

vSphere Virtual Machine Administration

ESXi 5.1
vCenter Server 5.1

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About vSphere Virtual Machine Administration

vSphere Virtual Machine Administration describes how to create, configure, and manage virtual machines in the VMware vSphere® environment.

In addition, this information provides introductions to the tasks that you can do within the system as well as cross-references to the information that describes the tasks.

This information focuses on managing virtual machines in the VMware vSphere Web Client and the VMware vSphere® Client™ and includes the following information.

- Creating and deploying virtual machines, templates, and clones
- Deploying OVF templates
- Configuring virtual machine hardware, options, and resources
- Managing multitiered applications with VMware vSphere vApp
- Monitoring solutions with the vCenter Solution Manager
- Managing virtual machines, including migration with VMware vSphere® vMotion® and using snapshots

vSphere Virtual Machine Administration covers VMware ESXi™ and VMware vCenter Server™.

Intended Audience

This information is written for experienced Windows or Linux system administrators who are familiar with virtualization.

Updated Information

This *vSphere Virtual Machine Administration* documentation is updated with each release of the product or when necessary.

This table provides the update history of the *vSphere Virtual Machine Administration* documentation.

| Revision | Description |
|-----------|---|
| 000766-02 | The topic “Add a SCSI Controller in the vSphere Web Client,” on page 141 provides the correct steps for adding a SCSI controller. |
| 000766-01 | <ul style="list-style-type: none">■ The new topic “Upload ISO Image Installation Media for a Guest Operating System,” on page 26 provides steps for uploading an ISO image file to a datastore.■ The topics “Configure a Datastore ISO File for the CD/DVD Drive in the vSphere Web Client,” on page 145 and “Add a CD or DVD Drive to a Virtual Machine in the vSphere Web Client,” on page 146 clarify that if an ISO file is not available in the datastore, you can upload the file from a local computer.■ The topic Chapter 14, “Required Privileges for Common Tasks,” on page 289 includes privileges required to upload ISO images to a datastore. |
| 000787-00 | Initial release. |

Introduction to VMware vSphere Virtual Machines

1

This information introduces the concept of virtual machines and how they function in the infrastructure environment with vSphere. You will find information about what constitutes a virtual machine and the features available for managing them.

This chapter includes the following topics:

- [“What Is a Virtual Machine?”](#) on page 11
- [“Virtual Machines and the Virtual Infrastructure,”](#) on page 12
- [“Virtual Machine Lifecycle,”](#) on page 13
- [“Virtual Machine Components,”](#) on page 13
- [“Virtual Machine Hardware Available to vSphere Virtual Machines,”](#) on page 13
- [“Virtual Machine Options and Resources,”](#) on page 15
- [“Where to Go From Here,”](#) on page 16
- [“vSphere Client and vSphere Web Client,”](#) on page 17

What Is a Virtual Machine?

A virtual machine is a software computer that, like a physical computer, runs an operating system and applications. The virtual machine is comprised of a set of specification and configuration files and is backed by the physical resources of a host. Every virtual machine has virtual devices that provide the same functionality as physical hardware and have additional benefits in terms of portability, manageability, and security.

A virtual machine consists of several types of files that you store on a supported storage device. The key files that make up a virtual machine are the configuration file, virtual disk file, NVRAM setting file, and the log file. You configure virtual machine settings through the vSphere Web Client or the vSphere Client. You do not need to touch the key files.

A virtual machine can have more files if one or more snapshots exist or if you add Raw Device Mappings (RDMs).



CAUTION Do not change, move, or delete these files without instructions from a VMware Technical Support Representative.

Table 1-1. Virtual Machine Files

| File | Usage | Description |
|-------|---------------------|--|
| .vmx | <i>vmname</i> .vmx | Virtual machine configuration file |
| .vmxf | <i>vmname</i> .vmxf | Additional virtual machine configuration files |

Table 1-1. Virtual Machine Files (Continued)

| File | Usage | Description |
|------------|--|---|
| .vmdk | <i>vmname</i> .vmdk | Virtual disk characteristics |
| -flat.vmdk | <i>vmname</i> -flat.vmdk | Virtual machine data disk |
| .nvram | <i>vmname</i> .nvram or nvram | Virtual machine BIOS or EFI configuration |
| .vmsd | <i>vmname</i> .vmsd | Virtual machine snapshots |
| .vmsn | <i>vmname</i> .vmsn | Virtual machine snapshot data file |
| .vswp | <i>vmname</i> .vswp | Virtual machine swap file |
| .vmss | <i>vmname</i> .vmss | Virtual machine suspend file |
| .log | vmware.log | Current virtual machine log file |
| -#.log | vmware-#.log (where # is a number starting with 1) | Old virtual machine log entries |

Virtual Machines and the Virtual Infrastructure

The infrastructure that supports virtual machines consists of at least two software layers, virtualization and management. In vSphere, ESXi provides the virtualization capabilities that aggregate and present the host hardware to virtual machines as a normalized set of resources. Virtual machines can run on an isolated ESXi host or on ESXi hosts that vCenter Server manages.

vCenter Server lets you pool and manage the resources of multiple hosts and lets you effectively monitor and manage your physical and virtual infrastructure. You can manage resources for virtual machines, provision virtual machines, schedule tasks, collect statistics logs, create templates, and more. vCenter Server also provides vSphere vMotion™, vSphere Storage vMotion, cross-host Storage vMotion, vSphere Distributed Resource Scheduler (DRS), vSphere High Availability (HA), and vSphere Fault Tolerance. These services enable efficient and automated resource management and high availability for virtual machines.

The VMware vSphere Web Client and the vSphere Client are interfaces to vCenter Server, ESXi hosts, and virtual machines. With the vSphere Web Client and the vSphere Client, you can connect remotely to vCenter Server. With the vSphere Client you can also connect directly to ESXi from any Windows system. The vSphere Web Client and the vSphere Client are the primary interfaces for managing all aspects of the vSphere environment. They also provide console access to virtual machines.

The vSphere Web Client and the vSphere Client present the organizational hierarchy of managed objects in inventory views. Inventories are the hierarchical structure used by vCenter Server or the host to organize managed objects. This hierarchy includes all of the monitored objects in vCenter Server.

In the vCenter Server hierarchy, a datacenter is the primary container of ESXi hosts, folders, clusters, resource pools, vSphere vApps, virtual machines, and so on.

Datastores are virtual representations of underlying physical storage resources in the datacenter. A datastore is the storage location (for example, a physical disk or LUN on a RAID, or a SAN) for virtual machine files. Datastores hide the idiosyncrasies of the underlying physical storage and present a uniform model for the storage resources required by virtual machines.

For some resources, options, or hardware to be available to virtual machines, the host must have the appropriate vSphere license. Licensing in vSphere is applicable to ESXi hosts, vCenter Server, and solutions. Licensing can be based on different criteria, depending on the specifics of each product. For details about vSphere licensing, see the *vCenter Server and Host Management* documentation.

Virtual Machine Lifecycle

You create and deploy virtual machines into your datacenter in a several ways. You can create a single virtual machine and install a guest operating system and VMware Tools on it. You can clone or create a template from an existing virtual machine, or deploy OVF templates.

The vSphere Web Client and the vSphere Client New Virtual Machine wizards and Virtual Machine Properties editors let you add, configure, or remove most of the virtual machine's hardware, options, and resources. You monitor CPU, memory, disk, network, and storage metrics using the performance charts in the vSphere Client. Snapshots let you capture the state of the virtual machine, including the virtual machine memory, settings, and virtual disks. You can roll back to the previous virtual machine state when needed.

With vSphere vApps, you can manage multitiered applications. You use vSphere Update Manager to perform orchestrated upgrades to upgrade the virtual hardware and VMware Tools of virtual machines in the inventory at the same time.

When a virtual machine is no longer needed, you can remove it from the inventory without deleting it from the datastore, or you can delete the virtual machine and all its files.

Virtual Machine Components

Virtual machines typically have an operating system, VMware Tools, and virtual resources and hardware that you manage in much the same way as you would manage a physical computer.

You install a guest operating system on a virtual machine the same way as you install an operating system on a physical computer. You must have a CD/DVD-ROM or ISO image containing the installation files from an operating system vendor.

VMware Tools is a suite of utilities that enhances the performance of the virtual machine's guest operating system and improves management of the virtual machine. With VMware Tools, you have more control over the virtual machine interface.

In the vSphere Web Client, you assign each virtual machine to a compatible ESXi host version, cluster, or datacenter by applying a compatibility setting. The compatibility setting determines which ESXi host versions the virtual machine can run on and the hardware features available to the virtual machine.

The hardware devices listed in the Virtual Machine Properties editor complete the virtual machine. Not all devices are configurable. Some hardware devices are part of the virtual motherboard and appear in the expanded device list of the Virtual Machine Properties editor, but you cannot modify or remove them. For a list of hardware devices and their functions, see [“Virtual Machine Hardware Available to vSphere Virtual Machines,”](#) on page 13.

Access to a virtual machine is controlled by the vSphere administrator.

Virtual Machine Hardware Available to vSphere Virtual Machines

VMware provides devices, resources, profiles, and vServices that you can configure or add to your virtual machine.

Virtual Machine Hardware

Not all hardware devices are available to every virtual machine. The host that the virtual machine runs on and the guest operating system must support devices that you add or configurations that you make.

In some cases, the host might not have the required vSphere license for a resource or device. Licensing in vSphere is applicable to ESXi hosts, vCenter Server, and solutions and can be based on different criteria, depending on the specifics of each product. For information about vSphere licensing, see the *vCenter Server and Host Management* documentation.

The PCI and SIO virtual hardware devices are part of the virtual motherboard, but cannot be configured or removed.

Table 1-2. Virtual Machine Hardware and Descriptions

| Hardware Device | Description |
|------------------|---|
| CPU | You can configure a virtual machine that runs on an ESXi host to have one or more virtual processors. A virtual machine cannot have more virtual CPUs than the actual number of logical CPUs on the host. You can change the number of CPUs allocated to a virtual machine and configure advanced CPU features, such as the CPU Identification Mask and hyperthreaded core sharing. |
| Chipset | The motherboard uses VMware proprietary devices based on the following chips: <ul style="list-style-type: none"> ■ Intel 440BX AGPset 82443BX Host Bridge/Controller ■ Intel 82371AB (PIIX4) PCI ISA IDE Xcelerator ■ National Semiconductor PC87338 ACPI 1.0 and PC98/99 Compliant SuperI/O ■ Intel 82093AA I/O Advanced Programmable Interrupt Controller |
| DVD/CD-ROM Drive | Installed by default when you create a new vSphere virtual machine. You can configure DVD/CD-ROM devices to connect to client devices, host devices, or Datastore ISO files. You can add, remove, or configure DVD/CD-ROM devices. |
| Floppy Drive | Installed by default when you create a new vSphere virtual machine. You can connect to a floppy drive located on the ESXi host, a floppy (.flp) image, or the floppy drive on your local system. You can add, remove, or configure floppy devices. |
| Hard Disk | Stores the virtual machine's operating system, program files, and other data associated with its activities. A virtual disk is a large physical file, or a set of files, that can be copied, moved, archived, and backed up as easily as any other file. |
| IDE 0, IDE 1 | By default, two Integrated Drive Electronics (IDE) interfaces are presented to the virtual machine. The IDE interface (controller) is a standard way for storage devices (Floppy drives, hard drives and CD-ROM drives) to connect to the virtual machine. |
| Keyboard | Mirrors the keyboard that is connected to the virtual machine console when you first connect to the console. |
| Memory | The virtual hardware memory size determines how much memory applications that are running inside the virtual machine have available to them. A virtual machine cannot benefit from more memory resources than its configured virtual hardware memory size. |
| Network Adapter | ESXi networking features provide communication between virtual machines on the same host, between virtual machines on different hosts, and between other virtual and physical machines. When you configure a virtual machine, you can add network adapters (NICs) and specify the adapter type. |
| Parallel port | Interface for connecting peripherals to the virtual machine. The virtual parallel port can connect to a file. You can add, remove, or configure virtual parallel ports. |
| PCI controller | Bus on the virtual machine motherboard that communicates with components such as hard disks and other devices. One PCI controller is presented to the virtual machine. You cannot configure or remove this device. |
| PCI Device | You can add up to six PCI vSphere DirectPath devices to a virtual machine. The devices must be reserved for PCI passthrough on the host on which the virtual machine runs. Snapshots are not supported with DirectPath I/O passthrough devices. |
| Pointing device | Mirrors the pointing device that is connected to the virtual machine console when you first connect to the console. |

Table 1-2. Virtual Machine Hardware and Descriptions (Continued)

| Hardware Device | Description |
|-----------------|--|
| Serial Port | Interface for connecting peripherals to the virtual machine. The virtual serial port can connect to a physical serial port, to a file on the host computer, or over the network. You can also use it to establish a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. A virtual machine can use up to four virtual serial ports. You can add, remove, or configure virtual serial ports. |
| SCSI controller | Provides access to virtual disks. The SCSI virtual controller appears to a virtual machine as different types of controllers, including LSI Logic Parallel, LSI Logic SAS, and VMware Paravirtual. You can change the SCSI controller type, allocate bus sharing for a virtual machine, or add a paravirtualized SCSI controller. |
| SCSI device | By default, a SCSI device interface is available to the virtual machine. The SCSI interface is a typical way to connect storage devices (floppy drives, hard drives, and DVD/CD-ROMs) to a virtual machine. You can add, remove, or configure SCSI devices. |
| SIO controller | Provides serial and parallel ports, floppy devices, and performs system management activities. One SIO controller is available to the virtual machine. You cannot configure or remove this device. |
| USB controller | The USB hardware chip that provides USB function to the USB ports that it manages. The virtual USB Controller is the software virtualization of the USB host controller function in the virtual machine. |
| USB device | You can add multiple USB devices, such as security dongles and mass storage devices, to a virtual machine. The USB devices can be connected to an ESXi host or a client computer. |
| VMCI | Virtual Machine Communication Interface device. Provides a high-speed communication channel between a virtual machine and the hypervisor. You can also enable VMCI for communication between virtual machines. You cannot add or remove VMCI devices. |

Virtual Machine Options and Resources

Each virtual device performs the same function for the virtual machine as hardware on a physical computer does.

A virtual machine might be running in any of several locations, such as ESXi hosts, datacenters, clusters, or resource pools. Many of the options and resources that you configure have dependencies on and relationships with these objects.

Every virtual machine has CPU, memory, and disk resources. CPU virtualization emphasizes performance and runs directly on the processor whenever possible. The underlying physical resources are used whenever possible. The virtualization layer runs instructions only as needed to make virtual machines operate as if they were running directly on a physical machine.

All recent operating systems provide support for virtual memory, allowing software to use more memory than the machine physically has. Similarly, the ESXi hypervisor provides support for overcommitting virtual machine memory, where the amount of guest memory configured for all virtual machines might be larger than the amount of the host's physical memory.

You can add virtual disks and add more space to existing disks, even when the virtual machine is running. You can also change the device node and allocate shares of disk bandwidth to the virtual machine.

VMware virtual machines have the following options:

| | |
|---------------------------------|--|
| General Options | View or modify the virtual machine name, and check the location of the configuration file and the working location of the virtual machine. |
| vApp Options | Enable or disable vApp functionality. When vApp is enabled, you can edit and configure an IP allocation policy and other configurations particular to vApps. |
| VMware Tools | Manage the power controls for the virtual machine and run VMware Tools scripts. You can also upgrade VMware Tools during power cycling and synchronize guest time with the host. |
| General Advanced Options | Disable acceleration and enable logging, debugging, and statistics. You can also add configuration parameters. |
| Power Management | Manage guest power options. Suspend the virtual machine or leave the virtual machine powered on when you put the guest operating system into standby. |
| CPUID Mask | Hide or expose the NX/XD flag. Hiding the NX/XD flag increases vMotion compatibility between hosts. |
| Memory/CPU Hotplug | Enable or disable CPU and memory hotplug. You can add Memory or CPU resources to a virtual machine while the virtual machine is running. You can disable Memory or CPU hotplug to avoid adding memory or CPUs while the virtual machine is running. Memory hotplug is supported on all 64 bit operating systems, but to use the added memory, the guest operating system must also support this feature. See the <i>VMware Compatibility Guide</i> . |
| Boot Options | Set the boot delay when powering on virtual machines or to force BIOS setup and configure failed boot recovery. |
| Fibre Channel NPIV | Control virtual machine access to LUNs on a per-virtual machine basis. N-port ID virtualization (NPIV) provides the ability to share a single physical Fibre Channel HBA port among multiple virtual ports, each with unique identifiers. |

Where to Go From Here

You must create, provision, and deploy your virtual machines before you can manage them.

To begin provisioning virtual machines, determine whether to create a single virtual machine and install an operating system and VMware tools, work with templates and clones, or deploy virtual machines, virtual appliances, or vApps stored in Open Virtual Machine Format (OVF).

After you provision and deploy virtual machines into the vSphere infrastructure, you can configure and manage them. You can configure existing virtual machines by modifying or adding hardware or install or upgrade VMware Tools. You might need to manage multitiered applications with VMware vApps or change virtual machine startup and shutdown settings, use virtual machine snapshots, work with virtual disks, or add, remove, or delete virtual machines from the inventory.

vSphere Client and vSphere Web Client

All administrative functions are available through the vSphere Web Client. A subset of those functions is available through the vSphere Client.

Table 1-3. Comparing the Two Clients

| vSphere Client | vSphere Web Client |
|--|---|
| <ul style="list-style-type: none"> ■ Locally installed application. ■ Windows operating system only. ■ Can connect to vCenter Server or directly to hosts. ■ Full range of administrative functionality except new features introduced in vSphere 5.1. | <ul style="list-style-type: none"> ■ Web application. ■ Cross platform. ■ Can connect to vCenter Server only. ■ Full range of administrative functionality. ■ Extensible plug-in-based architecture. |
| <p>Users: Virtual infrastructure administrators for specialized functions.</p> | <p>Users: Virtual infrastructure administrators, help desk, network operations center operators, virtual machine owners.</p> |

The vSphere Client uses the VMware API to access vCenter Server. After the user is authenticated, a session starts in vCenter Server, and the user sees the resources and virtual machines that are assigned to the user. For virtual machine console access, the vSphere Client first uses the VMware API to obtain the virtual machine location from vCenter Server. The vSphere Client then connects to the appropriate host and provides access to the virtual machine console.

Users can use the vSphere Web Client to access vCenter Server through a Web browser. The vSphere Web Client uses the VMware API to mediate the communication between the browser and the vCenter Server.

About Provisioning Virtual Machines

VMware provides several methods to provision vSphere virtual machines. The optimal method for your environment depends on factors such as the size and type of your infrastructure and the goals that you want to achieve.

Create a single virtual machine if no other virtual machines in your environment have the requirements you are looking for, such as a particular operating system or hardware configuration. For example, you might need a virtual machine that is configured only for testing purposes. You can also create a single virtual machine and install an operating system on it, and then use that virtual machine as a template from which to clone other virtual machines. See [“Create a Virtual Machine Without a Template or Clone in the vSphere Web Client,”](#) on page 21 or [“Creating a Virtual Machine in the vSphere Client,”](#) on page 59.

Deploy and export virtual machines, virtual appliances, and vApps stored in Open Virtual Machine Format (OVF) to use a preconfigured virtual machine. A virtual appliance is a virtual machine that typically has an operating system and other software installed. You can deploy virtual machines from local file systems, such as local disks (for example, C:), removable media (for example, CDs or USB keychain drives), and shared network drives. See [Chapter 5, “Deploying OVF Templates,”](#) on page 93.

Create a template to deploy multiple virtual machines from. A template is a master copy of a virtual machine that you can use to create and provision virtual machines. Use templates to save time. If you have a virtual machine that you will clone frequently, make that virtual machine a template. See [“Deploy a Virtual Machine from a Template in the vSphere Web Client,”](#) on page 27 or [“Working with Templates and Clones in the vSphere Client,”](#) on page 70.

Cloning a virtual machine can save time if you are deploying many similar virtual machines. You can create, configure, and install software on a single virtual machine. You can clone it multiple times, rather than creating and configuring each virtual machine individually. See [“Clone a Virtual Machine in the vSphere Web Client,”](#) on page 32 or [“Working with Templates and Clones in the vSphere Client,”](#) on page 70.

Cloning a virtual machine to a template preserves a master copy of the virtual machine so that you can create additional templates. For example, you can create one template, modify the original virtual machine by installing additional software in the guest operating system, and create another template. See [Clone a Virtual Machine to a Template in the vSphere Web Client](#) or [“Working with Templates and Clones in the vSphere Client,”](#) on page 70.

Deploying Virtual Machines in the vSphere Web Client

3

To deploy virtual machines in the vCenter Server inventory, you can deploy from a template, create a virtual machine, or clone an existing virtual machine.

This chapter includes the following topics:

- [“Create a Virtual Machine Without a Template or Clone in the vSphere Web Client,”](#) on page 21
- [“Deploy a Virtual Machine from a Template in the vSphere Web Client,”](#) on page 27
- [“Clone a Virtual Machine in the vSphere Web Client,”](#) on page 32
- [“Clone a Virtual Machine to a Template in the vSphere Web Client,”](#) on page 37
- [“Clone a Template to a Template in the vSphere Web Client,”](#) on page 41
- [“Convert a Template to a Virtual Machine in the vSphere Web Client,”](#) on page 44
- [“Customizing Guest Operating Systems in the vSphere Web Client,”](#) on page 46

Create a Virtual Machine Without a Template or Clone in the vSphere Web Client

You can create a single virtual machine if no other virtual machines in your environment have the requirements you are looking for, such as a particular operating system or hardware configuration. When you create a virtual machine without a template or clone, you can configure the virtual hardware, including processors, hard disks, and memory.

During the creation process a default disk is configured for the virtual machine. You can remove this disk and add a new hard disk, select an existing disk, or add an RDM disk on the Customize hardware page of the wizard.

Prerequisites

Verify that you have the following privileges:

- **Virtual machine.Inventory.Create new** on the destination folder or datacenter.
- **Virtual machine.Configuration.Add new disk** on the destination folder or datacenter, if you are adding a new disk.
- **Virtual machine.Configuration.Add existing disk** on the destination folder or datacenter, if you are adding an existing disk.
- **Virtual machine.Configuration.Raw device** on the destination folder or datacenter, if you are using a RDM or SCSI pass-through device.
- **Virtual machine.Configuration.Host USB device** on the destination folder or datacenter, if you are attaching a virtual USB device backed by a host USB device.

- **Virtual machine.Configuration.Advanced** on the destination folder or datacenter, if you are configuring advanced virtual machine settings.
- **Virtual machine.Configuration.Swapfile placement** on the destination folder or datacenter, if you are configuring swapfile placement.
- **Virtual machine.Configuration.Disk change tracking** on the destination folder or datacenter, if you are enabling change tracking on the virtual machine's disks.
- **Resource.Assign virtual machine to resource pool** on the destination host, cluster, or resource pool.
- **Datastore.Allocate space** on the destination datastore or datastore folder.
- **Network.Assign network** on the network that the virtual machine will be assigned to.

Procedure

- 1 [Start the New Virtual Machine Creation Process](#) on page 23
If you need a single virtual machine with a particular operating system and hardware configuration, you create a new virtual machine. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine.
- 2 [Select the Virtual Machine Name and Folder](#) on page 23
When you create a virtual machine, you provide a unique name for it. The unique name distinguishes it from existing virtual machines in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the virtual machine, depending on your organizational needs.
- 3 [Select a Resource](#) on page 23
When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.
- 4 [Select a Datastore](#) on page 23
Select the datastore or datastore cluster in which to store the virtual machine configuration files and all of the virtual disks. Each datastore might have a different size, speed, availability, and other properties. The available datastores are accessible from the destination resource that you selected.
- 5 [Select the Virtual Machine Compatibility](#) on page 24
You can accept the default ESXi host version for this virtual machine or select a different version, depending on the hosts in your environment.
- 6 [Select a Guest Operating System](#) on page 24
The guest operating system that you select affects the supported devices and number of virtual CPUs available for the virtual machine. The New Virtual Machine wizard does not install the guest operating system. The wizard uses this information to select appropriate default values, such as the amount of memory needed.
- 7 [Customize Virtual Machine Hardware in the vSphere Web Client](#) on page 25
Before you deploy a new virtual machine, you have the option to configure the virtual hardware. When you create a virtual machine, the virtual disk is selected by default. You can use the **New device** drop-down menu on the Customize Hardware page to add a new hard disk, select an existing disk, or add an RDM disk.
- 8 [Finish Virtual Machine Creation](#) on page 25
Before you deploy the virtual machine, you can review the virtual machine settings.
- 9 [Installing a Guest Operating System](#) on page 25
A virtual machine is not complete until you install the guest operating system and VMware Tools. Installing a guest operating system in your virtual machine is essentially the same as installing it in a physical computer.

Start the New Virtual Machine Creation Process

If you need a single virtual machine with a particular operating system and hardware configuration, you create a new virtual machine. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine.

Procedure

- 1 Right-click any inventory object that is a valid parent object of a virtual machine, such as a datacenter, folder, cluster, resource pool, or host, and select **NewVirtual Machine**.
- 2 Select **Create a new virtual machine** and click **Next**.

Select the Virtual Machine Name and Folder

When you create a virtual machine, you provide a unique name for it. The unique name distinguishes it from existing virtual machines in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the virtual machine, depending on your organizational needs.

Folders provide a way to store virtual machines for different groups in an organization and you can set permissions on them. If you prefer a flatter hierarchy, you can put all virtual machines in a datacenter and organize them a different way.

Procedure

- 1 Type a name for the virtual machine.
- 2 Select or search for the datacenter or folder in which to deploy the virtual machine.
- 3 Click **Next**.

Select a Resource

When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.

For example, a virtual machine has access to the memory and CPU resources of the host on which it resides. If you select a cluster for the virtual machine, and the administrator has configured the cluster to take advantage of HA and DRS, the virtual machine will have a greater level of availability.

Procedure

- 1 Search or browse for the host, cluster, vApp, or resource pool for the virtual machine.
If deploying the virtual machine to the selected location might cause compatibility problems, the problems appear at the bottom of the window.
- 2 Click **Next**.

Select a Datastore

Select the datastore or datastore cluster in which to store the virtual machine configuration files and all of the virtual disks. Each datastore might have a different size, speed, availability, and other properties. The available datastores are accessible from the destination resource that you selected.

