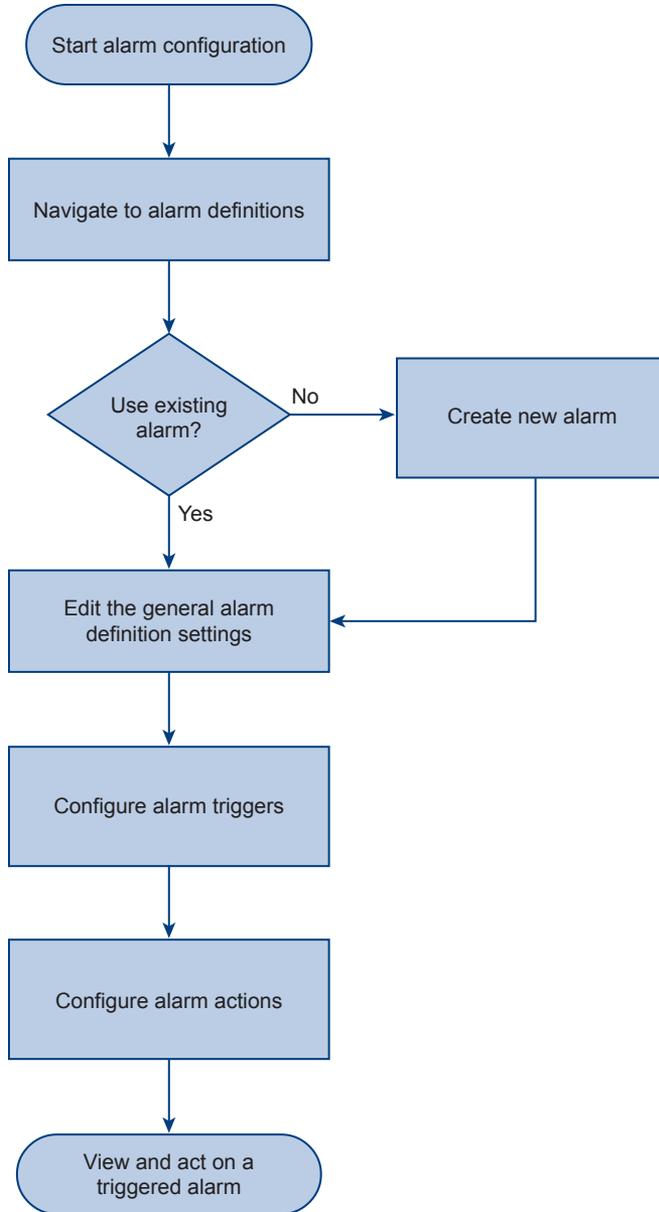
---

**NOTE** VMware recommends that you first experiment with the procedures presented in *vSphere Examples and Scenarios* on test instances in your datacenter.

---

## Alarm Definition Workflows

To configure alarm conditions and alarm actions for your vSphere environment, you can either create an alarm definition or edit an existing one. In this example, you use an existing alarm definition. Default alarms are not preconfigured with actions. You must manually set what action occurs when the triggering event, condition, or state occurs.

**Figure 6-1.** Alarm Definition Workflows

## Required Privileges for Configuring and Acknowledging an Alarm

You must have the Administrator role to configure alarms. Alarm privileges do not appear in other default sample roles accessible with the vSphere Web Client. To create a unique role for this process that does not include all the privileges of an Administrator, the following list contains the minimum privileges necessary.

- **Alarms.Create alarm**
- **Alarms.Modify alarm**
- **Alarms.Acknowledge alarm**

For information about roles, permissions, and privileges, see the *vSphere Security* documentation.

## Configure and Act on a Triggered Datastore Usage Alarm

In this example scenario, you change alarm settings and specify which actions occur when the datastore usage alarm is triggered. You acknowledge the alarm to let other users know that you are aware of datastore usage that exceeds a certain threshold.