On the Customize hardware page, you can configure the storage. For example, you can add a new hard disk, apply a storage profile, or place the configuration and disk files on separate storage devices.

Procedure

- ◆ 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 datastore cluster. | <ul style="list-style-type: none"> a Select a datastore cluster. b (Optional) If you 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 datastore cluster. c Click Next. |

Select the Virtual Machine Compatibility

You can accept the default ESXi host version for this virtual machine or select a different version, depending on the hosts in your environment.

The default compatibility for this virtual machine is determined by the host on which the virtual machine is created or by the default compatibility settings on the host, cluster, or datacenter. You can select a different compatibility from the default.

Only host versions that are in your environment appear in the **Compatible with** drop-down menu. For information about choices and compatibility strategies, see [“Virtual Machine Compatibility,”](#) on page 107.

Procedure

- ◆ Select the compatibility from the drop-down menu and click **Next**.

Select a Guest Operating System

The guest operating system that you select affects the supported devices and number of virtual CPUs available for the virtual machine. The New Virtual Machine wizard does not install the guest operating system. The wizard uses this information to select appropriate default values, such as the amount of memory needed.

See the *VMware Compatibility Guide* for details.

Beginning with vSphere 5.1, you cannot change the guest operating system after you create the virtual machine. See VMware knowledge base article at <http://kb.vmware.com/kb/2020801>.

When you select a guest operating system, BIOS or Extensible Firmware Interface (EFI) is selected by default, depending on the firmware supported by the operating system. Mac OS X Server guest operating systems support only EFI. If the operating system supports BIOS and EFI, you can change the default from the **Options** tab of the Virtual Machine Properties editor after you create the virtual machine and before you install the guest operating system. If you select EFI, you cannot boot an operating system that supports only BIOS, and the reverse.

IMPORTANT Do not change the firmware after the guest operating system is installed. The guest operating system installer partitions the disk in a particular format, depending on which firmware the installer was booted from. If you change the firmware, you will not be able to boot the guest.

The Mac OS X Server must run on Apple hardware. You cannot power on a Mac OS X Server if it is running on other hardware.

Procedure

- 1 Select the guest operating system family from the **Guest OS Family** drop-down menu.
- 2 Select a guest operating system version from the **Guest OS Version** drop-down menu.

- 3 If you selected **Other** as the guest operating system family, and **Other (32-bit)** or **Other (64-bit)** for the version, type a name for the operating system in the text box.
- 4 Click **Next**.

Customize Virtual Machine Hardware in the vSphere Web Client

Before you deploy a new virtual machine, you have the option to configure the virtual hardware. When you create a virtual machine, the virtual disk is selected by default. You can use the **New device** drop-down menu on the Customize Hardware page to add a new hard disk, select an existing disk, or add an RDM disk.

For information about virtual disk configuration, including instructions for adding different types of disks, see [“Add a Hard Disk to a Virtual Machine in the vSphere Web Client,”](#) on page 134.

For help configuring other virtual machine hardware, see [Chapter 7, “Configuring Virtual Machine Hardware in the vSphere Web Client,”](#) on page 107.

Procedure

- 1 (Optional) To add a new virtual hardware device, select the device from the **New device** drop-down menu and click **Add**.
- 2 (Optional) Expand any device to view and configure the device settings.
- 3 To remove a device, move your cursor over the device and click the **Remove** icon.
This icon appears only for virtual hardware that you can safely remove.
- 4 Click **Next**.

Finish Virtual Machine Creation

Before you deploy the virtual machine, you can review the virtual machine settings.

Procedure

- 1 Review the virtual machine settings and make changes by clicking **Back** to go back to the relevant page.
- 2 Click **Finish**.

The virtual machine appears in the vSphere Web Client inventory.

Installing a Guest Operating System

A virtual machine is not complete until you install the guest operating system and VMware Tools. Installing a guest operating system in your virtual machine is essentially the same as installing it in a physical computer.

The basic steps for a typical operating system are described in this section. See *VMware Guest Operating System Installation* on the VMware website for more information about individual guest operating systems.

Using PXE with Virtual Machines

You can start a virtual machine from a network device and remotely install a guest operating system using a Preboot Execution Environment (PXE). You do not need the operating system installation media. When you turn on the virtual machine, the virtual machine detects the PXE server.

PXE booting is supported for Guest Operating Systems that are listed in the VMware Guest Operating System Compatibility list and whose operating system vendor supports PXE booting of the operating system.

The virtual machine must meet the following requirements:

- Have a virtual disk without operating system software and with enough free disk space to store the intended system software.

- Have a network adapter connected to the network where the PXE server resides.

For details about guest operating system installation, see the *Guest Operating System Installation Guide* at <http://partnerweb.vmware.com/GOSIG/home.html>.

Install a Guest Operating System from Media

You can install a guest operating system from a CD-ROM or from an ISO image. Installing from an ISO image is typically faster and more convenient than a CD-ROM installation.

If the virtual machine's boot sequence progresses too quickly for you to open a console to the virtual machine and enter BIOS or EFI setup, you might need to delay the boot order. See [“Delay the Boot Sequence in the vSphere Client,”](#) on page 230.

Prerequisites

- Verify that the installation ISO image is present on a VMFS datastore or network file system (NFS) volume accessible to the ESXi host.
- Verify that you have the installation instructions that the operating system vendor provides.

Procedure

- 1 Log in to the vCenter Server system or host on which the virtual machine resides.
- 2 Select an installation method.

| Option | Action |
|------------------|--|
| CD-ROM | Insert the installation CD-ROM for your guest operating system into the CD-ROM drive of your ESXi host. |
| ISO image | <ol style="list-style-type: none"> a Right-click the virtual machine and select Edit Settings. The virtual machine Edit Settings dialog box opens. If the Virtual Hardware tab is not preselected, select it. b Select Datastore ISO File from the CD/DVD drop-down menu, and browse for the ISO image for your guest operating system. |

- 3 Right-click the virtual machine and select **Power On**.
A green right arrow appears next to the virtual machine icon in the inventory list.
- 4 Follow the installation instructions that the operating system vendor provides.

What to do next

Install VMware Tools. Installing VMware Tools in the guest operating system is important. Although the guest operating system can run without VMware Tools, you lose important functionality and convenience without them. See the *Installing and Configuring VMware Tools* documentation.

Upload ISO Image Installation Media for a Guest Operating System

You can upload an ISO image file to a datastore from your local computer. You can do this when a virtual machine, host, or cluster does not have access to a datastore or to a shared datastore that has the guest operating system installation media that you require.

Prerequisites

- Verify that the Client Integration Plug-In is installed. See [“Install the Client Integration Plug-In in the vSphere Web Client,”](#) on page 267. The installation process requires you to close any open browsers.
- Required privileges:
 - **Datastore.Browse datastore** on the datastore.

- **Datastore.Low level file operations** on the datastore.

Procedure

- 1 In the inventory, click **Datastores** and on the **Objects** tab, select the datastore to which you will upload the file.
- 2 Click the **Navigate to the datastore file browser** icon () .
- 3 (Optional) Click the **Create a new folder** icon.
- 4 Select the folder that you created or select an existing folder, and click the **Upload a File** icon () .
- 5 If the Client Integration Access Control dialog box appears, click **Allow** to allow the plug-in to access your operating system and proceed with the file upload.
- 6 On the local computer, find the file and upload it.
ISO upload times vary, depending on file size and network upload speed.
- 7 Refresh the datastore file browser to see the uploaded file in the list.

What to do next

After you upload the ISO image installation media, you can configure the virtual machine CD-ROM drive to access the file.

Deploy a Virtual Machine from a Template in the vSphere Web Client

Deploying a virtual machine from a template creates a virtual machine that is a copy of the template. The new virtual machine has the virtual hardware, installed software, and other properties that are configured for the template.

Prerequisites

You must have the following privileges to deploy a virtual machine from a template:

- **Virtual machine.Inventory.Create from existing** on the datacenter or virtual machine folder.
- **Virtual machine.Configuration.Add new disk** on the datacenter or virtual machine folder. Required only if you customize the original hardware by adding a new virtual disk.
- **Virtual machine.Provisioning.Deploy template** on the source template.
- **Resource.Assign virtual machine to resource pool** on the destination host, cluster, or resource pool.
- **Datastore.Allocate space** on the destination datastore.
- **Network.Assign network** on the network to which the virtual machine will be assigned. Required only if you customize the original hardware by adding a new network card.
- **Virtual machine.Provisioning.Customize** on the template or template folder if you are customizing the guest operating system.
- **Virtual machine.Provisioning.Read customization specifications** on the root vCenter Server if you are customizing the guest operating system.

Procedure

- 1 [Start the Deploy a Virtual Machine from a Template Task](#) on page 28

To save time, you can create a virtual machine that is a copy of a configured template. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine, or directly from the template. The wizard provides several options for creating and deploying virtual machines and templates.

2 [Select a Template](#) on page 29

After you select the template from which to deploy the virtual machine, you can optionally select to customize the guest operating system and the virtual machine hardware. You can also select to turn on the virtual machine when you complete the creation procedure. You can change the properties of the guest operating system, such as the computer name, and network and license settings, which helps prevent conflicts that can result if virtual machines with identical settings are deployed. You can add a CD device such as an ISO file to install the guest operating system, or reconfigure the virtual machines' hardware, such as storage or networking, before you deploy the virtual machine.

3 [Select the Virtual Machine Name and Folder](#) on page 29

When you create a virtual machine, you provide a unique name for it. The unique name distinguishes it from existing virtual machines in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the virtual machine, depending on your organizational needs.

4 [Select a Resource](#) on page 30

When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.

5 [Select a Datastore](#) on page 30

Select the datastore or datastore cluster in which to store the virtual machine configuration files and all of the virtual disks. Each datastore might have a different size, speed, availability, and other properties. The available datastores are accessible from the destination resource that you selected. You can select a format for the virtual machine's disks and assign a storage profile.

6 [Select Clone Options](#) on page 31

You can optionally select to customize the guest operating system, customize the virtual machine's hardware, and turn on the virtual machine when you complete the creation procedure. You can customize the guest operating system to change properties, such as the computer name, and network and license settings, which helps prevent conflicts that can result if you deploy virtual machines with identical settings. You can add a CD device such as an ISO file to install the guest operating system or you can reconfigure the virtual machine storage or networking, before you deploy the virtual machine.

7 [Customize the Guest Operating System](#) on page 31

When you customize a guest operating system, you can prevent conflicts that might result if you deploy virtual machines with identical settings, such as duplicate computer names. You can change the computer name, network settings, and license settings. You can customize guest operating systems when you clone a virtual machine or deploy a virtual machine from a template.

8 [Customize Virtual Machine Hardware in the vSphere Web Client](#) on page 32

Before you deploy a new virtual machine, you have the option to configure the virtual hardware. When you create a virtual machine, the virtual disk is selected by default. You can use the **New device** drop-down menu on the Customize Hardware page to add a new hard disk, select an existing disk, or add an RDM disk.

9 [Finish Virtual Machine Creation](#) on page 32

Before you deploy the virtual machine, you can review the virtual machine settings.

Start the Deploy a Virtual Machine from a Template Task

To save time, you can create a virtual machine that is a copy of a configured template. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine, or directly from the template. The wizard provides several options for creating and deploying virtual machines and templates.

If you open the wizard from a template, the Select a creation type page does not appear.

Procedure

- ◆ Select to deploy a virtual machine from a template.

| Option | Description |
|---|---|
| Open the New Virtual Machine wizard from any object in the inventory | a Right-click any inventory object that is a valid parent object of a virtual machine, such as a datacenter, folder, cluster, resource pool, or host, and select New Virtual Machine . b Select Deploy from template and click Next . The Select a name and folder page opens. |
| Open the Deploy From Template wizard from a template | Right-click the template and select Deploy VM from this Template . The Select a name and folder page opens. |

Select a Template

After you select the template from which to deploy the virtual machine, you can optionally select to customize the guest operating system and the virtual machine hardware. You can also select to turn on the virtual machine when you complete the creation procedure. You can change the properties of the guest operating system, such as the computer name, and network and license settings, which helps prevent conflicts that can result if virtual machines with identical settings are deployed. You can add a CD device such as an ISO file to install the guest operating system, or reconfigure the virtual machines' hardware, such as storage or networking, before you deploy the virtual machine.

This page appears only if you opened the New Virtual Machine wizard from a inventory object that is not a template.

NOTE If you start the deploy operation from a template, you select the customization and power options on a later page in the wizard.

Procedure

- 1 Search for or browse to the template.
- 2 (Optional) Select **Customize the operating system** to customize the guest operating system of the virtual machine.
- 3 (Optional) Select **Customize this virtual machine's hardware** to configure the virtual machine's hardware before deployment.
- 4 (Optional) Select **Power On Virtual Machine after creation** to power on the virtual machine after creation is complete.
- 5 Click **Next**.

Select the Virtual Machine Name and Folder

When you create a virtual machine, you provide a unique name for it. The unique name distinguishes it from existing virtual machines in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the virtual machine, depending on your organizational needs.

Folders provide a way to store virtual machines for different groups in an organization and you can set permissions on them. If you prefer a flatter hierarchy, you can put all virtual machines in a datacenter and organize them a different way.

Procedure

- 1 Type a name for the virtual machine.
- 2 Select or search for the datacenter or folder in which to deploy the virtual machine.

- 3 Click **Next**.

Select a Resource

When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.

For example, a virtual machine has access to the memory and CPU resources of the host on which it resides. If you select a cluster for the virtual machine, and the administrator has configured the cluster to take advantage of HA and DRS, the virtual machine will have a greater level of availability.

Procedure

- 1 Search or browse for the host, cluster, vApp, or resource pool for the virtual machine.

If deploying the virtual machine to the selected location might cause compatibility problems, the problems appear at the bottom of the window.

- 2 Click **Next**.

Select a Datastore

Select the datastore or datastore cluster in which to store the virtual machine configuration files and all of the virtual disks. Each datastore might have a different size, speed, availability, and other properties. The available datastores are accessible from the destination resource that you selected. You can select a format for the virtual machine's disks and assign a storage profile.

Procedure

- 1 Select the format for the virtual machine's disks and click **Next**.

| 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. |

- 2 (Optional) Assign a storage profile from the **VM Storage Profile** drop-down menu.

Storage profiles define the storage capabilities that are required by the applications running on the virtual machine.

- 3 Select a datastore location for the virtual disk.

| Option | Action |
|--|--|
| Store the virtual disk and virtual machine configuration files in the same location on a datastore. | Select Store with the virtual machine from the Location drop-down menu. |
| Store the disk in a separate datastore location. | Select Browse from the Location drop-down menu, and select a datastore for the disk. |
| Store all virtual machine files in the same datastore cluster. | <ol style="list-style-type: none"> Select Browse from the Location drop-down menu and select a datastore cluster for the disk. (Optional) If you 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 datastore cluster. |

Select Clone Options

You can optionally select to customize the guest operating system, customize the virtual machine's hardware, and turn on the virtual machine when you complete the creation procedure. You can customize the guest operating system to change properties, such as the computer name, and network and license settings, which helps prevent conflicts that can result if you deploy virtual machines with identical settings. You can add a CD device such as an ISO file to install the guest operating system or you can reconfigure the virtual machine storage or networking, before you deploy the virtual machine.

NOTE If you opened the wizard from an object other than a virtual machine or template, the Select Clone Options page does not appear. These options are available on a different page of the wizard.

Procedure

- 1 Select **Customize the Operating System**.
- 2 Select **Customize this virtual machine's hardware**.
- 3 Select **Power on virtual machine after creation**.
- 4 Click **Next**.

Customize the Guest Operating System

When you customize a guest operating system, you can prevent conflicts that might result if you deploy virtual machines with identical settings, such as duplicate computer names. You can change the computer name, network settings, and license settings. You can customize guest operating systems when you clone a virtual machine or deploy a virtual machine from a template.

Procedure

- 1 Apply a customization specification to the virtual machine.

| Option | Description |
|--|--|
| Select an existing specification | Select a customization specification from the list. |
| Create a specification | Click the Create a new specification icon, and complete the steps in the wizard. See “Customizing Guest Operating Systems,” on page 81. |
| Create a specification from an existing specification | <ol style="list-style-type: none"> Select a customization specification from the list. Click the Create a spec from an existing spec icon, and complete the steps in the wizard. See “Customizing Guest Operating Systems,” on page 81. |

- 2 Click **Next**.

Customize Virtual Machine Hardware in the vSphere Web Client

Before you deploy a new virtual machine, you have the option to configure the virtual hardware. When you create a virtual machine, the virtual disk is selected by default. You can use the **New device** drop-down menu on the Customize Hardware page to add a new hard disk, select an existing disk, or add an RDM disk.

For information about virtual disk configuration, including instructions for adding different types of disks, see [“Add a Hard Disk to a Virtual Machine in the vSphere Web Client,”](#) on page 134.

For help configuring other virtual machine hardware, see [Chapter 7, “Configuring Virtual Machine Hardware in the vSphere Web Client,”](#) on page 107.

Procedure

- 1 (Optional) To add a new virtual hardware device, select the device from the **New device** drop-down menu and click **Add**.
- 2 (Optional) Expand any device to view and configure the device settings.
- 3 To remove a device, move your cursor over the device and click the **Remove** icon.
This icon appears only for virtual hardware that you can safely remove.
- 4 Click **Next**.

Finish Virtual Machine Creation

Before you deploy the virtual machine, you can review the virtual machine settings.

Procedure

- 1 Review the virtual machine settings and make changes by clicking **Back** to go back to the relevant page.
- 2 Click **Finish**.

The virtual machine appears in the vSphere Web Client inventory.

Clone a Virtual Machine in the vSphere Web Client

Cloning a virtual machine creates a virtual machine that is a copy of the original. The new virtual machine is configured with the same virtual hardware, installed software, and other properties that were configured for the original virtual machine.

NOTE When heavily loaded applications, such as load generators, are running in the guest operating system during a clone operation, the virtual machine quiesce operation can fail and VMware Tools might be denied CPU resources and time out.

Prerequisites

If a load generator is running in the virtual machine, stop it before you perform the clone operation.

You must have the following privileges to clone a virtual machine:

- **Virtual machine.Provisioning.Clone virtual machine** on the virtual machine you are cloning.
- **Virtual machine.Inventory.Create from existing** on the datacenter or virtual machine folder.
- **Virtual machine.Configuration.Add new disk** on the datacenter or virtual machine folder.
- **Resource.Assign virtual machine to resource pool** on the destination host, cluster, or resource pool.
- **Datastore.Allocate space** on the destination datastore or datastore folder.
- **Network.Assign network** on the network to which the virtual machine will be assigned.

- **Virtual machine.Provisioning.Customize** on the virtual machine or virtual machine folder if you are customizing the guest operating system.
- **Virtual machine.Provisioning.Read customization specifications** on the root vCenter Server if you are customizing the guest operating system.

Procedure

- 1 [Start the Clone an Existing Virtual Machine Task](#) on page 34
To make an original copy of a virtual machine, you can clone an existing virtual machine. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine. You can also open the wizard directly from the virtual machine that you are going to clone.
- 2 [Select a Virtual Machine to Clone](#) on page 34
You select a virtual machine to clone, and you can optionally select to customize the guest operating system and the virtual machine hardware. You can also select to turn on the virtual machine when you complete the creation procedure. You can change the properties of the guest operating system, such as the computer name, and network and license settings, which helps prevent conflicts that can result if virtual machines with identical settings are deployed. You can add a CD device such as an ISO file to install the guest operating system, or reconfigure the virtual machines' hardware, such as storage or networking, before you deploy the virtual machine.
- 3 [Select the Virtual Machine Name and Folder](#) on page 35
When you create a virtual machine, you provide a unique name for it. The unique name distinguishes it from existing virtual machines in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the virtual machine, depending on your organizational needs.
- 4 [Select a Resource](#) on page 35
When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.
- 5 [Select a Datastore](#) on page 35
Select the datastore or datastore cluster in which to store the virtual machine configuration files and all of the virtual disks. Each datastore might have a different size, speed, availability, and other properties. The available datastores are accessible from the destination resource that you selected. You can select a format for the virtual machine's disks and assign a storage profile.
- 6 [Select Clone Options](#) on page 36
You can optionally select to customize the guest operating system, customize the virtual machine's hardware, and turn on the virtual machine when you complete the creation procedure. You can customize the guest operating system to change properties, such as the computer name, and network and license settings, which helps prevent conflicts that can result if you deploy virtual machines with identical settings. You can add a CD device such as an ISO file to install the guest operating system or you can reconfigure the virtual machine storage or networking, before you deploy the virtual machine.
- 7 [Customize the Guest Operating System](#) on page 36
When you customize a guest operating system, you can prevent conflicts that might result if you deploy virtual machines with identical settings, such as duplicate computer names. You can change the computer name, network settings, and license settings. You can customize guest operating systems when you clone a virtual machine or deploy a virtual machine from a template.
- 8 [Customize Virtual Machine Hardware in the vSphere Web Client](#) on page 37
Before you deploy a new virtual machine, you have the option to configure the virtual hardware. When you create a virtual machine, the virtual disk is selected by default. You can use the **New device** drop-down menu on the Customize Hardware page to add a new hard disk, select an existing disk, or add an RDM disk.

- 9 [Finish Virtual Machine Creation](#) on page 37

Before you deploy the virtual machine, you can review the virtual machine settings.

Start the Clone an Existing Virtual Machine Task

To make an original copy of a virtual machine, you can clone an existing virtual machine. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine. You can also open the wizard directly from the virtual machine that you are going to clone.

If you open the wizard from a virtual machine, the Select a creation type page does not appear.

Procedure

- ◆ Select to clone a virtual machine.

| Option | Description |
|---|--|
| Open the New Virtual Machine wizard from any object in the inventory | a Right-click any inventory object that is a valid parent object of a virtual machine, such as a datacenter, folder, cluster, resource pool, or host, and select New Virtual Machine . b Select Clone an Existing Virtual Machine and click Next . The Select a name and folder page opens. |
| Open the Clone Existing Virtual Machine wizard from a template | Right-click the virtual machine and select Clone . The Select a name and folder page opens. |

Select a Virtual Machine to Clone

You select a virtual machine to clone, and you can optionally select to customize the guest operating system and the virtual machine hardware. You can also select to turn on the virtual machine when you complete the creation procedure. You can change the properties of the guest operating system, such as the computer name, and network and license settings, which helps prevent conflicts that can result if virtual machines with identical settings are deployed. You can add a CD device such as an ISO file to install the guest operating system, or reconfigure the virtual machines' hardware, such as storage or networking, before you deploy the virtual machine.

This page appears only if you opened the New Virtual Machine wizard from a inventory object that is not a template.

NOTE If you start the deploy operation from a template, you select the customization and power options on a later page in the wizard.

Procedure

- 1 Search for or browse to the virtual machine, and select it.
- 2 (Optional) Select **Customize the operating system** to customize the guest operating system of the virtual machine.
- 3 (Optional) Select **Customize this virtual machine's hardware** to configure the virtual machine's hardware before deployment.
- 4 (Optional) Select **Power On Virtual Machine after creation** to power on the virtual machine after creation is complete.
- 5 Click **Next**.

Select the Virtual Machine Name and Folder

When you create a virtual machine, you provide a unique name for it. The unique name distinguishes it from existing virtual machines in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the virtual machine, depending on your organizational needs.

Folders provide a way to store virtual machines for different groups in an organization and you can set permissions on them. If you prefer a flatter hierarchy, you can put all virtual machines in a datacenter and organize them a different way.

Procedure

- 1 Type a name for the virtual machine.
- 2 Select or search for the datacenter or folder in which to deploy the virtual machine.
- 3 Click **Next**.

Select a Resource

When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.

For example, a virtual machine has access to the memory and CPU resources of the host on which it resides. If you select a cluster for the virtual machine, and the administrator has configured the cluster to take advantage of HA and DRS, the virtual machine will have a greater level of availability.

Procedure

- 1 Search or browse for the host, cluster, vApp, or resource pool for the virtual machine.
If deploying the virtual machine to the selected location might cause compatibility problems, the problems appear at the bottom of the window.
- 2 Click **Next**.

Select a Datastore

Select the datastore or datastore cluster in which to store the virtual machine configuration files and all of the virtual disks. Each datastore might have a different size, speed, availability, and other properties. The available datastores are accessible from the destination resource that you selected. You can select a format for the virtual machine's disks and assign a storage profile.

Procedure

- 1 Select the format for the virtual machine's disks and click **Next**.

| 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. |

- (Optional) Assign a storage profile from the **VM Storage Profile** drop-down menu.

Storage profiles define the storage capabilities that are required by the applications running on the virtual machine.

- Select a datastore location for the virtual disk.

| Option | Action |
|--|--|
| Store the virtual disk and virtual machine configuration files in the same location on a datastore. | Select Store with the virtual machine from the Location drop-down menu. |
| Store the disk in a separate datastore location. | Select Browse from the Location drop-down menu, and select a datastore for the disk. |
| Store all virtual machine files in the same datastore cluster. | <ol style="list-style-type: none"> Select Browse from the Location drop-down menu and select a datastore cluster for the disk. (Optional) If you 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 datastore cluster. |

Select Clone Options

You can optionally select to customize the guest operating system, customize the virtual machine's hardware, and turn on the virtual machine when you complete the creation procedure. You can customize the guest operating system to change properties, such as the computer name, and network and license settings, which helps prevent conflicts that can result if you deploy virtual machines with identical settings. You can add a CD device such as an ISO file to install the guest operating system or you can reconfigure the virtual machine storage or networking, before you deploy the virtual machine.

NOTE If you opened the wizard from an object other than a virtual machine or template, the Select Clone Options page does not appear. These options are available on a different page of the wizard.

Procedure

- Select **Customize the Operating System**.
- Select **Customize this virtual machine's hardware**.
- Select **Power on virtual machine after creation**.
- Click **Next**.

Customize the Guest Operating System

When you customize a guest operating system, you can prevent conflicts that might result if you deploy virtual machines with identical settings, such as duplicate computer names. You can change the computer name, network settings, and license settings. You can customize guest operating systems when you clone a virtual machine or deploy a virtual machine from a template.