The Datastore usage on disk alarm is one of the many default alarms included with vCenter Server. The alarm is enabled at installation. If the used disk space on the datastore exceeds 75 percent, the alarm triggers a Warning. If the used disk space on the datastore then exceeds 85 percent, the alarm triggers an Alert. These warnings and alerts appear in the user interface in the form of modified icons for the elements affected. To have the alarm perform actions beyond this visual notification, change the configuration of the alarm. Follow the workflow in the sample tasks in this example scenario to become familiar with changing the settings of an alarm and responding to a triggered alarm.

Changes that you can make to the datastore usage alarm include altering the percentage values for a Warning and for an Alert, modifying the frequency of an alarm, and defining the action the system takes at an alarm. For this example, you lower the percentage values, but keep the default frequency. In addition, on the Actions page, you configure the action so that the system sends an email to specified addresses when a condition triggers the alarm.

### Procedure

- 1 [Navigate to the Alarm Editing Dialog](#) on page 39  
To begin the example scenario, you must navigate to the Alarm Definitions page. You can view alarm settings from any object, but you can modify settings only through the vCenter Server object on which the alarm is defined.
- 2 [Modify the Definition of the Datastore Usage on Disk Alarm](#) on page 40  
In the previous task, you navigated to the Alarms definitions page and started the Datastore usage on disk - Edit wizard. You can specify the events, states, or conditions that trigger the alarm in the Datastore usage on disk - Edit wizard. Select triggers that you can activate in the example environment and choose an action that lets you verify alarm functionality.
- 3 [Configure vCenter Server to Send Alarm Email Notifications](#) on page 40  
By default, vCenter Server is not configured to send email notifications. Set the system SMTP server and sender account to receive an email when the datastore usage alarm is triggered.
- 4 [Trigger and Acknowledge the Datastore Usage Alarm](#) on page 41  
When storage space utilization on one of your datastores surpasses 30%, the *Datastore usage on disk - example* alarm is triggered. When you acknowledge an alarm, other users see the alarm as acknowledged and know that you are aware of disk space usage rates.
- 5 [Reset the Triggered Datastore Usage Alarm](#) on page 41  
You have set up, triggered, and acknowledged the datastore usage alarm. Now, address the critical trigger condition and reset the triggered *Datastore usage on disk - example* alarm to reenable its actions.

### Navigate to the Alarm Editing Dialog

To begin the example scenario, you must navigate to the Alarm Definitions page. You can view alarm settings from any object, but you can modify settings only through the vCenter Server object on which the alarm is defined.

#### Procedure

- 1 In the vSphere Web Client, connect to the vCenter Server system named *My vCenter Server 5.1*.
- 2 Select the vCenter Server object in the object navigator.

- 3 Click the **Manage** tab, and click **Alarm Definitions**.
- 4 Select **Datastore usage on disk** and click **Edit**.

### What to do next

To continue with the example scenario, use the Datastore usage on disk - Edit wizard to set trigger conditions and actions for the alarm. You select specific settings that let the alarm send you an email when datastore usage reaches a certain threshold.

## Modify the Definition of the Datastore Usage on Disk Alarm

In the previous task, you navigated to the Alarms definitions page and started the Datastore usage on disk - Edit wizard. You can specify the events, states, or conditions that trigger the alarm in the Datastore usage on disk - Edit wizard. Select triggers that you can activate in the example environment and choose an action that lets you verify alarm functionality.

The options that you choose on the General page of the wizard determine the options available on the **Triggers** tab.

### Prerequisites

Open the Datastore usage on disk - Edit wizard. See [“Navigate to the Alarm Editing Dialog,”](#) on page 39.

### Procedure

- 1 In the **Alarm name** text box, type **Datastore usage on disk - example**.
- 2 Leave all other settings on the General page to their default values, and click **Next**.
- 3 Change the trigger value in the **Warning Condition** column to **20%**.
- 4 Change the trigger value in the **Critical Condition** column to **30%**.
- 5 Leave all other settings on the Triggers page to their default values, and click **Next**.
- 6 Click the plus icon above the table, and select **Add a notification email**.
- 7 In the Configuration column, type your email address.  
For example, `sysadmin@my_corporation.com`.
- 8 In the column that indicates transition from warning to critical state () , select **Once**.  
Your vCenter Server system sends a single email message when the datastore usage surpasses 30%.
- 9 Leave all other settings on the Actions page to their default values, and click **Finish**.