Procedure

- 1 Apply a customization specification to the virtual machine.

| Option | Description |
|--|--|
| Select an existing specification | Select a customization specification from the list. |
| Create a specification | Click the Create a new specification icon, and complete the steps in the wizard. See “Customizing Guest Operating Systems,” on page 81. |
| Create a specification from an existing specification | <ol style="list-style-type: none"> a Select a customization specification from the list. b Click the Create a spec from an existing spec icon, and complete the steps in the wizard. See “Customizing Guest Operating Systems,” on page 81. |

- 2 Click **Next**.

Customize Virtual Machine Hardware in the vSphere Web Client

Before you deploy a new virtual machine, you have the option to configure the virtual hardware. When you create a virtual machine, the virtual disk is selected by default. You can use the **New device** drop-down menu on the Customize Hardware page to add a new hard disk, select an existing disk, or add an RDM disk.

For information about virtual disk configuration, including instructions for adding different types of disks, see [“Add a Hard Disk to a Virtual Machine in the vSphere Web Client,”](#) on page 134.

For help configuring other virtual machine hardware, see [Chapter 7, “Configuring Virtual Machine Hardware in the vSphere Web Client,”](#) on page 107.

Procedure

- 1 (Optional) To add a new virtual hardware device, select the device from the **New device** drop-down menu and click **Add**.
- 2 (Optional) Expand any device to view and configure the device settings.
- 3 To remove a device, move your cursor over the device and click the **Remove** icon.
This icon appears only for virtual hardware that you can safely remove.
- 4 Click **Next**.

Finish Virtual Machine Creation

Before you deploy the virtual machine, you can review the virtual machine settings.

Procedure

- 1 Review the virtual machine settings and make changes by clicking **Back** to go back to the relevant page.
- 2 Click **Finish**.

The virtual machine appears in the vSphere Web Client inventory.

Clone a Virtual Machine to a Template in the vSphere Web Client

After you create a virtual machine, you can clone it to a template. Templates are master copies of virtual machines that let you create ready-for-use virtual machines. You can make changes to the template, such as installing additional software in the guest operating system, while preserving the original virtual machine.

You cannot modify templates after you create them. To alter an existing template, you must convert it to a virtual machine, make the required changes, and convert the virtual machine back to a template. To preserve the original state of a template, clone the template to a template.

Prerequisites

If a load generator is running in the virtual machine, stop it before you perform the clone operation.

Verify that you have the following privileges:

- **Virtual machine.Provisioning.Create template from virtual machine** on the source virtual machine.
- **Virtual machine.Inventory.Create from existing** on virtual machine folder where the template is created.
- **Resource.Assign virtual machine to resource pool** on the destination host, cluster, or resource pool.
- **Datastore.Allocate space** on all datastores where the template is created.

Procedure

- 1 [Start the Clone a Virtual Machine to a Template Task](#) on page 38
To make a master copy of a virtual machine, you can clone the virtual machine to a template. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine, or directly from the template. The wizard provides several options for creating and deploying virtual machines and templates.
- 2 [Select a Virtual Machine to Clone to a Template](#) on page 39
To clone a virtual machine to a template, you must select an existing virtual machine to clone. You cannot modify a template after you create it. To change the template, you must convert it back to a virtual machine.
- 3 [Select a Name and Location for the Template](#) on page 39
When you deploy a template to the vCenter Server inventory, you provide a unique name for it. The unique name distinguishes it from existing templates in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the template, depending on your organizational needs.
- 4 [Select a Resource for a Virtual Machine Template](#) on page 39
When you deploy a virtual machine template, select a host or cluster resource for the template. The template must be registered with an ESXi host. The host handles all requests for the template and must be running when you create a virtual machine from the template.
- 5 [Select a Datastore for the Virtual Machine Template](#) on page 40
Each virtual machine or virtual machine template requires a folder or directory for its virtual disks and files. When you create a virtual machine or template to deploy to the vCenter Server inventory, select a datastore or datastore cluster for the virtual machine's configuration and other files and all of the virtual disks. Each datastore can have a different size, speed, availability, and other properties.
- 6 [Finish Virtual Machine Template Creation](#) on page 40
Before you deploy the template, you can review the template settings.

Start the Clone a Virtual Machine to a Template Task

To make a master copy of a virtual machine, you can clone the virtual machine to a template. You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine, or directly from the template. The wizard provides several options for creating and deploying virtual machines and templates.

If you open the wizard from a template, the Select a creation type page does not appear.

Procedure

- ◆ Select an option to clone a virtual machine to a template.

| Option | Description |
|---|--|
| Open the New Virtual Machine wizard from any object in the inventory | a Right-click any inventory object that is a valid parent object of a virtual machine, such as a datacenter, folder, cluster, resource pool, or host, and select New Virtual Machine . b Select Clone Virtual Machine to Template and click Next . The Select a name and folder page opens. |
| Open the Clone Virtual Machine to Template wizard from a template | Right-click the virtual machine and select All vCenter Actions > Template > Clone to Template . The Select a name and folder page opens. |

Select a Virtual Machine to Clone to a Template

To clone a virtual machine to a template, you must select an existing virtual machine to clone. You cannot modify a template after you create it. To change the template, you must convert it back to a virtual machine.

This page appears only if you opened the New Virtual Machine wizard from an inventory object other than a virtual machine, such as a host or cluster. If you opened the wizard from a virtual machine, this page does not appear.

Procedure

- 1 Browse or search for the virtual machine and select it.
- 2 Click **Next**.

Select a Name and Location for the Template

When you deploy a template to the vCenter Server inventory, you provide a unique name for it. The unique name distinguishes it from existing templates in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the template, depending on your organizational needs.

Folders provide a way to store virtual machines and templates for different groups in an organization and you can set permissions on them. If you prefer a flatter hierarchy, you can put all virtual machines and templates in a datacenter and organize them a different way.

Procedure

- 1 Type a name for the template.
- 2 Select or search for the datacenter or folder in which to deploy the template.
- 3 Click **Next**.

Select a Resource for a Virtual Machine Template

When you deploy a virtual machine template, select a host or cluster resource for the template. The template must be registered with an ESXi host. The host handles all requests for the template and must be running when you create a virtual machine from the template.

Procedure

- 1 Search or browse for the host or cluster and select it.
Any Compatibility problems appear at the bottom of the window.
- 2 Click **Next**.

Select a Datastore for the Virtual Machine Template

Each virtual machine or virtual machine template requires a folder or directory for its virtual disks and files. When you create a virtual machine or template to deploy to the vCenter Server inventory, select a datastore or datastore cluster for the virtual machine's configuration and other files and all of the virtual disks. Each datastore can have a different size, speed, availability, and other properties.

Procedure

- 1 Select the format for the virtual machine's disks and click **Next**.

| 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. |

- 2 (Optional) Apply a virtual machine Storage Profile from the **VM Storage Profile** drop-down menu.
- 3 Select a datastore location for the virtual disk.

| Option | Action |
|--|--|
| Store the virtual disk and virtual machine configuration files in the same location on a datastore. | Select Store with the virtual machine from the Location drop-down menu. |
| Store the disk in a separate datastore location. | Select Browse from the Location drop-down menu, and select a datastore for the disk. |
| Store all virtual machine files in the same datastore cluster. | <ol style="list-style-type: none"> a Select Browse from the Location drop-down menu and select a datastore cluster for the disk. b (Optional) If you 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 datastore cluster. |

Finish Virtual Machine Template Creation

Before you deploy the template, you can review the template settings.

Procedure

- 1 Review the template settings and make any necessary changes by clicking **Back** to go back to the relevant page.
- 2 Click **Finish**.

The progress of the clone task appears in the Recent Tasks pane. When the task completes, the template appears in the inventory.

Clone a Template to a Template in the vSphere Web Client

After you create a template, you can clone it to a template. Templates are master copies of virtual machines that let you create ready-for-use virtual machines. You can make changes to the template, such as installing additional software in the guest operating system, while preserving the state of the original template.

Prerequisites

Verify that you have the following privileges:

- **Virtual machine.Provisioning.Clone template** on the source template.
- **Virtual machine .Inventory.Create from existing** on the folder where the template is created.
- **Datastore.Allocate space** on all datastores where the template is created.

Procedure

- 1 [Start the Clone a Template to a Template Task](#) on page 41
To make changes to a template and preserve the state of the original template, you clone the template to a template.
- 2 [Select a Template to Clone in the vSphere Web Client](#) on page 42
If you started the New Virtual Machine wizard from an inventory object other than a template, you select a template to clone.
- 3 [Select a Name and Location for the Template](#) on page 42
When you deploy a template to the vCenter Server inventory, you provide a unique name for it. The unique name distinguishes it from existing templates in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the template, depending on your organizational needs.
- 4 [Select a Resource for a Virtual Machine Template](#) on page 42
When you deploy a virtual machine template, select a host or cluster resource for the template. The template must be registered with an ESXi host. The host handles all requests for the template and must be running when you create a virtual machine from the template.
- 5 [Select a Datastore for the Virtual Machine Template](#) on page 43
Each virtual machine or virtual machine template requires a folder or directory for its virtual disks and files. When you create a virtual machine or template to deploy to the vCenter Server inventory, select a datastore or datastore cluster for the virtual machine's configuration and other files and all of the virtual disks. Each datastore can have a different size, speed, availability, and other properties.
- 6 [Finish Virtual Machine Template Creation](#) on page 43
Before you deploy the template, you can review the template settings.

Start the Clone a Template to a Template Task

To make changes to a template and preserve the state of the original template, you clone the template to a template.

You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine, or directly from the template. The wizard provides several options for creating and deploying virtual machines and templates.

If you open the wizard from a template, the Select a creation type page does not appear.

Procedure

- ◆ Select to clone a template to a template.

| Option | Description |
|---|---|
| Open the New Virtual Machine wizard from any object in the inventory | a Right-click any inventory object that is a valid parent object of a virtual machine, such as a datacenter, folder, cluster, resource pool, or host, and select New Virtual Machine . |
| | b Select Clone Template to Template and click Next . The Select a name and folder page opens. |
| Open the Clone Template to Template wizard from a template | a Search or browse for a template. |
| | b Right-click the template and select Clone . The Select a name and folder page opens. |

Select a Template to Clone in the vSphere Web Client

If you started the New Virtual Machine wizard from an inventory object other than a template, you select a template to clone.

This page appears only if you opened the wizard from a nontemplate inventory object, such as a host or cluster. If you opened the Convert Template to Virtual Machine wizard from a template, this page does not appear.

Procedure

- 1 Accept the default template, the template from which you opened the **New Virtual Machine** wizard, or select a different template.
- 2 Click **Next**.

Select a Name and Location for the Template

When you deploy a template to the vCenter Server inventory, you provide a unique name for it. The unique name distinguishes it from existing templates in the virtual machine folder or datacenter. The name can contain up to 80 characters. You can select a datacenter or folder location for the template, depending on your organizational needs.

Folders provide a way to store virtual machines and templates for different groups in an organization and you can set permissions on them. If you prefer a flatter hierarchy, you can put all virtual machines and templates in a datacenter and organize them a different way.

Procedure

- 1 Type a name for the template.
- 2 Select or search for the datacenter or folder in which to deploy the template.
- 3 Click **Next**.

Select a Resource for a Virtual Machine Template

When you deploy a virtual machine template, select a host or cluster resource for the template. The template must be registered with an ESXi host. The host handles all requests for the template and must be running when you create a virtual machine from the template.

Procedure

- 1 Search or browse for the host or cluster and select it.

Any Compatibility problems appear at the bottom of the window.

- 2 Click **Next**.

Select a Datastore for the Virtual Machine Template

Each virtual machine or virtual machine template requires a folder or directory for its virtual disks and files. When you create a virtual machine or template to deploy to the vCenter Server inventory, select a datastore or datastore cluster for the virtual machine's configuration and other files and all of the virtual disks. Each datastore can have a different size, speed, availability, and other properties.

Procedure

- 1 Select the format for the virtual machine's disks and click **Next**.

| 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. |

- 2 (Optional) Apply a virtual machine Storage Profile from the **VM Storage Profile** drop-down menu.
- 3 Select a datastore location for the virtual disk.

| Option | Action |
|--|--|
| Store the virtual disk and virtual machine configuration files in the same location on a datastore. | Select Store with the virtual machine from the Location drop-down menu. |
| Store the disk in a separate datastore location. | Select Browse from the Location drop-down menu, and select a datastore for the disk. |
| Store all virtual machine files in the same datastore cluster. | <ol style="list-style-type: none"> a Select Browse from the Location drop-down menu and select a datastore cluster for the disk. b (Optional) If you 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 datastore cluster. |

Finish Virtual Machine Template Creation

Before you deploy the template, you can review the template settings.

Procedure

- 1 Review the template settings and make any necessary changes by clicking **Back** to go back to the relevant page.
- 2 Click **Finish**.

The progress of the clone task appears in the Recent Tasks pane. When the task completes, the template appears in the inventory.

Convert a Template to a Virtual Machine in the vSphere Web Client

Converting a template to a virtual machine changes the template. This action does not make a copy. You convert a template to a virtual machine to edit the template. You might also convert a template to a virtual machine if you do not need to preserve it as a master image for deploying virtual machines.

Prerequisites

Verify that you have the following privileges:

- **Virtual machine.Provisioning.MarkAsVM on the source template.**
- **Resource.AssignVMToPool** on the resource pool where the virtual machine will run.

Procedure

- 1 [Start the Convert a Template to a Virtual Machine Task](#) on page 44
To reconfigure a template with new or updated hardware or applications, you must convert the template to a virtual machine and clone the virtual machine back to a template. In some cases, you might convert a template to a virtual machine because you no longer need the template.
- 2 [Select a Template from Which to Deploy the Virtual Machine](#) on page 45
On the Select a template page of the wizard, you select a template to deploy from the list.
- 3 [Select a Resource](#) on page 45
When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.
- 4 [Finish Virtual Machine Creation](#) on page 45
Before you deploy the virtual machine, you can review the virtual machine settings.

Start the Convert a Template to a Virtual Machine Task

To reconfigure a template with new or updated hardware or applications, you must convert the template to a virtual machine and clone the virtual machine back to a template. In some cases, you might convert a template to a virtual machine because you no longer need the template.

You can open the New Virtual Machine wizard from any object in the inventory that is a valid parent object of a virtual machine, or directly from the template. The wizard provides several options for creating and deploying virtual machines and templates.

If you open the wizard from a template, the Select a creation type page does not appear.

This task provides steps to convert a template to a virtual machine. To clone a virtual machine back to a template, see [Clone a Virtual Machine to a Template in the vSphere Web Client](#).

Procedure

- ◆ Select how to convert a template to a virtual machine.

| Option | Description |
|---|---|
| Open the New Virtual Machine wizard from any object in the inventory | a Right-click any inventory object that is a valid parent object of a virtual machine, such as a datacenter, folder, cluster, resource pool, or host, and select New Virtual Machine . b Select Convert template to virtual machine and click Next . The Select a resource page opens. |
| Open the Convert Template to Virtual Machine wizard from a template | a Search or browse for a template. b Right-click the template and select Convert to Virtual Machine . The Select a resource page opens. |

Select a Template from Which to Deploy the Virtual Machine

On the Select a template page of the wizard, you select a template to deploy from the list.

This page appears only if you opened the New Virtual Machine wizard from a nontemplate inventory object, such as a host or cluster. If you opened the Convert Template to Virtual Machine wizard from a template, this page does not appear.

Procedure

- 1 Browse or search to locate a template.
- 2 Select the template.
- 3 Click **Next**.

Select a Resource

When you deploy a virtual machine, you select the host, cluster, vApp, or resource pool for the virtual machine to run in. The virtual machine will have access to the resources of the selected object.

For example, a virtual machine has access to the memory and CPU resources of the host on which it resides. If you select a cluster for the virtual machine, and the administrator has configured the cluster to take advantage of HA and DRS, the virtual machine will have a greater level of availability.

Procedure

- 1 Search or browse for the host, cluster, vApp, or resource pool for the virtual machine.
 If deploying the virtual machine to the selected location might cause compatibility problems, the problems appear at the bottom of the window.
- 2 Click **Next**.

Finish Virtual Machine Creation

Before you deploy the virtual machine, you can review the virtual machine settings.

Procedure

- 1 Review the virtual machine settings and make changes by clicking **Back** to go back to the relevant page.
- 2 Click **Finish**.

The virtual machine appears in the vSphere Web Client inventory.

Customizing Guest Operating Systems in the vSphere Web Client

When you clone a virtual machine or deploy a virtual machine from a template, you can customize the guest operating system of the virtual machine to change properties such as the computer name, network settings, and license settings.

Customizing guest operating systems can help prevent conflicts that can result if virtual machines with identical settings are deployed, such as conflicts due to duplicate computer names.

You can specify the customization settings by launching the Guest Customization wizard during the cloning or deployment process. Alternatively, you can create customization specifications, which are customization settings stored in the vCenter Server database. During the cloning or deployment process, you can select a customization specification to apply to the new virtual machine.

Use the Customization Specification Manager to manage customization specifications you create with the Guest Customization wizard.

Guest Operating System Customization Requirements

To customize the guest operating system, you must configure the virtual machine and guest to meet VMware Tools and virtual disk requirements. Other requirements apply, depending on the guest operating system type.

VMware Tools Requirements

The current version of VMware Tools must be installed on the virtual machine or template to customize the guest operating system during cloning or deployment.

Virtual Disk Requirements

The guest operating system being customized must be installed on a disk attached as SCSI node 0:0 in the virtual machine configuration.

Windows Requirements

Customization of Windows guest operating systems requires the following conditions:

- Microsoft Sysprep tools must be installed on the vCenter Server system. See [Chapter 6, “Installing the Microsoft Sysprep Tool,”](#) on page 103.
- The ESXi host that the virtual machine is running on must be 3.5 or later.

Guest operating system customization is supported on multiple Windows operating systems.

Linux Requirements

Customization of Linux guest operating systems requires that Perl is installed in the Linux guest operating system.

Guest operating system customization is supported on multiple Linux distributions.

Verifying Customization Support for a Guest Operating System

To verify customization support for Windows operating systems or Linux distributions and compatible ESXi hosts, see the *VMware Compatibility Guide* at VMware.com. You can use this online tool to search for the guest operating system and ESXi version. After the tool generates your list, click the guest operating system to see whether guest customization is supported.

Create a vCenter Server Application to Generate Computer Names and IP Addresses in the vSphere Web Client

As an alternative to entering computer names and IP addresses for virtual NICs when you customize guest operating systems, you can create a custom application and configure it so that vCenter Server can generate the names and addresses.

The application can be an arbitrary executable binary or script file appropriate for the corresponding operating system in which vCenter Server is running. After you configure an application and make it available to vCenter Server, each time you initiate a guest operating system customization for a virtual machine, vCenter Server executes the application.

The application must comply with the reference XML file in the VMware knowledge base article at <http://kb.vmware.com/kb/2007557>.

Prerequisites

Verify that Perl is installed on vCenter Server.

Procedure

- 1 Create the application and save it on the vCenter Server system's local disk.
- 2 Select a vCenter Server instance in the inventory.
- 3 Click the **Manage** tab, click **Settings**, and click **Advanced Settings**.
- 4 Click **Edit** and enter the configuration parameters for the script.
 - a In the **Key** text box, type `config.guestcust.name-ip-generator.arg1`.
 - b In the **Value** text box, type `c:\sample-generate-name-ip.pl` and click **Add**.
 - c In the **Key** text box, type `config.guestcust.name-ip-generator.arg2`.
 - d In the **Value** text box, type the path to the script file on the vCenter Server system and click **Add**. For example, type `c:\sample-generate-name-ip.pl`.
 - e In the **Key** text box, type `config.guestcust.name-ip-generator.program`.
 - f In the **Value** text box, type `c:\perl\bin\perl.exe` and click **Add**.
- 5 Click **OK**.

You can select the option to use an application to generate computer names or IP addresses during guest operating system customization.

Customize Windows During Cloning or Deployment in the vSphere Web Client

You can customize Windows guest operating systems for the virtual machine when you deploy a new virtual machine from a template or clone an existing virtual machine. Customizing the guest helps prevent conflicts that can result if virtual machines with identical settings are deployed, such as duplicate computer names.

You can prevent Windows from assigning new virtual machines or templates with the same Security IDs (SIDs) as the original virtual machine. Duplicate SIDs do not cause problems when the computers are part of a domain and only domain user accounts are used. However, if the computers are part of a Workgroup or local user accounts are used, duplicate SIDs can compromise file access controls. For more information, see the documentation for your Microsoft Windows operating system.

IMPORTANT The default administrator password is not preserved for Windows Server 2008 after customization. During customization, the Windows Sysprep utility deletes and recreates the administrator account on Windows Server 2008. You must reset the administrator password when the virtual machine starts the first time after customization.

Prerequisites

Verify that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Start the Guest Customization wizard when you clone a virtual machine or deploy from a template. See [“Clone a Virtual Machine in the vSphere Client,”](#) on page 70 or [“Deploy a Virtual Machine from a Template in the vSphere Client,”](#) on page 76.

Procedure

- 1 On the Select clone options page of the Clone Existing Virtual Machine wizard, select **Customize the operating system** and click **Next**.
- 2 Type the virtual machine owner’s name and organization and click **Next**.
- 3 Enter the guest operating system’s computer name.

The operating system uses this name to identify itself on the network. On Linux systems, it is called the host name.

| Option | Action |
|--|---|
| Enter a name | <p>a Type a name.</p> <p>The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive.</p> <p>b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This action appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 63 characters when combined with the numeric value.</p> |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 63 characters, it is truncated. |
| Enter a name in the Clone/Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 4 Provide licensing information for the Windows operating system and click **Next**.

| Option | Action |
|---|--|
| For non-server operating systems | Type the Windows product key for the new guest operating system. |
| For server operating systems | a Type the Windows product key for the new guest operating system. b Select Include Server License Information . c Select either Per seat or Per server . d If you selected Per server , enter the maximum number of simultaneous connections for the server to accept. |

- 5 Configure the administrator password for the virtual machine and click **Next**.

- a Type a password for the administrator account and confirm the password by typing it again.

NOTE You can change the administrator password only if the administrator password on the source Windows virtual machine is blank. If the source Windows virtual machine or template already has a password, the administrator password does not change.

- b (Optional) To log users into the guest operating system as Administrator, select the check box, and select the number of times to log in automatically.

- 6 Select the time zone for the virtual machine and click **Next**.

- 7 (Optional) On the Run Once page, specify commands to run the first time a user logs into the guest operating system and click **Next**.

See the Microsoft Sysprep documentation for information about RunOnce commands.

- 8 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|--|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | a Select Custom settings and click Next . b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK . d When all network interfaces are configured, click Next . |

- 9 Select how the virtual machine will participate in the network and click **Next**.

| Option | Action |
|------------------------------|--|
| Workgroup | Type a workgroup name. For example, MSHOME . |
| Windows Server Domain | a Type the domain name. b Type the user name and password for a user account that has permission to add a computer to the specified domain. |

- 10 Select Generate New Security ID (SID) and click **Next**.

A Windows Security ID (SID) is used in some Windows operating systems to uniquely identify systems and users. If you do not select this option, the new virtual machine has the same SID as the virtual machine or template from which it was cloned or deployed.

- 11 Save the customized options as an .xml file.

- a Select **Save this customization specification for later use**.
- b Specify the filename for the specification and click **Next**.

- 12 Click **Finish** to save your changes.

You return to the Deploy Template or to the Clone Virtual Machine wizard. The customization is finished after you complete the Deploy Template or the Clone Virtual Machine wizard.

When the new virtual machine starts for the first time, the guest operating system runs finalization scripts to complete the customization process. The virtual machine might restart several times during this process.

If the guest operating system pauses when the new virtual machine starts, it might be waiting for you to correct errors, such as an incorrect product key or an invalid user name. Open the virtual machine's console to determine whether the system is waiting for information.

What to do next

After you deploy and customize versions of Windows XP or Windows 2003 that are not volume licensed, you might need to reactivate your operating system on the new virtual machine.

If the new virtual machine encounters customization errors while it is starting, the errors are logged to %WINDIR%\temp\vmware-imc. To view the error log file, click the Windows **Start** button and select **Programs > Administrative Tools > Event Viewer**.

Customize Linux During Cloning or Deployment in the vSphere Web Client

In the process of deploying a new virtual machine from a template or cloning an existing virtual machine, you can customize Linux guest operating systems for the virtual machine.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

To perform this procedure, start the Customization wizard when you clone a virtual machine or deploy one from a template. See [“Clone a Virtual Machine in the vSphere Client,”](#) on page 70 or [“Deploy a Virtual Machine from a Template in the vSphere Client,”](#) on page 76.

Procedure

- 1 On the Select clone options page of the Clone Existing Virtual Machine wizard, select **Customize the operating system** and click **Next**.
- 2 Enter the guest operating system's computer name.

The operating system uses this name to identify itself on the network. On Linux systems, it is called the host name.

| Option | Action |
|-------------------------------------|---|
| Enter a name | <ol style="list-style-type: none"> a Type a name. The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive. b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This action appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 63 characters when combined with the numeric value. |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 63 characters, it is truncated. |

| Option | Action |
|--|---|
| Enter a name in the Clone/Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 3 Enter the **Domain Name** for the computer and click **Next**.
- 4 Select the time zone for the virtual machine and click **Next**.
- 5 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 6 Enter DNS and domain settings.
- 7 Save the customized options as an .xml file.
 - a Select **Save this customization specification for later use**.
 - b Specify the filename for the specification and click **Next**.
- 8 Click **Finish** to save your changes.

You return to the Deploy Template or to the Clone Virtual Machine wizard. The customization is finished after you complete the Deploy Template or the Clone Virtual Machine wizard.

When the new virtual machine starts for the first time, the guest operating system runs finalization scripts to complete the customization process. The virtual machine might restart several times during this process.

If the guest operating system pauses when the new virtual machine starts, it might be waiting for you to correct errors, such as an incorrect product key or an invalid user name. Open the virtual machine's console to determine whether the system is waiting for information.

What to do next

If the new virtual machine encounters customization errors while it is starting, the errors are reported using the guest's system logging mechanism. View the errors by opening `/var/log/vmware-
imc/toolsDeployPkg.log`.

Creating and Managing Customization Specifications in the vSphere Web Client

You can create and manage customization specifications for Windows and Linux guest operating systems. Customization specifications are XML files that contain guest operating system settings for virtual machines. When you apply a specification to the guest operating system during virtual machine cloning or deployment, you prevent conflicts that might result if you deploy virtual machines with identical settings, such as duplicate computer names.

vCenter Server saves the customized configuration parameters in the vCenter Server database. If the customization settings are saved, the administrator and domain administrator passwords are stored in encrypted format in the database. Because the certificate used to encrypt the passwords is unique to each vCenter Server system, if you reinstall vCenter Server or attach a new instance of the server to the database, the encrypted passwords become invalid. You must reenter the passwords before you can use them.