### What to do next

The alarm action that you specified requires you to configure vCenter Server to send email notifications.

## Configure vCenter Server to Send Alarm Email Notifications

By default, vCenter Server is not configured to send email notifications. Set the system SMTP server and sender account to receive an email when the datastore usage alarm is triggered.

### Procedure

- 1 Select the vCenter Server system *My vCenter Server 5.1* in the navigator.
- 2 Click the **Manage** tab, and click **Settings**.
- 3 Click **Edit**, and click **Mail**.
- 4 In the **Mail server** text field, type the IP address of your SMTP sever.

- 5 In the **Mail sender** text field, type `notifications@my_company.com`.
- 6 Click **OK**.

### What to do next

You configured vCenter Server to send you email notifications when datastore usage reaches a certain threshold. Next, increase datastore usage to trigger the alarm and act on the triggered alarm.

## Trigger and Acknowledge the Datastore Usage Alarm

When storage space utilization on one of your datastores surpasses 30%, the *Datastore usage on disk - example* alarm is triggered. When you acknowledge an alarm, other users see the alarm as acknowledged and know that you are aware of disk space usage rates.

### Procedure

- 1 On the host *ESXi-A*, increase datastore usage to a value above 30% to trigger the *Datastore usage on disk - example* alarm.

- Create snapshots of existing virtual machines.
- Deploy new virtual machines.

Your vCenter Server system sends an email message to the address that you specified and the alarm appears in the Alarms panel on the right.

- 2 In the Alarms panel, right-click the *Datastore usage on disk - example* alarm and select **Acknowledge**.

After you acknowledge the alarm, its actions are discontinued and the alarm appears in the Acknowledged tab of the Alarms panel. Alarms are neither cleared, nor reset when acknowledged.

- 3 Verify that you have received an email notification from the vCenter Server system.

### What to do next

Reset the triggered alarm to enable its actions.

## Reset the Triggered Datastore Usage Alarm

You have set up, triggered, and acknowledged the datastore usage alarm. Now, address the critical trigger condition and reset the triggered *Datastore usage on disk - example* alarm to reenable its actions.

Reset the alarm to enable vCenter Server to send email notifications for datastore usage to you.

### Procedure

- 1 Remove snapshots or virtual machines to reduce datastore usage to below 30%.
- 2 Right-click the *Datastore usage on disk - example* alarm in the Alarms pane and select **Reset**.

When datastore usage reaches 30% again, the alarm will be triggered and you receive an email notification.



# Creating a Role That Permits Completion of a Limited Task

---

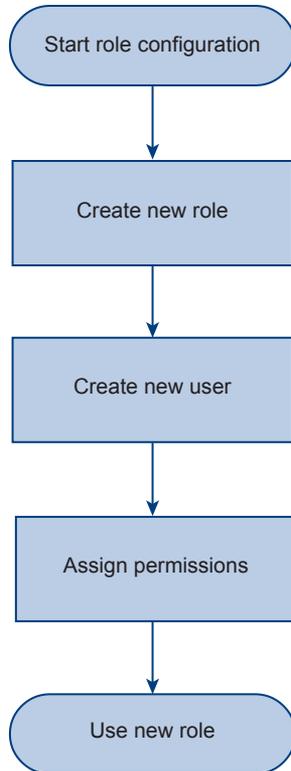
# 7

You can configure vSphere so that identified users can perform only a specific and focused function. This protects your system from errors that might be made by users who are in unfamiliar or sensitive parts of the system's interface.

If you follow the tenets of role-based access control (RBAC), you would create roles for particular job functions, and give each role a subset of permissions or privileges needed to do a function and no more. This protects the system from errors, while simplifying an administrator's task in assigning permissions.

vSphere provides the ability to achieve role-based access control, and includes a large collection of privileges that you can use to create a spectrum of roles. The privileges are described in the *vSphere Security* documentation. vCenter Server has nine roles defined. They vary in their functions and level of responsibility.

For this exercise, you create a role with a limited function: the ability to deploy new virtual machines from a template. A user with this role cannot move, modify, or delete a virtual machine, and cannot change the configuration of a host or datastore, for example. One scenario for this role is in an organization that provides virtual machine workstations to new hires, or needs to deploy development servers as new projects come on line. With a virtual machine deployment role in place, the manager can provide the role holder with a list of users and groups and needed virtual machines, and a runbook to follow for the process.

**Figure 7-1.** Workflow for Roles and Permissions

## Creating and Configuring a Role That Limits Users to Deploying Virtual Machines from Templates

For this example, the scenario is to create a role to be used by staff whose only function is to deploy virtual machines from templates as the need arises.

In product versions earlier than vCenter Server 5.1, users authenticate when vCenter Server validates their credentials against an Active Directory domain or the list of local operating system users. In vCenter Server 5.1, users can authenticate through vCenter Single Sign On.

### Procedure

- 1 [Define the Role to Be Assigned](#) on page 45  
To provide for more granular access to your vSphere environment, first create a new role. You can create a custom limited vCenter Server role by using the vSphere Web Client. A custom role is a set of privileges that you define.
- 2 [Create a User](#) on page 45  
You have created a limited role that allows for deployment of virtual machine templates. Create a vCenter Server user, which you can associate with the newly-created limited role. You can create new users in the vSphere Web Client.
- 3 [Assign Permissions](#) on page 46  
You have defined a role and created a user. To use the role and user, you must assign permissions to the relevant inventory objects.
- 4 [Use the New Role to Deploy a Virtual Machine from a Template](#) on page 47  
You have assigned permissions by adding a new role-user pair to the vCenter Server system *My vCenter Server 5.1*. You can use the new user *user-deploy* with its associated role to deploy a virtual machine from a template. No other actions are possible by using the new user and role.

## Define the Role to Be Assigned

To provide for more granular access to your vSphere environment, first create a new role. You can create a custom limited vCenter Server role by using the vSphere Web Client. A custom role is a set of privileges that you define.

### Procedure

- 1 Log in to the vSphere Web Client as the vCenter Server administrator.
- 2 Browse to **Administration > Role Manager**.
- 3 Select your vCenter Server system from the drop-down menu.
- 4 Click **Create role action**.
- 5 Type a name for the new role.  
Type **Deployer of virtual machines from template**.
- 6 Select privileges for the new role.
  - **Datastore.Allocate space**
  - **Datastore.Browse datastore**
  - **Global.Cancel task**
  - **Network.Assign network**
  - **Resource.Assign virtual machine to resource pool**
  - **Scheduled task.Create tasks**
  - **Scheduled task.Run task**
  - **Virtual machine.Configuration.Add new disk**
  - **Virtual machine.Inventory.Create new**
  - **Virtual machine.Provisioning.Deploy template**
- 7 Click **OK**.

You created the new vCenter Server role **Deployer of virtual machines from template**.

### What to do next

To use the new role, you must create a new user and associate it with the role.

## Create a User

You have created a limited role that allows for deployment of virtual machine templates. Create a vCenter Server user, which you can associate with the newly-created limited role. You can create new users in the vSphere Web Client.

You can associate roles with users and groups, so that the privileges provided by a role are only available to specific users.

In Windows-based vCenter Server installations, the administrator of the vCenter Server system is a separate entity from the administrator of vCenter Single Sign On.