Create a Customization Specification for Linux in the vSphere Web Client

Use the Guest Customization wizard to save guest operating system settings in a specification that you can apply when cloning virtual machines or deploying from templates.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Procedure

- 1 From the vSphere Client Home inventory page, select **Rules and Profiles > Customization Specification Manager**.
- 2 Click the **Create a New specification** icon.
- 3 Select Linux from the **Target VM Operating System** drop-down menu.
- 4 On the Set Registration Information page, type the virtual machine owner’s name and organization and click **Next**.
- 5 Enter the guest operating system’s computer name.

The operating system uses this name to identify itself on the network. On Linux systems, it is called the host name.

| Option | Action |
|--|---|
| Enter a name | <ol style="list-style-type: none"> a Type a name. The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive. b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This action appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 63 characters when combined with the numeric value. |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 63 characters, it is truncated. |
| Enter a name in the Clone/Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 6 Enter the **Domain Name** for the computer and click **Next**.

- 7 Select the time zone for the virtual machine and click **Next**.
- 8 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|--------------------------|---|
| Standard settings | Select Use standard network settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Manually select custom settings. b For each network interface in the virtual machine, click the pencil icon. c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 9 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 10 Enter DNS and domain settings.
- 11 Click **Finish** to save your changes.

The customization specification that you created is listed in the Customization Specification Manager. You can use the specification to customize virtual machine guest operating systems.

Create a Customization Specification for Windows in the vSphere Web Client

Use the Guest Customization wizard to save Windows guest operating system settings in a specification that you can apply when cloning virtual machines or deploying from templates.

NOTE The default administrator password is not preserved for Windows Server 2008 after customization. During customization, the Windows Sysprep utility deletes and recreates the administrator account on Windows Server 2008. You must reset the administrator password when the virtual machine starts the first time after customization.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Procedure

- 1 From the vSphere Client Home inventory page, select **Rules and Profiles > Customization Specification Manager**.
- 2 Click the **Create a new specification** icon to open the New VM Guest Customization Spec wizard.
- 3 Select Windows from the **Target VM Operating System** drop-down menu, and enter a name and optional description for the specification and click **Next**.
- 4 On the Set Registration Information page, type the virtual machine owner’s name and organization and click **Next**.

- 5 Enter the guest operating system's computer name.

The operating system uses this name to identify itself on the network. On Linux systems, it is called the host name.

| Option | Action |
|--|---|
| Enter a name | <p>a Type a name.</p> <p>The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive.</p> <p>b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This action appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 63 characters when combined with the numeric value.</p> |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 63 characters, it is truncated. |
| Enter a name in the Clone/Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 6 Provide licensing information for the Windows operating system and click **Next**.

| Option | Action |
|--|--|
| For nonserver operating systems | Type the Windows product key for the new guest operating system. |
| For server operating systems | <p>a Type the Windows product key for the new guest operating system.</p> <p>b Select Include Server License Information.</p> <p>c Select either Per seat or Per server.</p> <p>d If you select Per server, enter the maximum number of simultaneous connections for the server to accept.</p> |

- 7 Configure the administrator password for the virtual machine and click **Next**.

- a Type a password for the administrator account and confirm the password by typing it again.

NOTE You can change the administrator password only if the administrator password on the source Windows virtual machine is blank. If the source Windows virtual machine or template already has a password, the administrator password does not change.

- b (Optional) To log users into the guest operating system as Administrator, select the check box, and select the number of times to log in automatically.

- 8 Select the time zone for the virtual machine and click **Next**.

- 9 (Optional) On the Run Once page, specify commands to run the first time a user logs into the guest operating system and click **Next**.

See the Microsoft Sysprep documentation for information about RunOnce commands.

- 10 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|--------------------------|---|
| Standard settings | Select Use standard network settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ul style="list-style-type: none"> a Select Manually select custom settings. b For each network interface in the virtual machine, click the pencil icon. c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 11 Select how the virtual machine will participate in the network and click **Next**.

| Option | Action |
|------------------------------|--|
| Workgroup | Type a workgroup name. For example, MSHOME . |
| Windows Server Domain | <ul style="list-style-type: none"> a Type the domain name. b Type the user name and password for a user account that has permission to add a computer to the specified domain. |

- 12 (Optional) Select **Generate New Security ID (SID)** and click **Next**.

A Windows Security ID (SID) is used in some Windows operating systems to uniquely identify systems and users. If you do not select this option, the new virtual machine has the same SID as the virtual machine or template from which it was cloned or deployed.

Duplicate SIDs do not cause problems when the computers are part of a domain and only domain user accounts are used. However, if the computers are part of a Workgroup or local user accounts are used, duplicate SIDs can compromise file access controls. For more information, see the documentation for your Microsoft Windows operating system.

- 13 Click **Finish** to save your changes.

The customization specification that you created is listed in the Customization Specification Manager. You can use the specification to customize virtual machine guest operating systems.

Create a Customization Specification for Windows Using a Custom Sysprep Answer File in the vSphere Web Client

A custom sysprep answer file is a file that stores a number of customization settings such as computer name, licensing information, and workgroup or domain settings. You can supply a custom sysprep answer file as an alternative to specifying many of the settings in the Guest Customization wizard.

Windows 2000, Windows Server 2003, and Windows XP use a text file called `sysprep.inf`. Windows Server 2008, Windows Vista, and Windows 7 use an XML file called `sysprep.xml`. You can create these files using a text editor, or use the Microsoft Setup Manager utility to generate them. For more information about how to create a custom sysprep answer file, see the documentation for the relevant operating system.

You can prevent Windows from assigning new virtual machines or templates with the same Security IDs (SIDs) as the original virtual machine. Duplicate SIDs do not cause problems when the computers are part of a domain and only domain user accounts are used. However, if the computers are part of a Workgroup or local user accounts are used, duplicate SIDs can compromise file access controls. For more information, see the documentation for your Microsoft Windows operating system.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Click **New**.
- 3 In the Guest Customization wizard, select Windows from the **Target Virtual Machine OS** menu.
- 4 (Optional) Select **Use Custom Sysprep Answer File**.
- 5 Under Customization Specification Information, enter a name for the specification and an optional description and click **Next**.
- 6 Select the option to import or create a sysprep answer file and click **Next**.

| Option | Description |
|-------------------------------------|--|
| Import a Sysprep answer file | Click Browse and browse to the file. |
| Create a Sysprep answer file | Type the contents of the file in the text box. |

- 7 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 8 Select **Generate New Security ID (SID)** and click **Next**.

A Windows Security ID (SID) is used in some Windows operating systems to uniquely identify systems and users. If you do not select this option, the new virtual machine has the same SID as the virtual machine or template from which it was cloned or deployed.

- 9 Click **Finish** to save your changes.

The customization specification that you created is listed in the Customization Specification Manager. You can use the specification to customize virtual machine guest operating systems.

Edit a Customization Specification in the vSphere Web Client

You can edit existing specifications using the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Edit**.
- 3 Proceed through the Guest Customization wizard to change specification settings.

Remove a Customization Specification in the vSphere Web Client

You can remove customization specifications from the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Remove**.
- 3 In the confirmation dialog box, select **Yes**.

The specification is deleted from the disk.

Copy a Customization Specification in the vSphere Web Client

You can copy an existing customization specification using the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Copy**.

A new specification is created, *Copy of specification_name*.

Export a Customization Specification in the vSphere Web Client

You can export customization specifications and save them as .xml files. To apply an exported specification to a virtual machine, import the .xml file using the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Export**.
- 3 In the **Save As** dialog, enter a file name and location.
- 4 Click **Save**.

The specification is saved as an .xml file to the location you specified.

Import a Customization Specification in the vSphere Web Client

You can import an existing specification using the Customization Specification Manager, and use the specification to customize the guest operating system of a virtual machine.

Prerequisites

Before you begin, you must have at least one customization specification saved as an xml file located on a file system accessible from the vSphere Client.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Click **Import**.
- 3 From the Open dialog, browse to the .xml to import and click **Open**.

The imported specification is added to the list of customization specifications.

Deploying Virtual Machines in the vSphere Client

4

To deploy virtual machines in the vCenter Server inventory, you can deploy from a template, create a virtual machine, or clone an existing virtual machine.

This chapter includes the following topics:

- [“Creating a Virtual Machine in the vSphere Client,”](#) on page 59
- [“Working with Templates and Clones in the vSphere Client,”](#) on page 70
- [“Customizing Guest Operating Systems,”](#) on page 81

Creating a Virtual Machine in the vSphere Client

Virtual machines are the key component in a virtual infrastructure. You can create a single virtual machine to add to the vSphere inventory.

When you create a virtual machine, you associate it to a particular datacenter, host, cluster, or resource pool, and a datastore. After you turn on the virtual machine, it consumes resources dynamically as the workload increases, or it returns resources dynamically as the workload decreases.

Every virtual machine has virtual devices that provide the same function as physical hardware. A virtual machine gets CPU and memory, access to storage, and network connectivity from the host it runs on.

Start the Virtual Machine Creation Process in the vSphere Client

You use the Create New Virtual Machine wizard to create a virtual machine to place in the vSphere inventory. You open the wizard from the vSphere Client.

The selections you make in the New Virtual Machine wizard are not saved until you click **Finish** on the Ready to Complete page. If you cancel the wizard without completing all tasks, you cannot resume the wizard where you left off. You must start a new creation task.

You can create a new virtual machine in a datacenter, host, cluster, resource pool, or virtual machine folder.

Prerequisites

Verify that you have the following privileges:

- **Host.Local operations.Create virtual machine**
- **Virtual machine.Inventory.Create new** on the destination folder or datacenter.
- **Virtual machine.Configuration.Add new disk** on the destination folder or datacenter, if you are adding a new disk.
- **Virtual machine.Configuration.Add existing disk** on the destination folder or datacenter, if you are adding an existing disk.

- **Virtual machine.Configuration.Raw device** on the destination folder or datacenter, if you are using a RDM or SCSI pass-through device.
- **Virtual Machine.Configuration.Network**
- **Resource.Assign virtual machine to resource pool** on the destination host, cluster, or resource pool.
- **Datastore.Allocate space** on the destination datastore or datastore folder.
- **Network.Assign network** on the network that the virtual machine will be assigned to.

Procedure

- 1 Display the inventory objects in the vSphere Client by using the **Host and Clusters** view or the **VM and Templates** view.
- 2 Right-click an object and select **New > Virtual Machine**.

The New Virtual Machine wizard opens.

What to do next

Select a **Typical** or **Custom** configuration option in the New Virtual Machine wizard.

Select a Configuration Option for the New Virtual Machine in the vSphere Client

The **Typical** option shortens the virtual machine creation process by skipping choices that you rarely need to change from their defaults. The **Custom** option provides more flexibility and choices.

Several relationships affect the information that you must provide during virtual machine creation. These relationships include the inventory object on which you place the virtual machine, the customization path option you select, the datastore on which the virtual machine and its files reside, and the host or cluster on which it runs.

If you select a **Typical** configuration, the virtual machine hardware version defaults to that of the host on which you place the virtual machine. If you select a **Custom** configuration, you can accept the default or select an earlier hardware version. This configuration is useful if maintaining compatibility with an earlier version of an ESX/ESXi host is necessary.

Prerequisites

For a **Typical** configuration, verify that you have the following information:

- Virtual machine name and inventory location.
- Location in which to place the virtual machine (cluster, host, resource pool).
- Datastore on which to store the virtual machine's files.
- Guest operating system and version.
- Parameters for the virtual disk size and provisioning settings.

In addition to the information for a **Typical** configuration, for a **Custom** configuration, verify that you have the following information:

- Virtual machine version.
- Number of CPUs and memory size.
- Number of NICs, network to connect to, and network adapter types.
- SCSI controller type.
- Disk type (new disk, existing disk, RDM, or no disk).

Procedure

- 1 On the Configuration page of the New Virtual Machine wizard, select an option for creating the virtual machine.
- 2 Click **Next**.
The Name and Location page appears.

What to do next

Select a name and location for the virtual machine.

Enter a Name and Location for the Virtual Machine in the vSphere Client

The name you enter is used as the virtual machine's base name in the inventory. It is also used as the name of the virtual machine's files.

The name can be up to 80 characters long. If you are connected to vCenter Server and have folders in your inventory, names must be unique within the folder. Names are not case-sensitive, so the name `my_vm` is identical to `My_Vm`.

Prerequisites

Verify that you have an appropriate naming strategy in place.

Procedure

- 1 On the Name and Location page of the New Virtual Machine wizard, type a name.
- 2 Select a folder or the root of the datacenter.
- 3 Click **Next**.
The Host / Cluster or the Resource Pool page opens.

Select a Host or Cluster in the vSphere Client

You can place the virtual machine in a cluster or on a host that is not in a cluster.

A cluster is a collection of ESXi hosts and associated virtual machines with shared resources and a shared management interface. Grouping hosts into clusters allows you to enable many optional features that enhance the availability and flexibility of your infrastructure.

Procedure

- 1 On the Host / Cluster page of the New Virtual Machine wizard, select the host or cluster where you want to run the virtual machine.
- 2 Click **Next**.
If resource pools are configured on the host, the Resource Pool page opens. Otherwise, the Datastore page opens.

What to do next

Select a resource pool or a datastore on which to run the virtual machine.

Select a Resource Pool in the vSphere Client

Resource pools let you manage your computing resources within a host or cluster by setting them up in a meaningful hierarchy. Virtual machines and child resource pools share the resources of the parent resource pool.

The Resource Pool page appears only when resource pools are configured on the host.

Procedure

- 1 On the Resource Pool page of the New Virtual Machine wizard, navigate to the resource pool where you want to run the virtual machine.
- 2 Select the resource pool and click **Next**.
The virtual machine is placed in the resource pool you selected.

What to do next

Select a datastore in which to store the virtual machine files.

Select a Datastore in the vSphere Client

Datastores are logical containers that hide specifics of each storage device and provide a uniform model for storing virtual machine files. You can use datastores to store ISO images and virtual machine templates.

You can select from datastores already configured on the destination host or cluster.

Prerequisites

Required privileges:

- **Host.Local operations.Create virtual machine**
- **Virtual machine.Inventory.Create**
- **Datastore.Allocate space**

Procedure

- 1 On the Storage page of the New Virtual Machine wizard, select a datastore in which to store the virtual machine files.
- 2 (Optional) To turn off Storage DRS for the virtual machine, select **Disable Storage DRS for this virtual machine**.
- 3 (Optional) Apply a virtual machine storage profile from the **VM Storage Profile** drop-down menu.
Select a datastore that is compatible with the virtual machine storage profile and large enough to hold the virtual machine and all of its virtual disk files.
The list of datastores shows which datastores are compatible with the selected virtual machine storage profile.
- 4 Click **Next**.
If you selected a Typical configuration path, the Guest Operating System page appears. If you selected a Custom configuration path, the Virtual Machine Version page appears.

Select a Virtual Machine Version in the vSphere Client

If the host or cluster where you place the virtual machine supports more than one VMware virtual machine version, you can select a version for the virtual machine.

For virtual machine and host compatibility options, see [“Virtual Machine Hardware Versions,”](#) on page 178.

Procedure

- 1 Select a virtual machine hardware version.

| Option | Description |
|----------------------------------|---|
| Virtual machine version 8 | Compatible with ESXi 5.0 and later hosts. Provides the latest virtual machine features. Recommended for virtual machines that do not need to migrate to ESX/ESXi 4.x hosts. |
| Virtual machine version 7 | Compatible with ESX/ESXi 4, 4.x and 5.0 hosts. Recommended for sharing storage or virtual machines with ESX/ESXi versions 3.5 to 4.1. |
| Virtual machine version 4 | Compatible with ESX/ESXi 4.0 and later hosts. Recommended for virtual machines that need to run on ESX/ESXi 4 hosts. |

- 2 Click **Next**.

The Guest Operating System page opens.

What to do next

Select a guest operating system for the virtual machine.

Select an Operating System in the vSphere Client

The guest operating system that you select affects the supported devices and number of virtual CPUs available to the virtual machine.

The New Virtual Machine wizard does not install the guest operating system. The wizard uses this information to select appropriate default values, such as the amount of memory needed.

When you select a guest operating system, BIOS or Extensible Firmware Interface (EFI) is selected by default, depending on the firmware supported by the operating system. Mac OS X Server guest operating systems support only EFI. If the operating system supports BIOS and EFI, you can change the default from the Options tab of the Virtual Machine Properties editor after you create the virtual machine and before you install the guest operating system. If you select EFI, you cannot boot an operating system that supports only BIOS, and the reverse.

IMPORTANT Do not change the firmware after the guest operating system is installed.

The Mac OS X Server must run on Apple hardware. You cannot power on a Mac OS X Server if it is running on other hardware.

Procedure

- 1 On the Guest Operating System page of the New Virtual Machine wizard, select an operating system family.
- 2 Select an operating system and version from the drop-down menu and click **Next**.

If you selected a Novell NetWare guest operating system, the Memory page opens. If any of the total cores available on the host, the maximum virtual CPUs supported by the virtual machine hardware version, or the maximum supported CPUs on the guest operating system equal 1, the virtual machine CPU count is set to 1 and the Memory page opens.

- 3 If you selected **Other (32-bit)** or **Other (64-bit)**, enter a name for the operating system in the text box.
- 4 Click **Next**.

What to do next

You can add memory or CPUs for the virtual machine.

Select the Number of Virtual CPUs in the vSphere Client

You can configure a virtual machine to have up to 32 virtual CPUs. The number of licensed CPUs on the host, the number of CPUs that the guest operating system supports, and the virtual machine hardware version determine the number of virtual CPUs that you can add.

VMware Virtual Symmetric Multiprocessing (Virtual SMP) enables a single virtual machine to use multiple physical processors simultaneously. You must have Virtual SMP to power on multiprocessor virtual machines.

Procedure

- 1 On the CPUs page of the New Virtual Machine wizard, select a value from the **Number of virtual sockets** drop-down menu.
- 2 Select a value from the **Number of cores per socket** drop-down menu.

To determine the total number of cores, multiply the number of cores per socket by the number of virtual sockets. The resulting total number of cores is a number equal to or less than the number of logical CPUs on the host.

The total number of cores appears.

- 3 Click **Next**.

The Memory page opens.

What to do next

Select the memory for the virtual machine.

Configure Virtual Memory in the vSphere Client

The amount of memory that you allocate for a virtual machine is the amount of memory that the guest operating system detects.

Minimum memory size is 4MB for virtual machines that use BIOS firmware. Virtual machines that use EFI firmware require at least 96MB of RAM or they cannot power on.

Maximum memory size for a virtual machine depends on the host's physical memory and the virtual machine's hardware version.

If the virtual machine memory is greater than the host memory size, swapping occurs, which can have a severe effect on virtual machine performance. The memory size must be a multiple of 4MB. The maximum for best performance represents the threshold above which the host's physical memory is insufficient to run the virtual machine at full speed. This value fluctuates as conditions on the host change, for example, as virtual machines are powered on or off.

Table 4-1. Maximum Virtual Machine Memory

| Introduced in Host Version | Virtual Machine Version | Maximum Memory Size |
|----------------------------|-------------------------|---------------------|
| ESXi 5.0 | 8 | 1011GB |
| ESX/ESXi 4.x | 7 | 255GB |
| ESX/ESXi 3.x | 4 | 65,532MB |

The ESXi host version indicates when support began for the increased memory size. For example, the memory size of a version 4 virtual machine running on ESXi 5.0 is restricted to 65,532MB.

Procedure

- 1 On the Memory page of the New Virtual Machine wizard, select a size for the virtual memory.

You can use the slider or use the up and down arrows to select the number. To access the predefined default or recommended setting, click the colored triangles on the right-hand side of the memory bar.

- 2 Click **Next**.

The Network page opens.

What to do next

Select network adapters for the virtual machine.

Configure Networks in the vSphere Client

You can select the virtual network interface cards (NICs) to create on the virtual machine so that the virtual machine can communicate with other hosts and virtual machines. For each NIC, select the network and adapter type.



CAUTION Because virtual machines share their physical network hardware with the host, the accidental or malicious bridging of two networks by a virtual machine can occur. Spanning Tree protocol cannot protect against these occurrences.

You can select only four NICs during virtual machine creation. You can add more virtual NICs by selecting **Edit the virtual machine settings before completion** on the Ready to Complete page of the wizard, or by editing the virtual machine after it is created.

For more information about networking, see the *vSphere Networking* documentation.

Procedure

- 1 On the Network page of the New Virtual Machine wizard, select the number of NICs to connect from the drop-down menu.

- 2 For each NIC, select a network and adapter type from the drop-down menus

Depending on the host version and the guest operating system, a choice of adapter types for each virtual NIC might not be available. In many cases, only one type of adapter is supported. If more than one type of adapter is supported, the recommended type for the guest operating system is selected by default.

- 3 (Optional) Click **Connect at Power On** to connect the NIC when the virtual machine is powered on.

- 4 Click **Next** to add a SCSI Controller.

Select a SCSI Controller in the vSphere Client

To access virtual disks, a virtual machine uses virtual SCSI controllers. Each virtual disk that a virtual machine can access through one of the virtual SCSI controllers resides in the VMFS datastore, NFS-based datastore, or on a raw disk. The choice of SCSI controller does not affect whether your virtual disk is an IDE or SCSI disk.

The wizard preselects the correct default controller based on the guest operation system you selected on the Guest Operating System page.

LSI Logic SAS and VMware Paravirtual controllers are available only for virtual machines with hardware version 7 or later. For details about VMware Paravirtual controllers, including conditions for use and limitations, see [“About VMware Paravirtual SCSI Controllers,”](#) on page 143.

Disks with snapshots might not experience performance gains when used on LSI Logic SAS and LSI Logic Parallel controllers.

Procedure

- 1 On the SCSI Controller page of the New Virtual Machine wizard, accept the default or select a SCSI controller type.
 - BusLogic Parallel
 - LSI Logic Parallel
 - LSI Logic SAS
 - VMware Paravirtual
- 2 Click **Next**.
The Select a Disk page opens.

What to do next

Select a disk on which to store the guest operating system files and data.

Selecting a Virtual Disk Type

You can create a virtual disk, use an existing virtual disk, or create Raw Device Mappings (RDMs), which give your virtual disk direct access to SAN. A virtual disk comprises one or more files on the file system that appear as a single hard disk to the guest operating system. These disks are portable among hosts.

You use the Create Virtual Machine wizard to add virtual disks during virtual machine creation. To add disks later, select the **Do Not Create Disk** option and use the Add Hardware wizard in the Virtual Machine Properties dialog box.

NOTE You cannot reassign virtual disks to a different controller type.

You can select from the following options:

- [Create a Virtual Disk in the vSphere Client](#) on page 66
When you create a virtual disk, you can specify disk properties such as size, format, clustering features, and more.
- [Use an Existing Virtual Disk in the vSphere Client](#) on page 68
You can use an existing disk that is configured with an operating system or other virtual machine data. This choice allows you to freely move the virtual hard drive from virtual machine to virtual machine.
- [Add an RDM Disk to a Virtual Machine in the vSphere Client](#) on page 68
You can store virtual machine data directly on a SAN LUN instead of storing it in a virtual disk file. This ability is useful if you are running applications in your virtual machines that must detect the physical characteristics of the storage device. Mapping a SAN LUN allows you to use existing SAN commands to manage storage for the disk.

Create a Virtual Disk in the vSphere Client

When you create a virtual disk, you can specify disk properties such as size, format, clustering features, and more.

For detailed information about disk types, see [“About Virtual Disk Provisioning Policies,”](#) on page 132.

Procedure

- 1 On the Create a Disk page of the New Virtual Machine wizard, select the disk size.
You can increase the disk size later or add disks in the Virtual Machine Properties dialog box.

- 2 Select the format for the virtual machine's disks and click **Next**.

| Option | Action |
|-------------------------------------|--|
| 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 flat format, the data remaining on the physical device is zeroed out during creation. It might take much 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. |

- 3 Select a location to store the virtual disk files and click **Next**.

| Option | Description |
|---|--|
| Store with the virtual machine | Stores the files with the configuration and other virtual machine files. This option makes file management easier. |
| Specify a datastore or datastore cluster | Stores the file separately from other virtual machine files. |

The Advanced Options page opens.

- 4 Accept the default or select a different virtual device node.

In most cases, you can accept the default device node. For a hard disk, a nondefault device node is useful to control the boot order or to have different SCSI controller types. For example, you might want to boot from an LSI Logic controller and share a data disk with another virtual machine using a BusLogic controller with bus sharing turned on.

- 5 (Optional) To change the way disks are affected by snapshots, click **Independent** and select an option.

| Option | Description |
|------------------------------------|--|
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 6 Click **Next**.

Your changes are recorded and the Ready to Complete page opens.

What to do next

View the selections for your virtual machine on the Ready to Complete page.

Use an Existing Virtual Disk in the vSphere Client

You can use an existing disk that is configured with an operating system or other virtual machine data. This choice allows you to freely move the virtual hard drive from virtual machine to virtual machine.

Procedure

- 1 On the Select Existing Disk page of the New Virtual Machine wizard, browse for a virtual disk file, click **OK**, and click **Next**.
- 2 Accept the default or select a different virtual device node.

In most cases, you can accept the default device node. For a hard disk, a nondefault device node is useful to control the boot order or to have different SCSI controller types. For example, you might want to boot from an LSI Logic controller and share a data disk with another virtual machine using a BusLogic controller with bus sharing turned on.

- 3 (Optional) To change the way disks are affected by snapshots, click **Independent** and select an option.

| Option | Description |
|------------------------------------|--|
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 4 Click **Next**.

Your changes are recorded and the Ready to Complete page opens.

What to do next

Review the virtual machine configuration.

Add an RDM Disk to a Virtual Machine in the vSphere Client

You can store virtual machine data directly on a SAN LUN instead of storing it in a virtual disk file. This ability is useful if you are running applications in your virtual machines that must detect the physical characteristics of the storage device. Mapping a SAN LUN allows you to use existing SAN commands to manage storage for the disk.