**Procedure**

- 1 Log in to the vSphere Web Client as the vCenter Single Sign On administrator.
  - a In the **User name** text field, type **admin@System-Domain**.
  - b In the **Password** text field, type **My\_password1**.  
You set the vCenter Single Sign on password during the vCenter Server installation scenario.
- 2 Click **Administration**.
- 3 Click **SSO Users and Groups**, and click the **Users** tab.
- 4 Click the **New User** icon.
- 5 Fill in the required information to create a new user.
  - a In the **Username** text field, type **user-deploy**.
  - b In the **Password** text field, type **deploy-password**.
  - c Click **Regular user**.
  - d Click **OK**.
- 6 Log out of the vSphere Web Client.

**What to do next**

Assign the user and role that you created to the vCenter Server system.

**Assign Permissions**

You have defined a role and created a user. To use the role and user, you must assign permissions to the relevant inventory objects.

To assign permissions, select a user and a role for an object. Permissions propagate to child objects. In a production environment, you can assign the same permissions at one time on multiple objects by moving the objects to a folder and setting the permissions on the folder.

**Procedure**

- 1 Log in to the vSphere Web Client as the vCenter Server administrator.
  - a In the **User name** text box, type **administrator**.
  - b In the **Password** text box, type **My\_windows\_password**.  
You configured vCenter Server to use the administrative account of the host Windows machine in the Getting Started with vCenter Server scenario.
- 2 Select your vCenter Server system in the object navigator.
- 3 Click the **Manage** tab and click **Permissions**.
- 4 Click the **Add Permission** icon (+).
- 5 In the Add Permission dialog, assign the user and role that you created.
  - a Click **Add**.
  - b In the **Domain** drop-down menu, select **SYSTEM-DOMAIN**.
  - c Select the user **user-deploy**, and click **Add**.

- d In the **Assigned Role** drop-down menu, select **Deployer of virtual machines from template**.
- e Click **OK**.

The roles that are assigned to the object appear in the menu. The privileges contained in the role are listed in the section below the role title.

The new user entry appears in the list of users and groups that have permissions for the vCenter Server system.

#### **What to do next**

Deploy a virtual machine from template as the new user.

## **Use the New Role to Deploy a Virtual Machine from a Template**

You have assigned permissions by adding a new role-user pair to the vCenter Server system *My vCenter Server 5.1*. You can use the new user *user-deploy* with its associated role to deploy a virtual machine from a template. No other actions are possible by using the new user and role.

An OVF template lets you deploy virtual machines without the need to install and configure operating systems.

#### **Prerequisites**

Verify that you have a virtual machine template in the OVF format. Linux virtual machine templates are freely available for download over the Internet.

#### **Procedure**

- 1 Log in to the vSphere Web Client as the user that you associated with the limited role.
  - a In the **User name** text box, type **user-deploy**.
  - b In the **Password** text box, type **deploy-password**.
- 2 Select the host **ESX-A**.
- 3 Click **Actions**, and select **Deploy OVF Template**.
- 4 Follow the prompts to finish the wizard.

You have used a limited role to deploy from template a new virtual machine.



# Licensing vSphere

---

vSphere has different license editions that are suitable for environments of various scales and needs. When installed, ESXi hosts and vCenter Server are in an evaluation mode that lasts 60 days. While in evaluation mode, you can explore the full set of features for vSphere. After you decide which features serve the needs of your environment, you can choose the most appropriate vSphere and vCenter Server licenses.

In this scenario, you are a system administrator of a small vSphere environment that you are currently using in evaluation mode. You want to continue using your environment after the 60-day evaluation period expires.

When the evaluation period of ESXi hosts or vCenter Server expires, the hosts disconnect from vCenter Server. All powered-on virtual machines and configured features continue to run, but you cannot power on new virtual machines or use new features.

To avoid the consequences from the evaluation period expiry, you must license the ESXi hosts and the vCenter Server system in your environment. In this scenario, you have configured vMotion, therefore you need a vSphere 5 license that unlocks vMotion. You also need an appropriate vCenter Server 5 license.

The scenario uses the *ESXi-A* and *ESXi-B* hosts and the *My vCenter Server 5.1* system that you installed and configured in [Chapter 2, “Getting Started with ESXi,”](#) on page 7 and [Chapter 3, “Getting Started with vCenter Server and the vSphere Web Client,”](#) on page 15.

Information about configuring vMotion is available in [Chapter 5, “Configuring Hosts to Use vMotion for Increased Service Availability,”](#) on page 29.

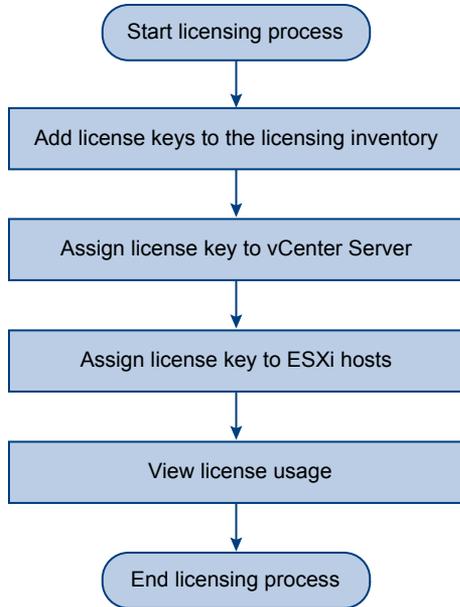
For more information about naming conventions and network details, see [“Network Environment,”](#) on page 8.

## Workflow for Licensing vSphere and Viewing License Usage

In this scenario, you license the *ESXi-A* and *ESXi-B* hosts and the *My vCenter Server 5.1* system.

To begin the licensing configuration, you add the vSphere 5.x and the vCenter Server 5.x licenses in the license inventory of the *My vCenter Server 5.1* system. You assign the licenses to the *My vCenter Server 5.1* system and the hosts the *ESXi-A* and *ESXi-B*.

After you license your vSphere environment, you use the license reporting function in vCenter Server to check the license usage for vSphere 5. In a production environment, checking the license usage for vSphere products regularly will help you to estimate the current and the future licensing needs of your environment.

**Figure 8-1.** Workflow for Licensing vSphere

## License ESXi Hosts and vCenter Server and View License Usage

You must license your vSphere environment before its 60-day evaluation period expires.

The scenario uses vSphere 5 Standard and vCenter Server 5 Standard licenses. In a production environment, the combinations between vSphere and vCenter Server licenses vary.

### Prerequisites

- Your vSphere environment is running in evaluation mode.
- You have valid vSphere 5 Standard and vCenter Server 5 Standard licenses.
- Required privileges: **Global.Licenses**

### Procedure

- 1 [Add License Keys to the vCenter Server License Inventory](#) on page 51  
You must license your vSphere environment before its 60-day evaluation period expires. To begin, add the vSphere 5 Standard and vCenter Server 5 Standard license keys to the inventory of the *My vCenter Server 5.1* system.
- 2 [Assign License Key to vCenter Server](#) on page 51  
You added the vSphere 5 Standard and vCenter Server 5 Standard licenses to the inventory of the *My vCenter Server 5.1* system. You must assign the vCenter Server 5.x Standard license key to the *My vCenter Server 5.1* system before its 60-day evaluation period expires.
- 3 [Assign a License Key to the ESXi Hosts](#) on page 52  
You licensed the *My vCenter Server 5.1* system. To complete the licensing configuration of your vSphere environment, you must assign the vSphere 5.x Standard license key to the *ESXi-A* and *ESXi-B* hosts before their 60-day evaluation period expires.
- 4 [View the License Usage for the ESXi Hosts](#) on page 53  
You licensed your vSphere environment. View the license usage for the vSphere 5 Standard product.

## Add License Keys to the vCenter Server License Inventory

You must license your vSphere environment before its 60-day evaluation period expires. To begin, add the vSphere 5 Standard and vCenter Server 5 Standard license keys to the inventory of the *My vCenter Server 5.1* system.

vCenter Server systems maintain inventories where license keys are stored. Before you assign license keys to assets, you must add them to the vCenter Server license inventory. You can use the license management function in the vSphere Web Client to add multiple license keys at a time.