When you map a LUN to a VMFS volume, vCenter Server creates a Raw Device Mapping (RDM) file that points to the raw LUN. Encapsulating disk information in a file allows vCenter Server to lock the LUN so that only one virtual machine can write to it at a time. For details about RDM, see the *vSphere Storage* documentation.

The RDM file has a `.vmdk` extension, but the file contains only disk information that describes the mapping to the LUN on the ESXi host. The actual data is stored on the LUN.

You can create the RDM as an initial disk for a new virtual machine or add it to an existing virtual machine. When you create the RDM, you specify the LUN to be mapped and the datastore on which to put the RDM.

NOTE You cannot deploy a virtual machine from a template and store its data on a LUN. You can only store its data in a virtual disk file.

Procedure

- 1 On the Select a Disk page of the New Virtual Machine wizard, select **Raw Device Mapping** and click **Next**.

- 2 From the list of SAN disks or LUNs, select a LUN for your virtual machine to access directly and click **Next**.
- 3 Select a datastore for the LUN mapping file and click **Next**.

You can place the RDM file on the same datastore where your virtual machine configuration file resides, or select a different datastore.

NOTE To use vMotion for virtual machines with enabled NPIV, make sure that the RDM files of the virtual machines are located on the same datastore. You cannot perform Storage vMotion or vMotion between datastores when NPIV is enabled.

- 4 Select a compatibility mode and click **Next**.

| Option | Description |
|-----------------|---|
| Physical | Allows the guest operating system to access the hardware directly. Physical compatibility is useful if you are using SAN-aware applications on the virtual machine. However, a virtual machine with a physical compatibility RDM cannot be cloned, made into a template, or migrated if the migration involves copying the disk. |
| Virtual | Allows the RDM to behave as if it were a virtual disk, so you can use such features as taking a snapshot, cloning, and so on. When you clone the disk or make a template from it, the contents of the LUN are copied into a .vmdk virtual disk file. When you migrate a virtual compatibility mode RDM, you can migrate the mapping file or copy the contents of the LUN into a virtual disk. |

- 5 Accept the default or select a different virtual device node.

In most cases, you can accept the default device node. For a hard disk, a nondefault device node is useful to control the boot order or to have different SCSI controller types. For example, you might want to boot from an LSI Logic controller and share a data disk with another virtual machine using a BusLogic controller with bus sharing turned on.

- 6 (Optional) To change the way disks are affected by snapshots, click **Independent** and select an option.

| Option | Description |
|------------------------------------|--|
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 7 Click **Next**.

Your changes are recorded and the Ready to Complete page opens.

What to do next

Review the virtual machine configuration.

Complete Virtual Machine Creation in the vSphere Client

The Ready to Complete page lets you review the configuration selections that you made for the virtual machine. You can change existing settings, configure resources, add hardware, and more.

You can configure additional virtual machine settings before or after completing the wizard.

Procedure

- 1 On the Ready to Complete page of the New Virtual Machine wizard, review the configuration settings for the virtual machine.
- 2 (Optional) Select **Edit the virtual machine settings before completion** and click **Continue**.
The Virtual Machine Properties editor opens. After you complete your changes and click **Finish**, both the Virtual Machine Properties editor and the New Virtual Machine wizard close. You cannot go back to review the wizard settings unless you click **Cancel**.
- 3 (Optional) Click **Cancel** to go back and review the wizard settings.
- 4 Click **Finish** to complete the creation task and close the wizard.

The virtual machine appears in the vSphere Client **Inventory** view.

What to do next

Before you can use the new virtual machine, you must partition and format the virtual drive, install a guest operating system, and install VMware Tools. Typically, the operating system's installation program handles partitioning and formatting the virtual drive.

Working with Templates and Clones in the vSphere Client

A clone is a copy of a virtual machine. A template is a master copy of a virtual machine that can be used to create many clones.

When you clone a virtual machine, you create a copy of the entire virtual machine, including its settings, any configured virtual devices, installed software, and other contents of the virtual machine's disks. You also have the option to use guest operating system customization to change some of the properties of the clone, such as the computer name and networking settings.

Cloning a virtual machine can save time if you are deploying many similar virtual machines. You can create, configure, and install software on a single virtual machine, and then clone it multiple times, rather than creating and configuring each virtual machine individually.

If you create a virtual machine that you want to clone frequently, make that virtual machine a template. A template is a master copy of a virtual machine that can be used to create and provision virtual machines. Templates cannot be powered on or edited, and are more difficult to alter than ordinary virtual machine. A template offers a more secure way of preserving a virtual machine configuration that you want to deploy many times.

When you clone a virtual machine or deploy a virtual machine from a template, the resulting cloned virtual machine is independent of the original virtual machine or template. Changes to the original virtual machine or template are not reflected in the cloned virtual machine, and changes to the cloned virtual machine are not reflected in the original virtual machine or template.

Clone a Virtual Machine in the vSphere Client

Cloning a virtual machine creates a duplicate of the virtual machine with the same configuration and installed software as the original.

Optionally, you can customize the guest operating system of the clone to change the virtual machine name, network settings, and other properties. This prevents conflicts that can occur if a virtual machine and a clone with identical guest operating system settings are deployed simultaneously.

Prerequisites

- You must be connected to vCenter Server in order to clone a virtual machine. You cannot clone virtual machines if you connect directly to an ESXi host.

- To customize the guest operating system of the virtual machine, check that your guest operating system meets the requirements for customization. See “[Guest Operating System Customization Requirements](#),” on page 81.
- To use a customization specification, you must first create or import the customization specification.
- To use a custom script to generate the host name or IP address for the new virtual machine, configure the script. See “[Configure a Script to Generate Computer Names and IP Addresses During Guest Operating System Customization in the vSphere Client](#),” on page 82.

Procedure

- 1 Right-click the virtual machine and select **Clone**.
- 2 Enter a virtual machine name, select a location, and click **Next**.
- 3 Select a host or cluster on which to run the new virtual machine.

| Option | Action |
|--|--|
| Run the virtual machine on a standalone host. | Select the host and click Next . |
| Run the virtual machine in a cluster with DRS automatic placement. | Select the cluster and click Next . |
| Run the virtual machine in a cluster without DRS automatic placement. | <ol style="list-style-type: none"> a Select the cluster and click Next. b Select a host within the cluster and click Next. |

- 4 Select a resource pool in which to run the virtual machine and click **Next**.
- 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. | <ol style="list-style-type: none"> a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. b Select a datastore and click Next. |
| Store all virtual machine files in the same datastore cluster. | <ol style="list-style-type: none"> a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. b Select a datastore cluster. c (Optional) If you 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 datastore cluster. d Click Next. |
| Store virtual machine configuration files and disks in separate locations. | <ol style="list-style-type: none"> a Click Advanced. b For the virtual machine configuration file and for each virtual disk, click Browse and select a datastore or datastore cluster. c (Optional) Apply a virtual machine storage profile from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. d (Optional) If you selected a datastore 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 datastore cluster. e Click Next. |

- 6 Select the format for the virtual machine's disks and click **Next**.

| 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. |

- 7 Select a guest operating system customization option.

| Option | Description |
|--|--|
| Do not customize | Select Do not customize and click Next . Does not customize any of the guest operating system settings. All settings remain identical to those of the source virtual machine. |
| Customize using the Customization Wizard | Opens the Customization Wizard so that you can select customization options for the guest operating system. Select this option and click Next to launch the Customization Wizard. <ul style="list-style-type: none"> ■ To customize a Linux guest operating system, see “Customize Linux During Cloning or Deployment in the vSphere Client,” on page 85. ■ To customize a Windows guest operating system, see “Customize Windows During Cloning or Deployment in the vSphere Client,” on page 83. |
| Customize using an existing customization specification | Uses the settings in a saved customization specification to customize the guest operating system. <ol style="list-style-type: none"> a Select Customize using an existing customization specification. b Select the customization specification that you want to use. c (Optional) Select Use the Customization Wizard to temporarily adjust the specification before deployment if you want to make changes to the specification for this deployment only. d Click Next. |

- 8 Review your selections and select whether to power on the virtual machine or edit virtual machine settings.

| Option | Action |
|---|--|
| Power on this virtual machine after creation | Select this option and click Finish . The virtual machine powers on after the deployment task completes. |
| Edit virtual hardware | <ol style="list-style-type: none"> a Select this option and click Continue. b Make any changes and click OK. |

| Option | Action |
|---|--|
| Show all storage recommendations | This option appears only when the virtual machine disks are stored on a datastore cluster and Storage DRS is enabled. Select this option, and click Continue . The dialog box lists the datastores in the datastore cluster that are recommended for virtual machine placement. |
| Edit Storage DRS rules | This option appears only when the virtual machine disks are stored on a datastore cluster. This option is selected when you select Edit virtual hardware . You can edit Storage DRS rules on the Options tab of the Virtual Machine Properties dialog box. Select the Edit Storage DRS rules check box, and click Continue . |

The cloned virtual machine is deployed. You cannot use or edit the virtual machine until the cloning is complete. This might take several minutes if the cloning involves creating a virtual disk. You can cancel the cloning at any point before the customization stage.

Create a Scheduled Task to Clone a Virtual Machine in the vSphere Client

This procedure creates a scheduled task to clone a virtual machine.

Procedure

- 1 Start the vSphere Client, and log in to the vCenter Server system.
- 2 From the Home page, click **Scheduled Tasks**.
- 3 Select **File > New > Scheduled Task**, or click **New**.
The **Select a Task to Schedule** dialog box appears.
- 4 Select **Clone a virtual machine** from the drop-down menu, and click **OK**.
The Clone Virtual Machine wizard appears.
- 5 Select the virtual machine to clone and click **Next**.
- 6 Follow the wizard through the same steps as those in the previous task in which you cloned a virtual machine.
- 7 Enter a name and a task description in the text box.
- 8 Select the frequency of the task.
- 9 Select **Now** or **Later**. If later, enter the time and date when you want the virtual machine to be deployed, and click **Next**.

To see the calendar, click **Later**, and click the drop-down arrow to select a date from the calendar. A red circle indicates today's date, and a dark circle indicates the scheduled date.

- 10 Review the information on the Ready to Complete New Virtual Machine page, and click **Finish**.

Optionally, you can select the check box to power on the new virtual machine after it is created.

vCenter Server adds the new task to the scheduled task list and completes it at the designated time. When it is time to perform the task, vCenter Server first verifies that the user who created the task still has permission to complete the task. If the permission levels are not acceptable, vCenter Server sends a message to the log and the task is not performed.

Create a Template in the vSphere Client

Create a template to create a master image of a virtual machine from which you can deploy many virtual machines.

You can create a template by converting a virtual machine to a template, cloning a virtual machine to a template, or cloning another template.

Convert a Virtual Machine to a Template in the vSphere Client

You can convert a virtual machine directly to a template instead of making a copy by cloning.

When you convert a virtual machine to a template, you cannot edit or power on the template unless you convert it back to a virtual machine.

Prerequisites

- You must be connected to vCenter Server to convert a virtual machine to a template. You cannot create templates if you connect the vSphere Client directly to an ESXi host.
- Before you convert a virtual machine to a template, select it in the inventory and power it off.

Procedure

- ◆ Right-click the virtual machine and select **Template > Convert to Template**.

vCenter Server marks that virtual machine as a template and displays the task in the Recent Tasks pane.

Clone a Template in the vSphere Client

Clone a template to create a copy of it.

Prerequisites

You must be connected to vCenter Server to clone a template. You cannot create templates if you connect directly to an ESXi host.

Procedure

- 1 Right-click the template and select **Clone**.
- 2 Give the new template a unique name and description and click **Next**.
- 3 Select the host or cluster and click **Next**.
- 4 Select a datastore for the template and click **Next**.
- 5 Specify in which format to store the template's virtual 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. |

- 6 Click **Next**.
- 7 Review the information for the template and click **Finish**.
You cannot use the new template until the cloning task completes.

vCenter Server adds the cloned template to the list in the **Virtual Machines** tab.

Clone Virtual Machine to Template in the vSphere Client

Cloning a virtual machine to a template creates a template copy of the virtual machine while leaving the original virtual machine in place.

Prerequisites

You must be connected to vCenter Server to clone a virtual machine to a template. You cannot create templates if you connect directly to an ESXi host.

Procedure

- 1 Right-click the virtual machine and select **Template > Clone to Template**.
- 2 Give the new template a name, select its inventory location, and click **Next**.
- 3 Pass through the target location page and click **Next**.
- 4 Specify in which format to store the template's virtual disks and click **Next**.

| 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. |

- 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. | a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. |
| | b Select a datastore and click Next . |
| Store all virtual machine files in the same datastore cluster. | a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. |
| | b Select a datastore cluster. |
| | c (Optional) If you 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 datastore cluster. |
| | d 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, click Browse and select a datastore or datastore cluster. |
| | c (Optional) Apply a virtual machine storage profile from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. |
| | d (Optional) If you selected a datastore 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 datastore cluster. |
| | e Click Next . |

- 6 Click **Finish**.

vCenter Server displays the Tasks inventory panel for reference and adds the cloned template to the list in the information panel.

Deploy a Virtual Machine from a Template in the vSphere Client

Deploying a virtual machine from a template creates a new virtual machine that is a copy of the template. The new virtual machine has the virtual hardware, installed software, and other properties configured for the template.

Prerequisites

- Verify that you are connected to vCenter Server. You cannot work with templates if you connect the vSphere Client directly to an ESXi host.
- You must be connected to vCenter Server to deploy a virtual machine from a template. You cannot deploy from a template if you connect the vSphere Client directly to an ESXi host.
- To customize the guest operating system of the virtual machine, check that your guest operating system meets the requirements for customization. See [“Guest Operating System Customization Requirements,”](#) on page 81.
- To use a customization specification, create or import the customization specification.
- To use a custom script to generate the host name or IP address for the new virtual machine, configure the script. See [“Configure a Script to Generate Computer Names and IP Addresses During Guest Operating System Customization in the vSphere Client,”](#) on page 82.

Procedure

- 1 Right-click the template, and select **Deploy Virtual Machine from this Template**.
- 2 Enter a virtual machine name, select a location, and click **Next**.
- 3 Select a host or cluster on which to run the new virtual machine.

| Option | Action |
|--|--|
| Run the virtual machine on a standalone host. | Select the host and click Next . |
| Run the virtual machine in a cluster with DRS automatic placement. | Select the cluster and click Next . |
| Run the virtual machine in a cluster without DRS automatic placement. | <ol style="list-style-type: none"> a Select the cluster and click Next. b Select a host within the cluster and click Next. |

- 4 Select a resource pool in which to run the virtual machine and click **Next**.
- 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. | <ol style="list-style-type: none"> a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. b Select a datastore and click Next. |
| Store all virtual machine files in the same datastore cluster. | <ol style="list-style-type: none"> a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. b Select a datastore cluster. c (Optional) If you 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 datastore cluster. d Click Next. |
| Store virtual machine configuration files and disks in separate locations. | <ol style="list-style-type: none"> a Click Advanced. b For the virtual machine configuration file and for each virtual disk, click Browse and select a datastore or datastore cluster. c (Optional) Apply a virtual machine storage profile from the VM Storage Profile drop-down menu. The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile. d (Optional) If you selected a datastore 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 datastore cluster. e Click Next. |

- 6 Select the format for the virtual machine's disks and click **Next**.

| 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. |

- 7 Select a guest operating system customization option.

| Option | Description |
|--|--|
| Do not customize | Select Do not customize and click Next . Does not customize any of the guest operating system settings. All settings remain identical to those of the source virtual machine. |
| Customize using the Customization Wizard | Opens the Customization Wizard so that you can select customization options for the guest operating system. Select this option and click Next to launch the Customization Wizard. <ul style="list-style-type: none"> ■ To customize a Linux guest operating system, see “Customize Linux During Cloning or Deployment in the vSphere Client,” on page 85. ■ To customize a Windows guest operating system, see “Customize Windows During Cloning or Deployment in the vSphere Client,” on page 83. |
| Customize using an existing customization specification | Uses the settings in a saved customization specification to customize the guest operating system. <ol style="list-style-type: none"> a Select Customize using an existing customization specification. b Select the customization specification that you want to use. c (Optional) Select Use the Customization Wizard to temporarily adjust the specification before deployment if you want to make changes to the specification for this deployment only. d Click Next. |

- 8 Review your selections and select whether to power on the virtual machine or edit virtual machine settings.

| Option | Action |
|---|--|
| Power on this virtual machine after creation | Select this option and click Finish . The virtual machine powers on after the deployment task completes. |
| Edit virtual hardware | <ol style="list-style-type: none"> a Select this option and click Continue. b Make any changes and click OK. |
| Show all storage recommendations | This option appears only when the virtual machine disks are stored on a datastore cluster and Storage DRS is enabled. Select this option, and click Continue . The dialog box lists the datastores in the datastore cluster that are recommended for virtual machine placement. |
| Edit Storage DRS rules | This option appears only when the virtual machine disks are stored on a datastore cluster. This option is selected when you select Edit virtual hardware . You can edit Storage DRS rules on the Options tab of the Virtual Machine Properties dialog box. Select the Edit Storage DRS rules check box, and click Continue . |

The virtual machine is deployed. You cannot use or edit the virtual machine until the deployment is complete. This might take several minutes if the deployment involves creating a virtual disk.

Change Template Software or Virtual Machine Configuration

To change the virtual hardware or virtual machine options in a template, or to upgrade an application, you must convert the template to a virtual machine. After you have edited the virtual machine, convert it back to a template.

Prerequisites

Verify that you are connected to vCenter Server. You cannot work with templates if you connect the vSphere Client directly to an ESXi host.

Procedure

- 1 Convert the template to a virtual machine.
- 2 Edit the virtual machine.
- 3 Convert the virtual machine to a template.

Change Template Name in the vSphere Client

Unlike other changes to templates, you do not have to convert a template to a virtual machine to change the name of a template.

Prerequisites

Verify that you are connected to vCenter Server. You cannot work with templates if you connect the vSphere Client directly to an ESXi host.

Procedure

- 1 Right-click the template and select **Rename**.
- 2 Enter a new name and click outside the field to save your changes.

Deleting Templates

You can delete a template by removing it from the inventory or deleting the template from the disk. If you remove the template from the inventory, it remains on the disk and can be reregistered with vCenter Server to restore it to the inventory.

Remove Templates from the Inventory in the vSphere Client

If you remove a template from the inventory, it is unregistered from the vCenter Server inventory, but it is not removed from the datastore.

Prerequisites

You must be connected to vCenter Server to remove a template from the inventory. You cannot work with templates if you connect directly to an ESXi host.

Procedure

- 1 Right-click the template, and select **Remove from Inventory**.
- 2 Click **OK** to confirm removing the template from the vCenter Server database.

The template is unregistered from the vCenter Server inventory.

Delete a Template from the Disk in the vSphere Client

Deleted templates are permanently removed from the system.

Prerequisites

You must be connected to vCenter Server to delete a template. You cannot work with templates if you connect the vSphere Client directly to an ESXi host.

Procedure

- 1 Right-click the template, and select **Delete from Disk**.
- 2 Click **OK** to confirm removing the template from the datastore.

The template is deleted from the disk and cannot be recovered.

Reregister Templates in the vSphere Client

Templates can become unregistered from the vCenter Server if they are removed from the inventory or if the hosts with which they are associated are removed from the vCenter Server and then readded.

Procedure

- 1 Start the vSphere client, and log in to the vCenter Server system.
- 2 From the Home page, click **VMs and Templates**.
- 3 Right-click the datastore that contains the template and select **Browse Datastore**.
- 4 Browse through the datastore folders to find the `.vmtx` file.
- 5 Right-click the `.vmtx` file and select **Add to Inventory**.

The Add to Inventory wizard appears.

- 6 Enter a template machine name, select a location, and click **Next**.

If you want the template to retain its original name, do not enter a name in the Add to Inventory wizard. vCenter Server will use the original name if the field in the wizard is left blank.

- 7 Select a host or cluster on which to store the template, and click **Next**.
- 8 Review your selections, and click **Finish**.

The template is registered to the host. You can view the template from the host's **Virtual Machine** tab.

Convert a Template to a Virtual Machine in the vSphere Client

Converting a template to a virtual machine changes the template rather than making a copy. You can convert a template to a virtual machine to edit the template. You might also convert a template to a virtual machine if you no longer need to preserve it as a master image for deploying virtual machines.

Prerequisites

You must be connected to vCenter Server to convert a template to a virtual machine. You cannot work with templates if you connect directly to an ESXi host.

Procedure

- 1 Right-click the template and select **Convert to Virtual Machine**.

- 2 Select the host or cluster on which to run the virtual machine.

| Option | Action |
|--|--|
| Run the virtual machine on a standalone host. | Select the host and click Next . |
| Run the virtual machine in a cluster with DRS automatic placement. | Select the cluster and click Next . |
| Run the virtual machine in a cluster without DRS automatic placement. | <ol style="list-style-type: none"> Select the cluster and click Next. Select a host within the cluster and click Next. |

If the template resides on a legacy VMFS2 datastore, you must select the host on which the template was created as the destination for the virtual machine.

- 3 Select a resource pool in which to run the virtual machine and click **Next**.
- 4 Review your selections and click **Finish**.

Customizing Guest Operating Systems

When you clone a virtual machine or deploy a virtual machine from a template, you can customize the guest operating system of the virtual machine to change properties such as the computer name, network settings, and license settings.

Customizing guest operating systems can help prevent conflicts that can result if virtual machines with identical settings are deployed, such as conflicts due to duplicate computer names.

You can specify the customization settings by choosing to launch the Guest Customization wizard during the cloning or deployment process. Alternatively, you can create customization specifications, which are customization settings stored in the vCenter Server database. During the cloning or deployment process, you can select a customization specification to apply to the new virtual machine.

Use the Customization Specification Manager to manage customization specifications you create with the Guest Customization wizard.

Guest Operating System Customization Requirements

To customize the guest operating system, you must configure the virtual machine and guest to meet VMware Tools and virtual disk requirements. Other requirements apply, depending on the guest operating system type.

VMware Tools Requirements

The current version of VMware Tools must be installed on the virtual machine or template to customize the guest operating system during cloning or deployment.

Virtual Disk Requirements

The guest operating system being customized must be installed on a disk attached as SCSI node 0:0 in the virtual machine configuration.

Windows Requirements

Customization of Windows guest operating systems requires the following conditions:

- Microsoft Sysprep tools must be installed on the vCenter Server system. See [Chapter 6, “Installing the Microsoft Sysprep Tool,”](#) on page 103.
- The ESXi host that the virtual machine is running on must be 3.5 or later.

Guest operating system customization is supported on multiple Windows operating systems.

Linux Requirements

Customization of Linux guest operating systems requires that Perl is installed in the Linux guest operating system.

Guest operating system customization is supported on multiple Linux distributions.

Verifying Customization Support for a Guest Operating System

To verify customization support for Windows operating systems or Linux distributions and compatible ESXi hosts, see the *VMware Compatibility Guide* at [VMware.com](http://www.vmware.com). You can use this online tool to search for the guest operating system and ESXi version. After the tool generates your list, click the guest operating system to see whether guest customization is supported.

Configure a Script to Generate Computer Names and IP Addresses During Guest Operating System Customization in the vSphere Client

As an alternative to entering the computer name or IP addresses for virtual NICs during guest operating system customization, you can create a custom application and configure it so that vCenter Server can use it to generate the computer name and IP addresses.

The application can be an arbitrary executable binary or script file appropriate for the corresponding operating system in which vCenter Server is running. After you configure a name-ip-generation application in vCenter Server, each time you initiate a guest OS customization for a virtual machine, the name-ip-app is executed and an XML string is generated in place and passed to its standard input. The name-ip-generation application on its behalf should generate and return the resulting XML string through its standard output.

The application must comply with the reference XML file in the VMware knowledge base article at <http://kb.vmware.com/kb/2007557>.

Prerequisites

Verify that Perl is installed on vCenter Server.

Procedure

- 1 Create the script and save it on the vCenter Server system's local disk.
- 2 In the vSphere Client connected to vCenter Server, select **Administration > vCenter Server Settings**.
- 3 Select **Advanced Settings**.
- 4 Enter the configuration parameters for the script.
 - a In the **Key** text box, type `config.guestcust.name-ip-generator.arg1`.
 - b In the **Value** text box, type `c:\sample-generate-name-ip.pl` and click **Add**.
 - c In the **Key** text box, type `config.guestcust.name-ip-generator.arg2`.
 - d In the **Value** text box, type the path to the script file on the vCenter Server system and click **Add**. For example, type `c:\sample-generate-name-ip.pl`.
 - e In the **Key** text box, type `config.guestcust.name-ip-generator.program`.
 - f In the **Value** text box, type `c:\perl\bin\perl.exe` and click **Add**.
- 5 Click **OK**.

You can select the option to use an application to generate computer names or IP addresses during customization.

Customize Windows During Cloning or Deployment in the vSphere Client

When you deploy a new virtual machine from a template or clone an existing virtual machine, you can customize Windows guest operating systems for the virtual machine.

NOTE The default administrator password is not preserved for Windows Server 2008 after customization. During customization, the Windows Sysprep utility deletes and recreates the administrator account on Windows Server 2008. You must reset the administrator password when the virtual machine boots the first time after customization.

Prerequisites

Verify that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Start the Guest Customization wizard when you clone a virtual machine or deploy from a template. See [“Clone a Virtual Machine in the vSphere Client,”](#) on page 70 or [“Deploy a Virtual Machine from a Template in the vSphere Client,”](#) on page 76.

Procedure

- 1 Select **Customize using the Customization Wizard** and click **Next**.
- 2 Type the virtual machine owner’s name and organization and click **Next**.
- 3 Enter the guest operating system’s computer name and click **Next**.

The operating system uses this name to identify itself on the network. On Linux systems, it is called the host name.

| Option | Action |
|--|---|
| Enter a name | <ol style="list-style-type: none"> a Type a name. The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive. b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 15 characters when combined with the numeric value. |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 15 characters, it is truncated. |
| Enter a name in the Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 4 Provide licensing information for the Windows operating system and click **Next**.

| Option | Action |
|---|--|
| For non-server operating systems | Type the Windows product key for the new guest operating system. |
| For server operating systems | <ol style="list-style-type: none"> a Type the Windows product key for the new guest operating system. b Select Include Server License Information. c Select either Per seat or Per server. d (Optional) If you select Per server, enter the maximum number of simultaneous connections for the server to accept. |

- 5 Configure the administrator password for the virtual machine and click **Next**.
 - a Type a password for the administrator account and confirm the password by typing it again.