### Procedure

- 1 Log in to the vSphere Web Client.
- 2 Select **Administration > Licensing > Licenses**.
- 3 Select **License Keys**.
- 4 Click the **Add License Keys (+)** icon.
- 5 Enter the vSphere 5 Standard license key, and press Enter to add a new line.
- 6 Enter the vCenter Server 5 Standard license key and click **Next**.
- 7 To label the license keys, type **My License Keys**.
- 8 Review the license keys and click **Finish**.

The vSphere 5 Standard and the vCenter Server 5 Standard license keys are added to the license inventory of the *My vCenter Server 5.1* system. The license keys appear in the **License Keys** tab.

### What to do next

Assign the vCenter Server 5 Standard license key to the *My vCenter Server 5.1* system before its 60-day evaluation period expires.

## Assign License Key to vCenter Server

You added the vSphere 5 Standard and vCenter Server 5 Standard licenses to the inventory of the *My vCenter Server 5.1* system. You must assign the vCenter Server 5.x Standard license key to the *My vCenter Server 5.1* system before its 60-day evaluation period expires.

You are using the *My vCenter Server 5.1* system in evaluation mode and have configured vMotion. When the evaluation period of a vCenter Server system expires, all hosts disconnect from that system. You cannot use vMotion if the *ESXi-A* and *ESXi-B* hosts are disconnected from the *My vCenter Server 5.1*.

### Procedure

- 1 In the vSphere Web Client, select **Administration > Licensing > License**.
- 2 Click the **vCenter Server Instances** tab.

The *My vCenter Server 5.1* system appears in evaluation mode.

- 3 Select the *My vCenter Server 5.1* system, and click **Assign License Key**.
- 4 Select the vCenter Server 5 Standard license key that you added.

To verify that it is the correct license key, view the license key label *My License Keys* under the license key details section.

- 5 Click **OK**.

- 6 To verify that the *My vCenter Server 5.1* system is licensed correctly, view the licensed features on vCenter Server.
  - a Navigate to the *My vCenter Server 5.1* system in the inventory.
  - b Click **Manage**, and click **Settings**.
  - c Under **System**, select **Licensing**.

Licensing information about the *My vCenter Server 5.1* appears. The product name for the license should be vCenter Server 5 Standard.

The *My vCenter Server 5.1* system is in licensed mode.

### What to do next

To complete the licensing configuration of your vSphere environment, assign the vSphere 5 Standard license key to the *ESXi-A* and *ESXi-B* hosts before their 60-day evaluation period expires.

## Assign a License Key to the ESXi Hosts

You licensed the *My vCenter Server 5.1* system. To complete the licensing configuration of your vSphere environment, you must assign the vSphere 5.x Standard license key to the *ESXi-A* and *ESXi-B* hosts before their 60-day evaluation period expires.

You are using the *ESXi-A* and *ESXi-B* hosts in evaluation mode and have configured vMotion. When the evaluation period of ESXi hosts expires, the hosts disconnect from vCenter Server. Powered-on virtual machines continue to run but you cannot power on any new virtual machines. You cannot use vMotion on ESXi hosts when they are disconnected from vCenter Server.

### Procedure

- 1 In the vSphere Web Client, select **Administration > Licensing > Licenses**.
- 2 Click the **Hosts** tab.
 

The *ESXi-A* and *ESXi-B* hosts appear in evaluation mode.
- 3 Press Shift and select the host *ESXi-A* and then host *ESXi-B*.
- 4 Click **Assign License Key**.
- 5 Select the vSphere 5 Standard license key that you added.

You can verify that the license key is the right one by viewing the label *My License Keys* under the license key details section.

- 6 Click **OK**.
- 7 To verify that the hosts are licensed correctly, view the licensed features on the hosts.
  - a Navigate to one of the hosts in the inventory.
  - b Click **Manage**, and click **Settings**.
  - c Under **System**, select **Licensing**.