NOTE You can change the administrator password only if the administrator password on the source Windows virtual machine is blank. If the source Windows virtual machine or template already has a password, the administrator password does not change.

- b (Optional) To log users into the guest operating system as Administrator, select the check box, and select the number of times to log in automatically.
- 6 Select the time zone for the virtual machine and click **Next**.
- 7 (Optional) On the Run Once page, specify commands to run the first time a user logs into the guest operating system and click **Next**.

See the Microsoft Sysprep documentation for information about RunOnce commands.

- 8 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 9 Select how the virtual machine will participate in the network and click **Next**.

| Option | Action |
|------------------------------|--|
| Workgroup | Type a workgroup name. For example, MSHOME . |
| Windows Server Domain | <ol style="list-style-type: none"> a Type the domain name. b Type the user name and password for a user account that has permission to add a computer to the specified domain. |

- 10 (Optional) Select Generate New Security ID (SID) and click **Next**.

A Windows Security ID (SID) is used in some Windows operating systems to uniquely identify systems and users. If you do not select this option, the new virtual machine has the same SID as the virtual machine or template from which it was cloned or deployed.

Duplicate SIDs do not cause problems when the computers are part of a domain and only domain user accounts are used. However, if the computers are part of a Workgroup or local user accounts are used, duplicate SIDs can compromise file access controls. For more information, see the documentation for your Microsoft Windows operating system.

- 11 Save the customized options as an .xml file.
 - a Select **Save this customization specification for later use**.
 - b Specify the filename for the specification and click **Next**.
- 12 Click **Finish** to save your changes.

You return to the Deploy Template or to the Clone Virtual Machine wizard. The customization is finished after you complete the Deploy Template or the Clone Virtual Machine wizard.

When the new virtual machine starts for the first time, the guest operating system runs finalization scripts to complete the customization process. The virtual machine might restart several times during this process.

If the guest operating system pauses when the new virtual machine starts, it might be waiting for you to correct errors, such as an incorrect product key or an invalid user name. Open the virtual machine's console to determine whether the system is waiting for information.

What to do next

After you deploy and customize versions of Windows XP or Windows 2003 that are not volume licensed, you might need to reactivate your operating system on the new virtual machine.

If the new virtual machine encounters customization errors while it is booting, the errors are logged to %WINDIR%\temp\vmware-*imc*. To view the error log file, click the Windows **Start** button and select **Programs > Administrative Tools > Event Viewer**.

Customize Linux During Cloning or Deployment in the vSphere Client

In the process of deploying a new virtual machine from a template or cloning an existing virtual machine, you can customize Linux guest operating systems for the virtual machine.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

To perform this procedure, launch the Customization wizard when cloning a virtual machine or deploying from a template. See [“Clone a Virtual Machine in the vSphere Client,”](#) on page 70 or [“Deploy a Virtual Machine from a Template in the vSphere Client,”](#) on page 76.

Procedure

- 1 Select **Customize using the Customization Wizard** and click **Next**.
- 2 Specify how to determine the host name to identify the guest operating system on the network.

| Option | Action |
|--|--|
| Enter a name | <p>a Type a name.</p> <p>The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive.</p> <p>b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 15 characters when combined with the numeric value.</p> |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 15 characters, it is truncated. |
| Enter a name in the Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 3 Enter the **Domain Name** for the computer and click **Next**.
- 4 Select the time zone for the virtual machine and click **Next**.

- 5 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 6 Enter DNS and domain settings.
- 7 Save the customized options as an .xml file.
 - a Select **Save this customization specification for later use**.
 - b Specify the filename for the specification and click **Next**.
- 8 Click **Finish** to save your changes.

You return to the Deploy Template or to the Clone Virtual Machine wizard. The customization is finished after you complete the Deploy Template or the Clone Virtual Machine wizard.

When the new virtual machine starts for the first time, the guest operating system runs finalization scripts to complete the customization process. The virtual machine might restart several times during this process.

If the guest operating system pauses when the new virtual machine starts, it might be waiting for you to correct errors, such as an incorrect product key or an invalid user name. Open the virtual machine's console to determine whether the system is waiting for information.

What to do next

If the new virtual machine encounters customization errors while it is booting, the errors are reported using the guest's system logging mechanism. View the errors by opening `/var/log/vmware-
imc/toolsDeployPkg.log`.

Managing Customization Specifications in the vSphere Client

Customization specifications are XML files that contain guest operating system settings for virtual machines. You create customization specifications with the Guest Customization wizard, and manage specifications using the Customization Specification Manager.

vCenter Server saves the customized configuration parameters in the vCenter Server database. If the customization settings are saved, the administrator, and domain administrator, passwords are stored in encrypted format in the database. Because the certificate used to encrypt the passwords is unique to each vCenter Server system, reinstalling vCenter Server, or attaching a new instance of the server the database, invalidates the encrypted passwords. The passwords must be re-entered before they can be used.

Create a Customization Specification for Linux in the vSphere Client

Use the Guest Customization wizard to save guest operating system settings in a specification that you can apply when cloning virtual machines or deploying from templates.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Click **New**.
- 3 Select Linux from the **Target Virtual Machine OS** menu.
- 4 Under Customization Specification Information, enter a name for the specification and an optional description and click **Next**.
- 5 Specify how to determine the host name to identify the guest operating system on the network.

| Option | Action |
|--|---|
| Enter a name | <ol style="list-style-type: none"> a Type a name. The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive. b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 15 characters when combined with the numeric value. |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 15 characters, it is truncated. |
| Enter a name in the Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 6 Enter the **Domain Name** for the computer and click **Next**.
- 7 Select the time zone for the virtual machine and click **Next**.
- 8 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 9 Enter DNS and domain settings.
- 10 Click **Finish** to save your changes.

The customization specification that you created is listed in the Customization Specification Manager. You can use the specification to customize virtual machine guest operating systems.

Create a Customization Specification for Windows in the vSphere Client

Use the Guest Customization wizard to save Windows guest operating system settings in a specification that you can apply when cloning virtual machines or deploying from templates.

NOTE The default administrator password is not preserved for Windows Server 2008 after customization. During customization, the Windows Sysprep utility deletes and recreates the administrator account on Windows Server 2008. You must reset the administrator password when the virtual machine boots the first time after customization.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Click **New**.
- 3 In the Guest Customization wizard, select Windows from the **Target Virtual Machine OS** menu.
- 4 Under Customization Specification Information, enter a name for the specification and an optional description and click **Next**.
- 5 Type the virtual machine owner’s name and organization and click **Next**.
- 6 Enter the guest operating system's computer name and click **Next**.

The operating system uses this name to identify itself on the network. On Linux systems, it is called the host name.

| Option | Action |
|--|--|
| Enter a name | <p>a Type a name.</p> <p>The name can contain alphanumeric characters and the hyphen (-) character. It cannot contain periods (.) or blank spaces and cannot be made up of digits only. Names are not case-sensitive.</p> <p>b (Optional) To ensure that the name is unique, select Append a numeric value to ensure uniqueness. This appends a hyphen followed by a numeric value to the virtual machine name. The name is truncated if it exceeds 15 characters when combined with the numeric value.</p> |
| Use the virtual machine name | The computer name that vCenter Server creates is identical to the name of the virtual machine on which the guest operating system is running. If the name exceeds 15 characters, it is truncated. |
| Enter a name in the Deploy wizard | The vSphere Client prompts you to enter a name after the cloning or deployment is complete. |
| Generate a name using the custom application configured with vCenter Server | Enter a parameter that can be passed to the custom application. |

- 7 Provide licensing information for the Windows operating system and click **Next**.

| Option | Action |
|---|--|
| For non-server operating systems | Type the Windows product key for the new guest operating system. |
| For server operating systems | <ul style="list-style-type: none"> a Type the Windows product key for the new guest operating system. b Select Include Server License Information. c Select either Per seat or Per server. d (Optional) If you select Per server, enter the maximum number of simultaneous connections for the server to accept. |

- 8 Configure the administrator password for the virtual machine and click **Next**.

- a Type a password for the administrator account and confirm the password by typing it again.

NOTE You can change the administrator password only if the administrator password on the source Windows virtual machine is blank. If the source Windows virtual machine or template already has a password, the administrator password does not change.

- b (Optional) To log users into the guest operating system as Administrator, select the check box, and select the number of times to log in automatically.

- 9 Select the time zone for the virtual machine and click **Next**.

- 10 (Optional) On the Run Once page, specify commands to run the first time a user logs into the guest operating system and click **Next**.

See the Microsoft Sysprep documentation for information about RunOnce commands.

- 11 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ul style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 12 Select how the virtual machine will participate in the network and click **Next**.

| Option | Action |
|------------------------------|--|
| Workgroup | Type a workgroup name. For example, MSHOME . |
| Windows Server Domain | <ul style="list-style-type: none"> a Type the domain name. b Type the user name and password for a user account that has permission to add a computer to the specified domain. |

- 13 (Optional) Select Generate New Security ID (SID) and click **Next**.

A Windows Security ID (SID) is used in some Windows operating systems to uniquely identify systems and users. If you do not select this option, the new virtual machine has the same SID as the virtual machine or template from which it was cloned or deployed.

Duplicate SIDs do not cause problems when the computers are part of a domain and only domain user accounts are used. However, if the computers are part of a Workgroup or local user accounts are used, duplicate SIDs can compromise file access controls. For more information, see the documentation for your Microsoft Windows operating system.

- 14 Click **Finish** to save your changes.

The customization specification that you created is listed in the Customization Specification Manager. You can use the specification to customize virtual machine guest operating systems.

Create a Customization Specification for Windows Using a Custom Sysprep Answer File in the vSphere Client

A custom sysprep answer file is a file that stores a number of customization settings such as computer name, licensing information, and workgroup or domain settings. You can supply a custom sysprep answer file as an alternative to specifying many of the settings in the Guest Customization wizard.

Windows 2000, Windows Server 2003, and Windows XP use a text file called `sysprep.inf`. Windows Server 2008, Windows Vista, and Windows 7 use an XML file called `sysprep.xml`. You can create these files using a text editor, or use the Microsoft Setup Manager utility to generate them. For more information about how to create a custom sysprep answer file, see the documentation for the relevant operating system.

Prerequisites

Ensure that all requirements for customization are met. See [“Guest Operating System Customization Requirements,”](#) on page 81.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Click **New**.
- 3 In the Guest Customization wizard, select Windows from the **Target Virtual Machine OS** menu.
- 4 (Optional) Select **Use Custom Sysprep Answer File**.
- 5 Under Customization Specification Information, enter a name for the specification and an optional description and click **Next**.
- 6 Select the option to import or create a sysprep answer file and click **Next**.

| Option | Description |
|-------------------------------------|--|
| Import a Sysprep answer file | Click Browse and browse to the file. |
| Create a Sysprep answer file | Type the contents of the file in the text box. |

- 7 Select the type of network settings to apply to the guest operating system.

| Option | Action |
|-------------------------|---|
| Typical settings | Select Typical settings and click Next . vCenter Server configures all network interfaces from a DHCP server using default settings. |
| Custom settings | <ol style="list-style-type: none"> a Select Custom settings and click Next. b For each network interface in the virtual machine, click the ellipsis button (...). c Enter IP address and other network settings and click OK. d When all network interfaces are configured, click Next. |

- 8 (Optional) Select **Generate New Security ID (SID)** and click **Next**.

A Windows Security ID (SID) is used in some Windows operating systems to uniquely identify systems and users. If you do not select this option, the new virtual machine has the same SID as the virtual machine or template from which it was cloned or deployed.

Duplicate SIDs do not cause problems when the computers are part of a domain and only domain user accounts are used. However, if the computers are part of a Workgroup or local user accounts are used, duplicate SIDs can compromise file access controls. For more information, see the documentation for your Microsoft Windows operating system.

- 9 Click **Finish** to save your changes.

The customization specification that you created is listed in the Customization Specification Manager. You can use the specification to customize virtual machine guest operating systems.

Edit a Customization Specification in the vSphere Client

You can edit existing specifications using the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Edit**.
- 3 Proceed through the Guest Customization wizard to change specification settings.

Remove a Customization Specification in the vSphere Client

You can remove customization specifications from the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Remove**.
- 3 In the confirmation dialog box, select **Yes**.

The specification is deleted from the disk.

Copy a Customization Specification in the vSphere Client

You can copy an existing customization specification using the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Copy**.

A new specification is created, Copy of *specification_name*.

Export a Customization Specification in the vSphere Client

You can export customization specifications and save them as .xml files. To apply an exported specification to a virtual machine, import the .xml file using the Customization Specification Manager.

Prerequisites

You must have at least one customization specification.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Right-click a specification and select **Export**.
- 3 In the **Save As** dialog, enter a file name and location.
- 4 Click **Save**.

The specification is saved as an .xml file to the location you specified.

Import a Customization Specification in the vSphere Client

You can import an existing specification using the Customization Specification Manager, and use the specification to customize the guest operating system of a virtual machine.

Prerequisites

Before you begin, you must have at least one customization specification saved as an xml file located on a file system accessible from the vSphere Client.

Procedure

- 1 From the vSphere Client Home page, select **Customization Specifications Manager**.
- 2 Click **Import**.
- 3 From the Open dialog, browse to the .xml to import and click **Open**.

The imported specification is added to the list of customization specifications.

Deploying OVF Templates

The VMware vSphere Client (vSphere Client) allows you to deploy and export virtual machines, virtual appliances, and vApps stored in Open Virtual Machine Format (OVF). An appliance is a pre-configured virtual machine that typically includes a preinstalled guest operating system and other software.

Deploying an OVF template allows you to add pre-configured virtual machines to your vCenter Server or ESXi inventory. Deploying an OVF template is similar to deploying a virtual machine from a template. However, you can deploy an OVF template from any local file system accessible from the vSphere Client machine, or from a remote web server. The local file systems can include local disks (such as C:), removable media (such as CDs or USB keychain drives), and shared network drives.

Exporting OVF templates allows you to create virtual appliances that can be imported by other users. You can use the export function to distribute pre-installed software as a virtual appliance, or as a means of distributing template virtual machines to users, including users who cannot directly access and use the templates in your vCenter Server inventory.

This chapter includes the following topics:

- [“About OVF,”](#) on page 93
- [“Deploy an OVF Template,”](#) on page 94
- [“Deploy an OVF Template in the vSphere Web Client,”](#) on page 96
- [“Browse VMware Virtual Appliance Marketplace,”](#) on page 99
- [“Export an OVF Template in the vSphere Web Client,”](#) on page 99
- [“Export an OVF Template,”](#) on page 100

About OVF

OVF is a file format that allows for exchange of virtual appliances across products and platforms.

The OVF format offers the following advantages:

- OVF files are compressed, allowing for faster downloads.
- The vSphere Client validates an OVF file before importing it, and ensures that it is compatible with the intended destination server. If the appliance is incompatible with the selected host, it cannot be imported and an error message appears.
- OVF can encapsulate multi-tiered applications and more than one virtual machine.

Deploy an OVF Template

You can deploy an OVF template from a local file system accessible to the vSphere Client machine, or from a web URL.

Procedure

- 1 In the vSphere Client, select **File > Deploy OVF Template**.

The Deploy OVF Template wizard appears.

- 2 Specify the source location and click **Next**.

| Option | Action |
|-------------------------|---|
| Deploy from File | Browse your file system for an OVF or OVA template. |
| Deploy from URL | Specify a URL to an OVF template located on the internet. Example: <code>http://vmware.com/VMTN/appliance.ovf</code> |

- 3 View the OVF Template Details page and click **Next**.
- 4 If license agreements are packaged with the OVF template, the End User License Agreement page appears. Agree to accept the terms of the licenses and click **Next**.
- 5 (Optional) Edit the name and select the folder location within the inventory where the vApp will reside, and click **Next**.

NOTE When the vSphere Client is connected directly to an ESXi host, the option to select the folder location does not appear.

- 6 Select the deployment configuration from the drop-down menu and click **Next**.

The option selected typically controls the memory settings, number of CPUs and reservations, and application-level configuration parameters.

NOTE This page appears only if the OVF template contains deployment options.

- 7 Select the host or cluster on which you want to deploy the OVF template and click **Next**.
- 8 Select the host on which you want to run the deployed OVF template, and click **Next**.

NOTE This page appears only if the destination is a resource pool associated with a cluster with DRS disabled or in manual mode.

- 9 Navigate to, and select the resource pool where you want to run the OVF template and click **Next**.

NOTE This page appears only if the cluster contains a resource pool.

- 10 (Optional) Apply a virtual machine storage profile from the **VM Storage Profile** drop-down menu.

IMPORTANT You cannot select a virtual machine storage profile if the host or cluster in which the virtual machine runs has a license that does not include virtual machine storage profiles.

The list of datastores shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile.

- 11 Select a datastore to store the deployed OVF template, and click **Next**.

Datastores are a unifying abstraction for storage locations such as Fibre Channel, iSCSI LUNs, or NAS volumes. On this page, you select from datastores already configured on the destination cluster or host. The virtual machine configuration file and virtual disk files are stored on the datastore. Select a datastore large enough to accommodate the virtual machine and all of its virtual disk files.

- 12 Select the disk format to store the virtual machine virtual disks, and click **Next**.

| Format | 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 | A type of 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. it might take much longer to create disks in this format than to create other types o disks. |
| Thin Provision | Use this format to save storage space. For the thin disk, you provision as much datastore space as the disk would require based on the value that you enter for the disk size. However, the thin disk starts small and at first, uses only as much datastore space as the disk needs for its initial operations. |

- 13 If the appliance that you are deploying has one ore more vService dependencies, select a binding service provider.
- 14 For each network specified in the OVF template, select a network by right-clicking the **Destination Network** column in your infrastructure to set up the network mapping and click **Next**.
- 15 On the **IP Allocation** page, configure how IP addresses are allocated for the virtual appliance and click **Next**.

| Option | Description |
|------------------|--|
| Fixed | You will be prompted to enter the IP addresses in the Appliance Properties page. |
| Transient | IP addresses are allocated from a specified range when the appliance is powered on. The IP addresses are released when the appliance is powered off. |
| DHCP | A DHCP server is used to allocate the IP addresses. |

This page does not appear if the deployed OVF template does not contain information about the IP scheme it supports.

- 16 Set the user-configurable properties and click **Next**.

The set of properties that you are prompted to enter depend on the selected IP allocation scheme. For example, you are prompted for IP related information for the deployed virtual machines only in the case of a fixed IP allocation scheme.

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

The progress of the import task appears in the vSphere Client Status panel.

Deploy an OVF Template in the vSphere Web Client

You can deploy an OVF template from a local file system accessible to the vSphere Web Client, or from a Web URL.

Prerequisites

Install the Client Integration plug-in before you deploy an OVF template. This plug-in enables OVF deployment on your local filesystem.

NOTE Depending on the security settings of your browser, you might have to explicitly approve the plug-in when you use it the first time.

For more information, see [“Install the Client Integration Plug-In in the vSphere Web Client,”](#) on page 267.

Procedure

- ◆ Select any inventory object that is a valid parent object of a virtual machine, such as a datacenter, folder, cluster, resource pool, or host.

Select **Actions > All vCenter Actions > Deploy OVF Template**.

Select the OVF Source Location

Specify the location where the source the OVF template resides.

Procedure

- 1 Specify the source location and click .

| Option | Action |
|-------------------------|--|
| Deploy from File | Browse your file system for an OVF or OVA template. |
| Deploy from URL | Type a URL to an OVF template located on the internet. Example: http://vmware.com/VMTN/appliance.ovf |

- 2 Click **Next**.

Review the OVF Details

The OVF template details display available information about the file.

Procedure

- ◆ Review the OVF template details and click **Next**.

Accept the OVF License Agreements

This page appears only if license agreements are packaged with the OVF template.

Procedure

- ◆ Agree to accept the terms of the end user license agreements, and click **Next**.

Select OVF Name and Location

Specify a name and location for the deployed template.

Procedure

- 1 Edit the name of the template.
The name must be unique within each vCenter Server virtual machine folder.
- 2 Select the folder location within the inventory where the vApp or VM will reside.
- 3 Click **Next**.

Select OVF Deployment Configuration

The deployment configuration typically controls the memory settings, number of CPUs and reservations, and application-level configuration parameters.

This page appears only if the OVF template contains deployment options.

Procedure

- ◆ Select the deployment configuration from the drop-down menu and click **Next**.

Select a Resource for the OVF Template

Select a resource for the template.

Procedure

- 1 Select or browse for a resource (host, cluster, vApp, or resource pool) on which you want to deploy the OVF template.
Any Compatibility problems appear at the bottom of the window.
- 2 Click **Next**.

Select Storage for OVF Template

Select the location to store the files for the deployed template.

Procedure

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

| Format | 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 | A type of 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. it might take much longer to create disks in this format than to create other types o disks. |
| Thin Provision | Use this format to save storage space. For the thin disk, you provision as much datastore space as the disk would require based on the value that you enter for the disk size. However, the thin disk starts small and at first, uses only as much datastore space as the disk needs for its initial operations. |

- 2 Select a datastore to store the deployed OVF template.

Datastores are a unifying abstraction for storage locations such as Fibre Channel, iSCSI LUNs, or NAS volumes. On this page, you select from datastores already configured on the destination cluster or host. The virtual machine configuration file and virtual disk files are stored on the datastore. Select a datastore large enough to accommodate the virtual machine and all of its virtual disk files.

- 3 Click **Next**.

Configure Networks for OVF Template

Set up and configure the networks the deployed OVF templates use.

Procedure

- 1 For each network specified in the OVF template, select a network by right-clicking the **Destination Network** column in your infrastructure to set up the network mapping.
- 2 On the **IP Allocation** menu, configure how IP addresses are allocated for the virtual appliance.

| Option | Description |
|------------------|--|
| Fixed | You will be prompted to enter the IP addresses in the Appliance Properties page. |
| Transient | IP addresses are allocated from a specified range when the appliance is powered on. The IP addresses are released when the appliance is powered off. |
| DHCP | A DHCP server is used to allocate the IP addresses. |

This option does not appear if the deployed OVF template does not contain information about the IP scheme it supports.

- 3 Type the network protocol information.

This option only appears if the OVF you deploy contains network properties.

The network protocol setting might be for the DNS servers or gateway. You can type a host name or IP address.

- 4 Click **Next**.

Customize the OVF Template

Customize the deployment properties of the template.

Procedure

- 1 Customize the deployment properties.

All required properties must have a valid value before you can continue.

- 2 Click **Next**.

Configure vService Dependency

Select a binding service for the template's vService dependency.

This page appears if the appliance you are deploying has one or more vService dependency.

Procedure

- 1 Select a binding service provider.
- 2 Click **Next**.

Browse VMware Virtual Appliance Marketplace

Available vApps appear in the main panel.

To get to the Virtual Appliance Marketplace page, select **File > Browse VA Marketplace** from the main menu.

Procedure

- ◆ Select an available vApp and click **Download Now**.

The OVF Template Details page appears.

Export an OVF Template in the vSphere Web Client

An OVF package captures the state of a virtual machine or vApp into a self-contained package. The disk files are stored in a compressed, sparse format.

Required privilege: **vApp.Export**

Procedure

- 1 In the vSphere Web Client, navigate to a virtual machine or vApp and select **Export OVF Template** from the Inventory Actions menu.
- 2 In the Export OVF Template dialog, type the **Name** of the template.
For example, type **MyVm**.

NOTE When exporting an OVF template with a name that contains asterisk (*) characters, those characters turn into underscore characters (_).

- 3 Click **Choose** to browse to the folder location where you want to save the template.
- 4 Select **Overwrite existing files** if you wish to overwrite files with the same name on your desktop.
- 5 In the **Format** field, determine how you want to store the files.
 - Select **Folder of files (OVF)** to store the OVF template as a set of files (.ovf, .vmdk, and .mf) This format is optimal if you plan to publish the OVF files on a Web server or image library. The package can be imported, for example, into the vSphere Web Client by publishing the URL to the .ovf file.
 - Select **Single file (OVA)** to package the OVF template into a single .ova file. This might be convenient to distribute the OVF package as a single file if it needs to be explicitly downloaded from a Web site or moved around using a USB key.
- 6 In the **Annotation** field, type a description for the virtual machine.
- 7 Select the **Enable advanced options** checkbox if you want to include other information in the exported template.
- 8 Click **OK**.

Example: Folder Locations for OVF and OVA Files

If you type **OvfLib** for a new OVF folder, the following files might be created:

- C:\OvfLib\MyVm\MyVm.ovfI
- C:\OvfLib\MyVm.mf
- C:\OvfLib\MyVm-disk1.vmdk

If you type **C:\NewFolder\OvfLib** for a new OVF folder, the following files might be created:

- C:\NewFolder\OvfLib\MyVm\MyVm.ovfI
- C:\NewFolder\OvfLib\MyVm.mf
- C:\NewFolder\OvfLib\MyVm-disk1.vmdk

If you choose to export into the OVA format, and type **MyVm**, the file C:\MyVm.ova is created.

Export an OVF Template

An OVF package captures the state of a virtual machine or vApp into a self-contained package. The disk files are stored in a compressed, sparse format.

Required privilege: **vApp.Export**

Procedure

- 1 Select the virtual machine or vApp and select **File > Export > Export OVF Template**.

- 2 In the Export OVF Template dialog, type the **Name** of the template.

For example, type **MyVm**.

NOTE When exporting an OVF template with a name that contains asterisk (*) characters, those characters turn into underscore characters (_).

- 3 Enter the **Directory** location where the exported virtual machine template is saved, or click “...” to browse for the location.

The C:\ drive is the default location where the template is stored.

For example, **OvfLib**.

- 4 In the **Format** field, determine how you want to store the files.

- Select **Folder of files (OVF)** to store the OVF template as a set of files (.ovf, .vmdk, and .mf) This format is optimal if you plan to publish the OVF files on a web server or image library. The package can be imported, for example, into the vSphere client by publishing the URL to the .ovf file.
- Select **Single file (OVA)** to package the OVF template into a single .ova file. This might be convenient to distribute the OVF package as a single file if it needs to be explicitly downloaded from a web site or moved around using a USB key.

- 5 In **Description**, type a description for the virtual machine.

By default, the text from the **Notes** pane on the virtual machine’s **Summary** tab appears in this text box.

- 6 Select the checkbox if you want to include image files attached to floppy and CD/DVD devices in the OVF package.

NOTE This checkbox only shows if the virtual machine is connected to an ISO file or if the floppy drive is connected to a floppy image.

- 7 Click **OK**.

The download process is shown in the Export window.

Example: Folder Locations for OVF and OVA Files

If you type **OvfLib** for a new OVF folder, the following files might be created:

- C:\OvfLib\MyVm\MyVm.ovfI

- C:\OvfLib\MyVm.mf
- C:\OvfLib\MyVm-disk1.vmdk

If you type **C:\NewFolder\OvfLib** for a new OVF folder, the following files might be created:

- C:\NewFolder\OvfLib\MyVm\MyVm.ovf
- C:\NewFolder\OvfLib\MyVm.mf
- C:\NewFolder\OvfLib\MyVm-disk1.vmdk

If you choose to export into the OVA format, and type **MyVm**, the file C:\MyVm.ova is created.

Installing the Microsoft Sysprep Tool

Install the Microsoft Sysprep tool so that you can customize Windows guest operating systems when you clone virtual machines.

The guest operating system customization feature in vCenter Server and VMware vCenter Server Appliance uses the functions of the Sysprep tool. Verify that your vCenter Server or VMware vCenter Server Appliance system meets the following requirements before you customize your virtual machine's Windows guest operating systems:

- Install the Microsoft Sysprep tool. Microsoft includes the system tool set on the installation CD-ROM discs for Windows 2000, Windows XP, and Windows 2003. The Sysprep tool is built into the Windows Vista and Windows 2008 operating systems.
- The correct versions of the Sysprep tool is installed for each guest operating system that you want to customize.
- The password for the local administrator account on the virtual machines is set to blank ("").
- If you are using the VMware vCenter Server Application, you must have access to the VMware vCenter Server Appliance Web console.

NOTE Customization operations will fail if the correct version of the Sysprep tool is not found.

This chapter includes the following topics:

- [“Install the Microsoft Sysprep Tool from a Microsoft Web Site,”](#) on page 103
- [“Install the Microsoft Sysprep Tool from the Windows Operating System CD,”](#) on page 104
- [“Install the Microsoft Sysprep Tool for VMware vCenter Server Appliance,”](#) on page 105

Install the Microsoft Sysprep Tool from a Microsoft Web Site

You can download and install the Microsoft Sysprep tool from the Microsoft Web site.

Prerequisites

Verify that you download the correct version for the guest operating system to customize. Microsoft has a different version of Sysprep for each release and service pack of Windows. You must use the version of Sysprep specific to the operating system that you are deploying.

The vCenter Server installer creates a Sysprep directory in *ALLUSERSPROFILE*. The *ALLUSERSPROFILE* location is usually `\Documents And Settings\All Users\`. The `vpxd.cfg` file is also in this location. On Windows 2008, the file location is `C:\ProgramData\VMware\VMware VirtualCenter\sysprep\`.

Procedure

- 1 Download the Sysprep files from the Microsoft Download Center and save them to your local system.
- 2 Open and expand the .cab file.

The contents of the .cab file vary, depending on the operating system.

- 3 Extract the files to the appropriate directory for your guest operating system.

The following Sysprep support directories are created during the vCenter Server installation:

```
C:\ALLUSERSPROFILE\Application Data\VMware\VMware VirtualCenter\sysprep
... \1.1\
... \2k\
... \xp\
... \svr2003\
... \xp-64\
... \svr2003-64\
```

- 4 Select the subdirectory that corresponds to your operating system.
- 5 Click **OK** to expand the files.

What to do next

Customize a new virtual machine with a supported Windows guest operating system when you clone an existing virtual machine.

Install the Microsoft Sysprep Tool from the Windows Operating System CD

You can install the Microsoft Sysprep tool from a CD.

The vCenter Server installer creates a Sysprep directory in *ALLUSERSPROFILE*. The *ALLUSERSPROFILE* location is usually `\Documents and Settings\All Users\`. The `vpxd.cfg` file is also in this location. On Windows 2008, the file location is `C:\ProgramData\VMware\VMware VirtualCenter\sysprep\`.

Procedure

- 1 Insert the Windows operating system CD into the CD-ROM drive, often the D: drive.
- 2 Locate the `DEPLOY.CAB` file in the `\Support\Tools` directory on the CD.
- 3 Open and expand the `DEPLOY.CAB` file.

The contents of the .cab file vary, depending on the operating system.

- 4 Extract the files to the directory appropriate for your guest operating system.

The following Sysprep support directories are created during the vCenter Server installation:

```
C:\ALLUSERSPROFILE\Application Data\VMware\VMware VirtualCenter\sysprep
... \1.1\
... \2k\
... \xp\
... \svr2003\
... \xp-64\
... \svr2003-64\
```

- 5 Select the subdirectory that corresponds to your operating system.
- 6 Click **OK** to expand the files.

- 7 Repeat this procedure to extract Sysprep files for each of the Windows guest operating systems that you plan to customize using vCenter Server.

What to do next

Customize a new virtual machine with a supported Windows guest operating system when you clone an existing virtual machine.

Install the Microsoft Sysprep Tool for VMware vCenter Server Appliance

After you download and install the Microsoft Sysprep tool from the Microsoft Web site, you can use the VMware vCenter Server Appliance Web console to upload the files to the appliance.

Prerequisites

Verify that you download the correct version for the guest operating system to customize. Microsoft has a different version of Sysprep for each release and service pack of Windows. You must use the version of Sysprep specific to the operating system that you are deploying.

When you upload the files to vCenter Server Appliance, the contents of the CAB file for the Sysprep Tool version that you downloaded are saved in `/etc/vmware-vpx/sysprep/OS`. For example, `/etc/vmware-vpx/sysprep/2k` or `/etc/vmware-vpx/sysprep/xp`.

Procedure

- 1 Download the Sysprep files from the Microsoft Download Center and save them to your local system.
- 2 Log in to the VMware vCenter Server Appliance Web console and click the vCenter Server **Summary** tab.
- 3 In the Utilities panel, click the Sysprep Files **Upload** button.
- 4 Select a Windows platform directory, and browse to the file.
- 5 Click **Open**.
The file is uploaded to the vCenter Server Appliance.
- 6 Click **Close**.

You can customize a new virtual machine with a supported Windows guest operating system when you clone an existing virtual machine.

Configuring Virtual Machine Hardware in the vSphere Web Client

7

You can add or configure most virtual machine properties during the virtual machine creation process or after you create the virtual machine and install the guest operating system.

You configure the virtual machines hardware and can change nearly every characteristic that you selected when you created the virtual machine. You can view the existing hardware configuration and add or remove hardware. You can configure CPUs, CPU hyperthreading resources, memory, and disks.

This chapter includes the following topics:

- [“Virtual Machine Compatibility,”](#) on page 107
- [“Virtual CPU Configuration,”](#) on page 112
- [“Virtual Memory Configuration,”](#) on page 119
- [“Network Virtual Machine Configuration,”](#) on page 122
- [“Parallel and Serial Port Configuration,”](#) on page 125
- [“Virtual Disk Configuration,”](#) on page 132
- [“SCSI Controller Configuration,”](#) on page 141
- [“Other Virtual Machine Device Configuration,”](#) on page 144
- [“Configure the Virtual Machine Communication Interface in the vSphere Web Client,”](#) on page 152
- [“USB Configuration from an ESXi Host to a Virtual Machine,”](#) on page 152
- [“USB Configuration from a Client Computer to a Virtual Machine in the vSphere Web Client,”](#) on page 159
- [“Add a Shared Smart Card Reader to Virtual Machines in the vSphere Web Client,”](#) on page 165

Virtual Machine Compatibility

When you create a virtual machine or upgrade an existing virtual machine, you use the virtual machine compatibility setting to select the ESXi host versions that the virtual machine can run on.

The compatibility setting determines the virtual hardware available to the virtual machine, which corresponds to the physical hardware available on the host. Virtual hardware includes BIOS and EFI, available virtual PCI slots, maximum number of CPUs, maximum memory configuration, and other characteristics. New virtual hardware capabilities are typically released once a year with major or minor releases of vSphere.

Each virtual machine compatibility level supports at least five major or minor vSphere releases. For example, a virtual machine with ESXi 3.5 and later compatibility can run on ESXi 3.5, ESXi 4.0, ESXi 4.1, ESXi 5.0, and ESXi 5.1.

Table 7-1. Virtual Machine Compatibility Options

| Compatibility | Description |
|--------------------------|---|
| ESXi 5.1 and later | This virtual machine (hardware version 9) is compatible with ESXi 5.1 and later. |
| ESXi 5.0 and later | This virtual machine (hardware version 8) is compatible with ESXi 5.0 and 5.1. |
| ESX/ESXi 4.x and later | This virtual machine (hardware version 7) is compatible with ESX/ ESXi 4.x, ESXi 5.0, and ESXi 5.1. |
| ESX/ESXi 3.5 and later | This virtual machine (hardware version 4) is compatible with ESX/ESXi 3.5, ESX/ESXi 4.x, and ESXi 5.1. It is also compatible with VMware Server 1.0 and later. ESXi 5.0 does not allow creation of virtual machines with this compatibility, but you can run such virtual machines if they were created on a host with different compatibility. |
| ESX Server 2.x and later | This virtual machine (hardware version 3) is compatible with ESX Server 2.x, ESX/ESXi 3.5, ESX/ESXi 4.x, and ESXi 5.0. You cannot create or edit virtual machines with ESX Server 2.x compatibility. You can only start or upgrade them. |

The compatibility setting that appears in the **Compatible with** drop-down menu is the default for the virtual machine that you are creating. The following factors determine the default virtual machine compatibility:

- The ESXi host version on which the virtual machine is created.
- The inventory object that the default virtual machine compatibility is set on, including a host, cluster, or datacenter.

You can accept the default compatibility or select a different setting. It is not always necessary to select the latest ESXi host version. Selecting an earlier version can provide greater flexibility and is useful in the following situations:

- To standardize testing and deployment in your virtual environment.
- If you do not need the capabilities of the latest host version.
- To maintain compatibility with older hosts.

When you create a virtual machine, consider the environment that the virtual machine will run in and weigh the benefits of different compatibility strategies. Consider your options for these scenarios, which demonstrate the flexibility inherent with each virtual machine compatibility selection.

| Objects in Environment | Compatibility | Results |
|--|--------------------|--|
| Cluster with ESXi 5.0 and ESXi 4.x hosts | ESX 4.x and later | Preserves the ability of the virtual machine to run on other hosts in the cluster, such as ESXi 5.0. You might not have access to the latest virtual hardware features. |
| Cluster with ESXi 5.0 and ESXi 4.x hosts | ESXi 5.0 and later | Gives you access to virtual hardware features that are not available with ESXi 4.x. Can also run on ESXi 5.0 and later hosts. <ul style="list-style-type: none"> ■ You cannot migrate this virtual machine to an ESXi 4.x host. ■ This virtual machine does not have all the capabilities available to virtual machines that run on ESXi 5.1, for example, you cannot use 64 virtual processors. |
| ESXi 5.1 host | ESXi 5.1 and later | Provides access to the latest virtual features, but cannot share resources with earlier hosts. |

If virtual machines do not have to stay compatible with older ESX/ESXi host versions, you can upgrade them.

- To maintain virtual machine compatibility with ESX/ESXi 3.5 hosts, upgrade the virtual machine on an ESX/ESXi 3.5 host, which results in a virtual machine upgrade to version 4.
- To maintain virtual machine compatibility with ESX/ESXi 4.x hosts, upgrade the virtual machine on an ESX/ESXi 4.x host, which results in a virtual machine upgrade to version 7.

Set the Default Compatibility for Virtual Machine Creation in the vSphere Web Client

You can set the default compatibility for virtual machine creation on the host, cluster, or datacenter. These options ensure that when virtual machines are added to an existing vSphere environment, they will be compatible with the host versions that reside there.

The following conditions apply:

- To set the default compatibility on the cluster, the cluster must contain hosts that are connected and not in maintenance mode.
- A default compatibility setting on the host overrides a default cluster or datacenter setting.
- A default compatibility setting on the cluster overrides a default datacenter setting.

Prerequisites

Required privileges:

- On the host or cluster: **Host.Inventory.Modify cluster**
- On the datacenter: **Datacenter.Reconfigure datacenter**

Procedure

- ◆ Select a host, cluster, or datacenter in the inventory.

| Option | Action |
|-------------------|--|
| Host | <ol style="list-style-type: none"> a Click the Manage tab, and click Settings. b In the Virtual Machines section, select Default VM Compatibility and click Edit. c Select the compatibility from the drop-down menu and click OK. |
| Cluster | <ol style="list-style-type: none"> a Click the Manage tab and click Settings. b Click the Edit button next to Default VM Compatibility. c Select the compatibility from the drop-down menu and click OK. |
| Datacenter | <ol style="list-style-type: none"> a Right-click the datacenter and select Edit Default VM Compatibility. b Select the compatibility from the drop-down menu and click OK. |

When you create a virtual machine on one of these objects, the default compatibility setting is used.

Determine the Default Virtual Machine Compatibility Setting in the vSphere Web Client

The compatibility setting for a virtual machine provides information about the hosts, clusters, or datacenter the virtual machine is compatible with.

The virtual machine **Summary** tab displays the compatibility for the virtual machine. You can set and view the default compatibility used for virtual machine creation at the host, cluster, or datacenter level.

Procedure

- ◆ Select an inventory object and display the virtual machine compatibility.

| Option | Action |
|------------------------|--|
| Virtual machine | Select a virtual machine in the inventory and click the Summary tab. The top panel displays the Compatibility setting. |
| Host | Select a host in the inventory and click the Manage tab. The Default Virtual Machine Compatibility is listed in the Virtual Machines section. |
| Cluster | Select a cluster in the inventory, click the Manage tab, and in the Configuration section, click General . |
| Datacenter | Right-click a datacenter in the inventory and select All Virtual Infrastructure Actions > Edit Default VM Compatibility . |

You can change the default compatibility or upgrade the virtual machine compatibility.

Hardware Features Available with Virtual Machine Compatibility Settings

The virtual machine compatibility setting determines the virtual hardware available to the virtual machine, which corresponds to the physical hardware available on the host. You can review and compare the hardware available for different compatibility levels to help you determine whether to upgrade the virtual machines in your environment.

Table 7-2. Supported Features for Virtual Machine Compatibility

| Feature | ESXi 5.1 and later | ESXi 5.0 and later | ESX/ESXi 4.x and later | ESX/ESXi 3.5 and later |
|---|--------------------|--------------------|------------------------|------------------------|
| Hardware version | 9 | 8 | 7 | 4 |
| Maximum memory (MB) | 1035264 | 1035264 | 261120 | 65532 |
| Maximum number of logical processors | 64 | 32 | 8 | 4 |
| Maximum number of cores (virtual CPUs) per socket | 64 | 32 | 8 | 1 |
| Maximum SCSI adapters | 4 | 4 | 4 | 4 |
| Bus Logic adapters | Y | Y | Y | Y |
| LSI Logic adapters | Y | Y | Y | Y |
| LSI-Logic SAS adapters | Y | Y | Y | N |
| VMware Paravirtual controllers | Y | Y | Y | N |
| Virtual SCSI disk | Y | Y | Y | Y |
| SCSI passthrough | Y | Y | Y | Y |
| SCSI hot plug support | Y | Y | Y | Y |
| IDE nodes | Y | Y | Y | Y |
| Virtual IDE disk | Y | Y | Y | N |
| Virtual IDE CDROMs | Y | Y | Y | Y |
| IDE hot plug support | N | N | N | N |
| Maximum NICs | 10 | 10 | 10 | 4 |

Table 7-2. Supported Features for Virtual Machine Compatibility (Continued)

| Feature | ESXi 5.1 and later | ESXi 5.0 and later | ESX/ESXi 4.x and later | ESX/ESXi 3.5 and later |
|-------------------------------|---|---|------------------------|------------------------|
| PCNet32 | Y | Y | Y | Y |
| VMXNet | Y | Y | Y | Y |
| VMXNet2 | Y | Y | Y | Y |
| VMXNet3 | Y | Y | Y | N |
| E1000 | Y | Y | Y | Y |
| E1000e | Y | Y | N | N |
| USB 1.x and 2.0 | Y | Y | Y | N |
| USB 3.0 | Y (Supported only for Passthrough from client computers to virtual machines on Linux guests.) | Y (Supported only for Passthrough from client computers to virtual machines on Linux guests.) | N | N |
| Maximum video memory (KB) | 524288 | 131072 | 131072 | 131072 |
| SVGA displays | 10 | 10 | 10 | 1 |
| SVGA 3D hardware acceleration | Y | Y | N | N |
| VMCI | Y | Y | Y | N |
| PCI passthrough | 6 | 6 | 6 | 0 |
| PCI Hot plug support | Y | Y | Y | N |
| Nested HV support | Y | N | N | N |
| vPMC support | Y | N | N | N |
| Serial ports | 4 | 4 | 4 | 4 |
| Parallel ports | 3 | 3 | 3 | 3 |
| Floppy devices | 2 | 2 | 2 | 2 |
| Guest OS support | 91 | 91 | 78 | 45 |

Virtual CPU Configuration

You can add, change, or configure CPU resources to improve virtual machine performance. You can set most of the CPU parameters during virtual machine creation or after the guest operating system is installed. Some actions require you to power off the virtual machine before changing the settings.

VMware uses the following terminology. Understanding these terms can help you plan your CPU resource allocation strategy.

| | |
|--|---|
| CPU | The CPU or processor is the portion of a computer system that carries out the instructions of a computer program and is the primary element carrying out the computer's functions. CPUs contain cores. |
| CPU Socket | A physical connector on a computer motherboard that accepts a single physical CPU. Many motherboards can have multiple sockets that can in turn accept multicore processors (CPUs). The vSphere Client computes the total number of cores to give the virtual machine from the number of virtual sockets and cores per socket that you select. The vSphere Web Client computes the total number of virtual sockets from the number of cores and cores per socket that you select. |
| Core | Comprises a unit containing an L1 cache and functional units needed to run programs. Cores can independently run programs or threads. One or more cores can exist on a single CPU. |
| Corelet | An AMD processor corelet is architecturally equivalent to a logical processor. Certain future AMD processors will comprise a number of compute units, where each compute unit has a number of corelets. Unlike a traditional processor core, a corelet lacks a complete set of private, dedicated execution resources. It shares some execution resources with other corelets such as an L1 Instruction Cache or a floating-point execution unit. AMD refers to corelets as cores, but because these are unlike traditional cores, VMware uses the nomenclature of "corelets" to make resource sharing more apparent. |
| Thread | Some cores can run independent streams of instructions simultaneously. In existing implementations, cores can run one or two software threads at one time by multiplexing the functional units of the core between the software threads, as necessary. Such cores are called dual or multithreaded. |
| Resource sharing | Shares specify the relative priority or importance of a virtual machine or resource pool. If a virtual machine has twice as many shares of a resource as another virtual machine, it is entitled to consume twice as much of that resource when these two virtual machines are competing for resources. |
| Resource allocation | You can change CPU resource allocation settings, such as shares, reservation, and limit, when available resource capacity does not meet demands. For example, if at year end the workload on accounting increases, you can increase the accounting resource pool reserve. |
| vSphere Virtual Symmetric Multiprocessing (Virtual SMP) | Feature that enables a single virtual machine to have multiple cores. |

Virtual CPU Limitations

The maximum number of virtual CPUs that you can assign to a virtual machine depends on the number of logical CPUs on the host, the host license, and the type of guest operating system that is installed on the virtual machine.

Be aware of the following limitations:

- A virtual machine cannot have more virtual CPUs than the number of logical cores on the host. The number of logical cores is equal to the number of physical cores if hyperthreading is disabled or two times that number if hyperthreading is enabled.
- Not every guest operating system supports Virtual SMP, and some that do require reinstallation if the number of CPUs changes. For more information about using Virtual SMP, search the VMware Knowledge Base.
- Guest operating systems that support Virtual SMP might support fewer processors than are available on the host. For information about Virtual SMP support, see the *VMware Compatibility Guide*.
- Hyperthreaded hosts might affect virtual machine performance, depending on the workload. The best practice is to test your workload to determine whether to enable or disable hyperthreading on your hosts.

Configuring Multicore Virtual CPUs

VMware multicore virtual CPU support lets you control the number of cores per virtual socket in a virtual machine. This capability lets operating systems with socket restrictions use more of the host CPU's cores, which increases overall performance.

IMPORTANT When you configure your virtual machine for multicore virtual CPU settings, you must ensure that your configuration complies with the requirements of the guest operating system EULA.

Using multicore virtual CPUs can be useful when you run operating systems or applications that can take advantage of only a limited number of CPU sockets.

You can configure a virtual machine that runs on an ESXi host to have up to 64 virtual CPUs. A virtual machine cannot have more virtual CPUs than the actual number of logical CPUs on the host. The number of logical CPUs is the number of physical processor cores or two times that number if hyperthreading is enabled. For example, if a host has 64 logical CPUs, you can configure the virtual machine for 64 virtual CPUs.

You configure how the virtual CPUs are assigned in terms of cores and cores per socket. Determine how many CPU cores you want in the virtual machine, then select the number of cores you want in each socket, depending on whether you want a single core CPU, dual-core CPU, tri-core CPU, and so on. Your selection determines the number of sockets that the virtual machine has.

For more information about multicore CPUs, see the *vSphere Resource Management* documentation.

Change CPU Hot Plug Settings in the vSphere Web Client

The CPU hot plug option lets you add CPU resources for a virtual machine while the machine is turned on.

The following conditions apply:

- For best results, use virtual machines that are compatible with ESXi 5.0 and later.
- Hot-adding multicore virtual CPUs is supported only with virtual machine that are compatible with ESXi 5.0 and later.
- Not all guest operating systems support CPU hot add. You can disable these settings if the guest is not supported.

- To use the CPU hot-add feature with virtual machines that are compatible with ESXi 4.x and later, set the **Number of cores per socket** to 1.
- Adding CPU resources to a running virtual machine with CPU hot plug enabled disconnects and reconnects all USB passthrough devices connected to that virtual machine.

Prerequisites

Verify that the virtual machine is running under the following conditions:

- VMware Tools is installed. This condition is required for hot plug functionality with Linux guest operating systems.
- The virtual machine has a guest operating system that supports CPU hot plug.
- The virtual machine compatibility is ESX/ESXi 4.x or later.
- The virtual machine is turned off.
- Required privileges: **Virtual Machine.Configuration.Settings**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CPU**, and select **Enable CPU Hot Add**.
- 3 Click **OK**.

You can now add CPUs while the virtual machine is turned on.

Change the Number of Virtual CPUs in the vSphere Web Client

You can configure a virtual machine that runs on an ESXi host to have up to 64 virtual CPUs. You can change the number of virtual CPUs while the virtual machine is running or turned off.

Virtual CPU hot add is supported for virtual machines with multicore CPU support and ESXi 5.0 and later compatibility. When the virtual machine is turned on, and CPU hot add is enabled, you can hot add virtual CPUs to the running virtual machine. You can add only multiples of the number of cores per socket.

IMPORTANT When you configure your virtual machine for multicore virtual CPU settings, you must ensure that your configuration complies with the requirements of the guest operating system EULA.

Prerequisites

- If CPU hot add is not enabled, turn off the virtual machine before adding CPUs.
- If CPU hot remove is not enabled, turn off the virtual machine before removing CPUs.
- To hot add multicore CPUs, verify that the virtual machine compatibility is ESXi 5.0 and later.
- Required privilege: **Virtual Machine.Configuration.Change CPU Count** on the virtual machine

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Expand **CPU**, and select the number of cores from the **CPU** drop-down menu.

- 3 Select the number of cores per socket from the **Cores Per Socket** drop-down menu.
- 4 Click **OK**.

Allocate CPU Resources in vSphere Web Client

To manage workload demands, you can change the amount of CPU resources allocated to a virtual machine by using the shares, reservations, and limits settings.

A virtual machine has the following user-defined settings that affect its CPU resource allocation.

| | |
|--------------------|---|
| Limit | Places a limit on the consumption of CPU time for a virtual machine. This value is expressed in MHz or GHz. |
| Reservation | Specifies the guaranteed minimum allocation for a virtual machine. The reservation is expressed in MHz or GHz. |
| Shares | Each virtual machine is granted a number of CPU shares. The more shares a virtual machine has, the more often it gets a time slice of a CPU when there is no CPU idle time. Shares represent a relative metric for allocating CPU capacity. |

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CPU**, and allocate the CPU capacity for the virtual machine.

| Option | Description |
|--------------------|---|
| Reservation | Guaranteed CPU allocation for this virtual machine. |
| Limit | Upper limit for this virtual machine's CPU allocation. Select Unlimited to specify no upper limit. |
| Shares | CPU shares for this virtual machine in relation to the parent's total. Sibling virtual machines share resources according to their relative share values bounded by the reservation and limit. Select Low , Normal , or High , which specify share values respectively in a 1:2:4 ratio. Select Custom to give each virtual machine a specific number of shares, which express a proportional weight. |

- 3 Click **OK**.

Configure Hyperthreaded Core Sharing in the vSphere Web Client

To increase performance, you can select how the virtual CPUs of a virtual machine share physical cores on a hyperthreaded system.

Hyperthreading technology allows a single physical processor to behave like two logical processors. The hyperthreaded core sharing option provides detailed control over whether to schedule a virtual machine to share a physical processor core. The processor can run two independent applications at the same time. Although hyperthreading does not double the performance of a system, it can increase performance by better utilizing idle resources.

ESXi generally manages processor scheduling well, even when hyperthreading is enabled. These settings are useful only for detailed tweaking of critical virtual machines.

Prerequisites

- The hyperthreaded core sharing option must be enabled in your system's BIOS settings. See the *vSphere Resource Management* documentation.
- Turn off the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CPU**, and select a sharing mode from the **HT Sharing** drop-down menu.

| Option | Description |
|----------------------|--|
| Any (default) | The virtual CPUs of this virtual machine can share cores with other virtual CPUs of this or other virtual machines. |
| None | The virtual CPUs of this virtual machine have exclusive use of a processor core whenever they are scheduled to it. The other hyperthread of the core is halted while this virtual machine is using the core. |
| Internal | On a virtual machine with exactly two virtual processors, the two virtual processors are allowed to share one physical core (at the discretion of the host scheduler), but this virtual machine never shares a core with any other virtual machine. If this virtual machine has any other number of processors other than two, this setting is the same as the None setting. |

- 3 Click **OK**.