Licensing information about the host appears.

The *ESXi-A* and *ESXi-B* hosts are in licensed mode. You completed the licensing configuration of your vSphere environment.

The scenario assumes that the *ESXi-A* and *ESXi-B* hosts have 2 CPUs each. The CPU usage for the vSphere 5 Standard license is 4 CPUs.

### What to do next

Use the license reporting function in vCenter Server to view the license usage for vSphere 5 Standard.

In a production environment, viewing the license usage for vSphere products regularly can help you to estimate the current and the future licensing needs of your vSphere environment.

## View the License Usage for the ESXi Hosts

You licensed your vSphere environment. View the license usage for the vSphere 5 Standard product.

Tracking the license usage for vSphere products can help you to estimate if the available license capacity is sufficient to cover the current and the future licensing needs of your environment and to develop your license purchasing strategy accordingly.

### Procedure

- 1 In the vSphere Web Client, select **Administration > Licensing > License Reports**.
- 2 From the **Time period** drop-down menu, select **Custom**.
- 3 Select the start date and the end date of the period in which you have used your environment in licensed mode and click **Recalculate**.

The license reporting function aggregates license usage data for the period from the license usage snapshots that vCenter Server collects every hour.

- 4 From the Products Chart pane, select **vSphere 5 Standard**.

Details about the license usage of vSphere 5 Standard appear in the Product Details pane. vSphere 5 Standard has 50% of free license capacity that allows you to grow your environment accordingly.



# Index

## A

- alarm definition scenario, email notifications **40**
- alarms
  - configuring in an example **39**
  - example for an object in inventory **37**
  - triggers **40**
  - viewing the settings for an example **39**

## C

- cluster, create **31**
- clusters, requirements for enabling EVC **32**
- create user **45**

## D

- datastore usage alarm
  - modify definition **40**
  - open edit wizard **39**
- datastore usage alarm, acknowledge **41**
- datastore usage alarm, reset **41**
- define role **45**
- deploy virtual machine from template **47**

## E

- ESXi
  - configure **10**
  - deploy virtual machine **12**
  - getting started **7, 9**
  - install intractively **10**
  - install vSphere Client **11**
- EVC
  - requirements **32**
  - supported processors **32**

## G

- getting started
  - with ESXi **7**
  - with vCenter Server **15**

## H

- host, add to cluster **32**
- hosts, configure for vMotion **30**

## I

- iSCSI adapters, configure software **24**
- iSCSI storage
  - bind adapters **26**
  - configuring adapters **23**
- iSCSI storage, activate adapter **25**
- iSCSI storage, add datastore **27**
- iSCSI storage, create a VMkernel adapter **25**

## L

- license
  - compliance **53**
  - usage **53**
- license key
  - add **51**
  - assign **51, 52**
  - hosts **52**
  - vCenter Server **51**
  - vSphere **51**
- licensing
  - evaluation mode **49, 50**
  - hosts **49**
  - license usage **49**
  - scenario **50**
  - vCenter Server **49**
  - vCenter Server licenses **50**
  - vSphere **49**
  - vSphere licenses **50**

## M

- migration, with vMotion **35**

## N

- network environment **8**
- networking, configure **33**

## P

- permissions, assigning **46**

## R

- role-based access control, example scenario **43**

## S

- scenario, create role for deploying virtual machines **44**

## **V**

- vCenter Server
  - add host **21**
  - getting started **15**
  - install **19**
  - install SSO **18**
  - install vSphere Web Client **20**
  - installation prerequisites **18**
- vCenter Server license **51**
- vCenter Server, install Inventory Service **19**
- virtual machines, migrating with vMotion **35**
- virtual machines, configure **34**
- virtual machines, migrate **34**
- vMotion **29, 35**
- vMotion scenario **30**
- VMware tools, install and configure **34**
- vSphere, about **16**
- vSphere components **16**
- vSphere infrastructure **16**
- vSphere licenses **52**