Configure Processor Scheduling Affinity in the vSphere Web Client

The **Scheduling Affinity** option gives you detailed control over how virtual machine CPUs are distributed across the host's physical cores (and hyperthreads if hyperthreading is enabled). ESXi generally manages processor scheduling well, even when hyperthreading is enabled. These settings are useful only for detailed tweaking of critical virtual machines.

Using CPU affinity, you can assign a virtual machine to a specific processor. This assignment allows you to restrict the assignment of virtual machines to a specific available processor in multiprocessor systems.

This setting does not appear for virtual machines in a DRS cluster or when the host has only one processor core and no hyperthreading.

For potential issues with CPU affinity, see the *vSphere Resource Management* documentation.

Prerequisites

- Verify that the virtual machine is turned off.
- Verify that the virtual machine does not reside in a DRS cluster.
- Verify that the host has more than one physical processor core.
- Privileges: **Virtual machine.Configuration.Change resource**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.

- 2 On the **Virtual Hardware** tab, expand **CPU**, and enter a comma-separated list of hyphenated processor ranges in the **Scheduling Affinity** text box.

For example, "0,4-7" would indicate affinity with CPUs 0,4,5,6, and 7. Selecting all processors is identical to selecting no affinity. You must provide at least as many processor affinities as you have virtual CPUs.

- 3 Click **OK**.

Change CPU Identification Mask Settings in the vSphere Web Client

CPU identification (CPU ID) masks control the CPU features visible to the virtual machine's guest operating system. Masking or hiding CPU features can make a virtual machine widely available to ESXi hosts for migration. 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 disallow migration with vMotion.

For example, masking the AMD No eXecute (NX) and the Intel eXecute Disable (XD) bits prevents the virtual machine from using these features, but provides compatibility that allows you to migrate virtual machines to ESXi hosts that do not include this capability. When the NX/XD bit is visible to the guest operating system, the virtual machine can use this feature, but you can migrate the virtual machine only to hosts on which the feature is enabled.



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.

Prerequisites

Turn off the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CPU**, and in the **CPUID Mask** drop-down menu, select an NX/XD option.

| Option | Description |
|--|--|
| Hide the NX/XD flag from guest | Increases vMotion compatibility. Hiding the NX/XD flag increases vMotion compatibility between hosts, but might disable certain CPU security features. |
| Expose the NX/XD flag to guest | Keeps all CPU security features enabled. |
| Keep current Advanced setting values for the NX/XD flag | Uses the NX/XD flag settings specified in the CPU Identification Mask dialog box. Enabled only when current settings specify something other than what is specified in the other NX/XD flag options, for example, if the NX/XD flag bit setting varies with processor brand. |

- 3 Click **OK**.

Expose VMware Hardware Assisted Virtualization in the vSphere Web Client

You can expose full CPU virtualization to the guest operating system so that applications that require hardware virtualization can run on virtual machines without binary translation or paravirtualization.

Prerequisites

- Verify that the virtual machine compatibility is ESXi 5.1 and later.

- Intel Nehalem Generation (Xeon Core i7) or later processors or AMD Opteron Generation 3 (Greyhound) or later processors.
- Verify that Intel VT-x or AMD-V is enabled in the BIOS so that hardware assisted virtualization is possible.
- Required Privileges: **Virtual machine.Configuration.Settings** set on the vCenter Server system.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CPU**, and select **Expose hardware-assisted virtualization to guest OS**.
- 3 Click **OK**.

The **Manage** tab refreshes, and the Nested Hypervisor CPU option shows **Enabled**.

Enable Virtual CPU Performance Counters in the vSphere Web Client

You can use performance tuning tools in the guest operating system for software profiling. You can identify and improve processor performance problems. This capability is useful for software developers who optimize or debug software that runs in the virtual machine.

The following conditions apply:

- If virtual CPU performance counters are enabled, you can migrate the virtual machine only to hosts that have compatible CPU performance counters.
- If an ESXi host's BIOS uses a performance counter or if Fault Tolerance is enabled, some virtual performance counters might not be available for the virtual machine to use.

NOTE If a virtual machine resides on an ESXi host in an EVC cluster, CPU counters are not supported for virtual machine creation or editing. You must disable CPU performance counters.

For a list of virtualized Model-Specific Registers (MSRs), see the VMware knowledge base article at <http://kb.vmware.com/kb/2030221>.

Prerequisites

- Verify that the virtual machine compatibility is ESXi 5.1 and later.
- Verify that the virtual machine is turned off.
- Verify that Intel Nehalem Generation (Xeon Core i7) or later processors or AMD Opteron Generation 3 ("Greyhound") or later processors are installed.
- Verify that Intel VT-x or AMD-V is enabled in the BIOS so that hardware-assisted virtualization is possible.
- Required Privileges: **Virtual machine.Configuration.Settings** is set on the vCenter Server system.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CPU** and enable virtualized CPU performance counters.
- 3 Click **OK**.

Change CPU/MMU Virtualization Settings in the vSphere Web Client

ESXi can determine whether a virtual machine should use hardware support for virtualization. ESXi makes this determination based on the processor type and the virtual machine. Overriding the automatic selection can provide better performance for some use cases.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CPU**, and select an instruction set from the **CPU/MMU Virtualization** drop-down menu.
- 3 Click **OK**.

Virtual Memory Configuration

You can add, change, or configure virtual machine memory resources or options to enhance virtual machine performance. You can set most of the memory parameters during virtual machine creation or after the guest operating system is installed. Some actions require that you power off the virtual machine before changing the settings.

The memory resource settings for a virtual machine determine how much of the host's memory is allocated to the virtual machine. The virtual hardware memory size determines how much memory is available to applications that run in the virtual machine. A virtual machine cannot benefit from more memory resources than its configured virtual hardware memory size. ESXi hosts limit the memory resource use to the maximum amount useful for the virtual machine, so that you can accept the default of Unlimited memory resources.

Change the Memory Configuration in the vSphere Web Client

You can reconfigure the amount of memory allocated to a virtual machine to enhance performance.

Minimum memory size is 4MB for virtual machines that use BIOS firmware. Virtual machines that use EFI firmware require at least 96MB of RAM or they cannot power on.

Maximum memory size for a virtual machine depends on the host's physical memory and the virtual machine's compatibility setting.

If the virtual machine memory is greater than the host memory size, swapping occurs, which can have a severe effect on virtual machine performance. The memory size must be a multiple of 4MB. The maximum for best performance represents the threshold above which the host's physical memory is insufficient to run the virtual machine at full speed. This value fluctuates as conditions on the host change, for example, as virtual machines are powered on or off.

Table 7-3. Maximum Virtual Machine Memory

| Introduced in Host Version | Virtual Machine Compatibility | Maximum Memory Size |
|----------------------------|-------------------------------|---------------------|
| ESXi 5.1 | ESXi 5.1 and later | 1011GB |
| ESXi 5.0 | ESXi 5.0 and later | 1011GB |
| ESX/ESXi 4.x | ESXi 4.x and later | 255GB |
| ESX/ESXi 3.x | ESXi 3.x and later | 65,532MB |

The ESXi host version indicates when support began for the increased memory size. For example, the memory size of a virtual machine with ESXi 3.x and later compatibility running on ESXi 5.0 is restricted to 65,532MB.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand Memory, and in the **RAM** text box, type the amount of RAM to assign to the virtual machine or select one of the suggested values from the drop-down menu.
- 3 Select whether the memory is specified in MB or GB.
- 4 Click **OK**.

Allocate Memory Resources in the vSphere Web Client

You can change the amount of memory resources allocated to a virtual machine by using the shares, reservations, and limits settings. The host determines the appropriate amount of physical RAM to allocate to virtual machines based on these settings. You can assign a high or low shares value to a virtual machine, depending on its load and status.

The following user-defined settings affect the memory resource allocation of a virtual machine.

| | |
|--------------------|---|
| Limit | Places a limit on the consumption of memory for a virtual machine. This value is expressed in megabytes. |
| Reservation | Specifies the guaranteed minimum allocation for a virtual machine. The reservation is expressed in megabytes. If the reservation cannot be met, the virtual machine will not turn on. |
| Shares | Each virtual machine is granted a number of memory shares. The more shares a virtual machine has, the greater share of host memory it receives. Shares represent a relative metric for allocating memory capacity. For more information about share values, see the <i>vSphere Resource Management</i> documentation. |

You cannot assign a reservation to a virtual machine that is larger than its configured memory. If you give a virtual machine a large reservation and reduce its configured memory size, the reservation is reduced to match the new configured memory size.

Prerequisites

Verify that the virtual machine is turned off.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand Memory, and allocate the memory capacity for the virtual machine.

| Option | Description |
|--------------------|--|
| Reservation | Guaranteed memory allocation for this virtual machine. |
| Limit | Upper limit for this virtual machine's memory allocation. Select Unlimited to specify no upper limit. |
| Shares | The values Low , Normal , High , and Custom are compared to the sum of all shares of all virtual machines on the server. |

- 3 Click **OK**.

Change Memory Hot Add Settings in the vSphere Web Client

Memory hot add lets you add memory resources for a virtual machine while the machine is turned on.

Enabling memory hot add produces some extra memory overhead on the ESXi host for the virtual machine.

Prerequisites

- Power off the virtual machine.
- Ensure that the virtual machine has a guest operating system that supports memory hot add functionality.
- Ensure that the virtual machine compatibility is ESXi 4.x and later.
- Ensure that VMware Tools is installed.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Memory**, and select **Enable** to enable adding memory to the virtual machine while it is turned on.
- 3 Click **OK**.

Associate Memory Allocation with a NUMA Node in the vSphere Web Client

You can specify that all future memory allocations on a virtual machine use pages associated with a single NUMA node. The NUMA node is also called manual memory affinity. When the virtual machine uses local memory, the performance improves on that virtual machine.

The following conditions apply to memory optimization with NUMA:

- The NUMA option is available only if the host uses NUMA memory architecture.
- Affinity settings are meaningful only when used to modify the performance of a specific set of virtual machines on one host. This option is not available when the virtual machine resides on a DRS cluster. All affinity values are cleared when you move the virtual machine to a new host.
- You can specify nodes to use for future memory allocations only if you also specified CPU affinity. If you make manual changes only to the memory affinity settings, automatic NUMA rebalancing does not work properly.
- Checking all the boxes is the same as applying no affinity.

For information about NUMA and advanced memory resources, including usage examples, see the *Resource Management* documentation.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Memory**, and set the NUMA node affinity for the virtual machine.
- 3 Click **OK**.

Network Virtual Machine Configuration

ESXi networking features provide communication between virtual machines on the same host, between virtual machines on different hosts, and between other virtual and physical machines. The networking features also allow management of ESXi hosts and provide communication between VMkernel services (NFS, iSCSI, or vSphere vMotion) and the physical network. When you configure networking for a virtual machine, you select or change an adapter type, a network connection, and whether to connect the network when the virtual machine powers on.

Network Adapter Types

When you configure a virtual machine, you can add network adapters (NICs) and specify the adapter type.

The type of network adapters that are available depend on the following factors:

- The virtual machine version, which depends on what host created it or most recently updated it.
- Whether the virtual machine has been updated to the latest version for the current host.
- The guest operating system.

The following NIC types are supported:

| | |
|----------------------------|--|
| E1000 | Emulated version of the Intel 82545EM Gigabit Ethernet NIC, with drivers available in most newer guest operating systems, including Windows XP and later and Linux versions 2.4.19 and later. |
| Flexible | Identifies itself as a Vlan adapter when a virtual machine boots, but initializes itself and functions as either a Vlan or a VMXNET adapter, depending on which driver initializes it. With VMware Tools installed, the VMXNET driver changes the Vlan adapter to the higher performance VMXNET adapter. |
| Vlan | Emulated version of the AMD 79C970 PCnet32 LANCE NIC, an older 10 Mbps NIC with drivers available in most 32bit guest operating systems except Windows Vista and later. A virtual machine configured with this network adapter can use its network immediately. |
| VMXNET | Optimized for performance in a virtual machine and has no physical counterpart. Because operating system vendors do not provide built-in drivers for this card, you must install VMware Tools to have a driver for the VMXNET network adapter available. |
| VMXNET 2 (Enhanced) | Based on the VMXNET adapter but provides high-performance features commonly used on modern networks, such as jumbo frames and hardware offloads. VMXNET 2 (Enhanced) is available only for some guest operating systems on ESX/ESXi 3.5 and later. |
| VMXNET 3 | Next generation of a paravirtualized NIC designed for performance. VMXNET 3 offers all the features available in VMXNET 2 and adds several new features, such as multiqueue support (also known as Receive Side Scaling in Windows), IPv6 offloads, and MSI/MSI-X interrupt delivery. VMXNET 3 is not related to VMXNET or VMXNET 2. |

For network adapter compatibility considerations, see the *VMware Compatibility Guide*.

Network Adapters and Legacy Virtual Machines

Legacy virtual machines are virtual machines that are supported by the product in use, but are not current for that product. The default network adapter types for all legacy virtual machines depend on the adapters available and compatible to the guest operating system and the version of virtual hardware on which the virtual machine was created.

If you do not upgrade a virtual machine to correspond with an upgrade to a newer version of an ESXi host, your adapter settings remain unchanged. If you upgrade your virtual machine to take advantage of newer virtual hardware, your default adapter settings will likely change to be compatible with the guest operating system and upgraded host hardware.

To verify the network adapters that are available to your supported guest operating system for a particular version of vSphere ESXi, see the VMware Compatibility Guide.

Change the Virtual Network Adapter (NIC) Configuration in the vSphere Web Client

To change the way the virtual machine communicates with the host or other virtual machines over the network, you can change the power-on connection setting, the MAC address, and the network connection for the virtual network adapter configuration for a virtual machine.

Prerequisites

Required privilege: **Network.Assign network** on a network if you are changing the network the virtual machine connects to.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand Network adapter, and select the network to connect to from the drop-down menu.

The menu lists all networks configured for virtual machine use on the host.

- 3 (Optional) Change the **Status** settings.

| Option | Description |
|----------------------------|--|
| Connected | Select or deselect this option while the virtual machine is running to connect or disconnect the virtual network adapter. This check box is not available when the virtual machine is turned off. |
| Connect at power on | Select this option for the virtual network adapter to connect to the network when the virtual machine turns on. If you do not check this option, you must manually connect the adapter in order for the virtual machine to access the network. |

- 4 Select the network adapter type to use from the **Adapter Type** drop-down menu.
- 5 (Optional) Select how to assign the **MAC address** from the drop-down menu.
 - Select **Automatic** to automatically assign a MAC address.
 - Select **Manual** to manually enter the MAC address you want.
- 6 Click **OK**.

Add a Network Adapter to a Virtual Machine in the vSphere Web Client

You can add a network adapter (NIC) to a virtual machine to bridge a network, to enhance communications, or to replace an older adapter. When you add a NIC to a virtual machine, you select the adapter type, network connection, and whether the device should connect when the virtual machine is turned on.

Prerequisites

Required privilege: **Network.Assign network**
on a network.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 From the **New device** drop-down menu, select **Network** and click **Add**.

The new network adapter appears at the bottom of the device list.

- 3 (Optional) Expand **New Network**, and change the **Status** settings.

| Option | Description |
|----------------------------|---|
| Connected | Select or deselect this option while the virtual machine is running to connect or disconnect the virtual network adapter. This check box is not available when the virtual machine is not turned on. |
| Connect at power on | Select this option for the virtual network adapter to connect to the network when the virtual machine turns on. If you do not check this option, you must manually connect the adapter for the virtual machine to access the network. |

- 4 Select the network adapter type to use from the **Adapter Type** drop-down menu.
- 5 (Optional) Select how to assign the **MAC address** from the drop-down menu.
 - Select **Automatic** to automatically assign a MAC address.
 - Select **Manual** to manually enter the MAC address that you want.
- 6 From the **Network Connection** drop-down menu, select the network to connect to.
The menu lists all networks configured for virtual machine use on the host.
- 7 Click **OK**.

Parallel and Serial Port Configuration

Parallel and serial ports are interfaces for connecting peripherals to the virtual machine. The virtual serial port can connect to a physical serial port or to a file on the host computer. You can also use it to establish a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. You can add parallel and serial ports and change the serial port configuration.

Using Serial Ports with vSphere Virtual Machines

You can set up virtual serial ports connections for vSphere virtual machines in several ways. The connection method that you select depends on the task that you need to accomplish.

You can set up virtual serial ports to send data in the following ways.

| | |
|---|--|
| Physical serial port on the host | Sets the virtual machine to use a physical serial port on the host computer. This method lets you use an external modem or a hand-held device in a virtual machine. |
| Output to file | Sends output from the virtual serial port to a file on the host computer. This method lets you capture the data that a program running in the virtual machine sends to the virtual serial port. |
| Connect to a named pipe | Sets a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. With this method, two virtual machines or a virtual machine and a process on the host can communicate as if they were physical machines connected by a serial cable. For example, use this option for remote debugging on a virtual machine. |
| Connect over the network | Enables a serial connection to and from a virtual machine's serial port over the network. The Virtual Serial Port Concentrator (vSPC) aggregates traffic from multiple serial ports onto one management console. vSPC behavior is similar to physical serial port concentrators. Using a vSPC also allows network connections to a virtual machine's serial ports to migrate seamlessly when you use vMotion to migrate the virtual machine. For requirements and steps to configure the Avocent ACS v6000 virtual serial port concentrator, see http://kb.vmware.com/kb/1022303 . |

Server and Client Connections for Named Pipe and Network Serial Ports

You can select a client or server connection for serial ports. Your selection determines whether the system waits for a connection or initiates it. Typically, to control a virtual machine over a serial port, you select a server connection. This selection lets you control the connections, which is useful if you connect to the virtual machine only occasionally. To use a serial port for logging, select a client connection. This selection lets the virtual machine connect to the logging server when the virtual machine starts and to disconnect when it stops.

Physical Serial Port Conditions

When you use a physical serial port for serial port passthrough from an ESXi host to a virtual machine, the following conditions apply.

| Supported | Not Supported |
|---|---|
| Serial ports that are integrated into the motherboard | Migration with vMotion |
| | Serial ports present on add-on expansion cards might be supported by PCI DirectPath I/O. See “Add a PCI Device in the vSphere Web Client,” on page 150 or “Add a PCI Device in the vSphere Client,” on page 212. |
| | Serial ports connected through USB are not supported for serial port passthrough. They might be supported by USB passthrough from an ESXi host to a virtual machine. See “USB Configuration from an ESXi Host to a Virtual Machine,” on page 152. |

Adding a Firewall Rule Set for Serial Port Network Connections

If you add or configure a serial port that is backed by a remote network connection, ESXi firewall settings can prevent transmissions.

Before you connect network-backed virtual serial ports, you must add one of the following firewall rule sets to prevent the firewall from blocking communication:

- **VM serial port connected to vSPC.** Use to connect the serial port output through a network with the **Use virtual serial port concentrator** option enabled to allow only outgoing communication from the host.
- **VM serial port connected over network.** Use to connect the serial port output through a network without the virtual serial port concentrator.

IMPORTANT Do not change the allowed IP list for either rule set. Updates to the IP list can affect other network services that might be blocked by the firewall.

For details about allowing access to an ESXi service through the firewall, see the *vSphere Security* documentation.

Change the Serial Port Configuration in the vSphere Web Client

A virtual machine can use up to four virtual serial ports. You can connect the virtual serial port to a physical serial port or to a file on the host computer. You can also use a host-side named pipe to set up a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. In addition, you can use a port or vSPC URI to connect a serial port over the network.

Virtual machines can be in a powered-on state during configuration.

Prerequisites

- Check that you know the correct media types for the port to access, vSPC connections, and any conditions that might apply. See [“Using Serial Ports with vSphere Virtual Machines,”](#) on page 125.
- To connect a serial port over a network, add a Firewall rule set. See [“Adding a Firewall Rule Set for Serial Port Network Connections,”](#) on page 126.
- To use authentication parameters with network serial port connections, see [“Authentication Parameters for Virtual Serial Port Network Connections,”](#) on page 128.
- Required privileges:
 - **Virtual machine.Configuration.Modify device settings** on the virtual machine.
 - **Virtual machine.Interaction.Device connection** on the virtual machine to change the device connection status.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Serial port**, and select a connection type.

| Option | Action |
|---------------------------------|--|
| Use physical serial port | Select this option to have the virtual machine use a physical serial port on the host computer. Select the serial port from the drop-down menu. |
| Use output file | Select this option to send output from the virtual serial port to a file on the host computer. Browse to select an output file to connect the serial port to. |
| Use named pipe | Select this option to set a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. <ol style="list-style-type: none"> a Type a name for the pipe in the Pipe Name field. b Select the Near end and Far end of the pipe from the drop-down menus. |
| Connect over the network | Select Use network to connect through a remote network. <ol style="list-style-type: none"> a Select the network backing. <ul style="list-style-type: none"> ■ Select Server to have the virtual machine monitor incoming connections from other hosts. ■ Select Client to have the virtual machine initiate a connection to another host. b Enter a Port URI. The URI is the remote end of the serial port to which the virtual machine's serial port should connect. c If vSPC is used as an intermediate step to access all virtual machines through a single IP address, select Use Virtual Serial Port Concentrator and enter the vSPC URI location. |
| Printer | Select Printer to connect to a remote printer. |

- 3 (Optional) Select **Yield on CPU poll**.

Select this option only for guest operating systems that use serial ports in polled mode. This option prevents the guest from consuming excessive CPUs.
- 4 Select **Connect at power on** to connect the serial port when the virtual machine powers on.
- 5 Click **OK**.

Example: Establishing Serial Port Network Connections to a Client or Server Without Authentication Parameters

If you do not use vSPC and you configure your virtual machine with a serial port connected as a server with a `telnet://:12345` URI, you can connect to your virtual machine's serial port from your Linux or Windows operating system.

```
telnet yourESXiServerIPAddress 12345
```

Similarly, if you run the Telnet Server on your Linux system on port 23 (`telnet://yourLinuxBox:23`), you configure the virtual machine as a client URI.

```
telnet://yourLinuxBox:23
```

The virtual machine initiates the connection to your Linux system on port 23.

Authentication Parameters for Virtual Serial Port Network Connections

When you establish serial port connections over the network, you can use authentication parameters to secure the network. These parameters can support an encrypted connection with a remote system using SSL over Telnet or Telnets, or an encrypted connection with a concentrator using SSL over Telnet or Telnets.

URI Forms

If you do not use virtual serial port network connection (vSPC) and you configure your virtual machine with a serial port connected as a server with a `telnet://:12345` URI, you can connect to your virtual machine's serial port from your Linux or Windows operating system. You use one of the following formats:

- Telnet over TCP.

```
telnet://host:port
```

The virtual machine and remote system can negotiate and use SSL if the remote system supports the Telnet authentication option. If not, the connection uses unencrypted text (plain text).

- Telnets over SSL over TCP.

```
telnets://host:port
```

SSL negotiation begins immediately, and you cannot use the Telnet authentication option.

Authentication Parameters

For an encrypted connection, the URI includes a set of authentication parameters. Enter the parameters as key words or key/value pairs. You can enter authentication parameters for secure Telnet (`telnets`), or for Telnet (`telnet`) as shown in the following syntax:

```
telnet://host:port #key[=value] [&key[=value] ...]
```

The first parameter must have a number sign (#) prefix. Additional parameters must have an ampersand (&) prefix. The following parameters are supported.

| | |
|--------------------------------|---|
| thumbprint=<i>value</i> | Specifies a certificate thumbprint against which the peer certificate thumbprint is compared. When you specify a thumbprint, certificate verification is enabled. |
| peerName=<i>value</i> | Specifies the peer name that is used to validate the peer certificate. When you specify a peer name, certificate verification is enabled. |
| verify | Forces certificate verification. The virtual machine will verify that the peer certificate subject matches the specified peerName and that it was signed by a certificate authority known to the ESXi host. Verification is enabled if you specify a thumbprint or peerName |
| cipherList=<i>value</i> | Specifies a list of SSL ciphers. The ciphers are specified as a list separated by colons, spaces, or commas. |

Example: Establishing Serial Port Network Connections to a Client or Server

Simple Server Connection

To connect to a virtual machine's serial port from a Linux or Windows operating system if you do not use vSPC, configure the virtual machine with a serial port connected as a server with a `telnet://:12345` URI. To access a virtual serial port from a client, use `telnet yourESXiServerIPAddress 12345`.

Secure Server Connection

To enforce an encrypted connection to the virtual machine's serial port from a Linux operating system, you can configure Telnet to enforce encryption by configuring the virtual machine with a serial port connected as a server with a `telnet://:12345#verify` URI.

To access a virtual serial port from a client, use `telnet-ssl yourESXServerName 12345`. This connection will fail if the Telnet program you are using does not support SSL encryption.

Simple Client Connection

If you are running a Telnet server on your system and you want the virtual machine to automatically connect to it, you can configure the virtual machine as a client using `telnet://yourLinuxBox:23`.

The Virtual machine keeps initiating the Telnet connection to port 23 on `yourLinuxBox`.

Secure Client Connection

Additional URI options allow you to enforce a specific server certificate and restrict the ciphers being used. Virtual machines with a serial port configured as a client with `telnet://ipOfYourLinuxBox:23#cipherList=DHE-RSA-AES256-SHA256:DHE-RSA-AES256-SHA&peerName=myLinuxBoxName.withDomain` will connect to `ipOfYourLinuxBox` only if the system supports one of two listed ciphers, and if it presents a trusted certificate issued to `myLinuxBoxName.withDomain`. Replace `.withDomain` with the full domain name, for example, `example.org`.

Add a Serial Port to a Virtual Machine in the vSphere Web Client

A virtual machine can use up to four virtual serial ports. You can connect the virtual serial port to a physical serial port or to a file on the host computer. You can also use a host-side named pipe to set up a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. In addition, you can use a port or vSPC URI to connect a serial port over the network.

Prerequisites

- Verify that the virtual machine is powered off.
- Check that you know the correct media types for the port to access, vSPC connections, and any conditions that might apply. See [“Using Serial Ports with vSphere Virtual Machines,”](#) on page 125.
- To connect a serial port over a network, add a Firewall rule set. See [“Adding a Firewall Rule Set for Serial Port Network Connections,”](#) on page 126.
- To use authentication parameter with network serial port connections, see [“Authentication Parameters for Virtual Serial Port Network Connections,”](#) on page 128.
- Required privilege: **Virtual Machine .Configuration.Add or Remove Device**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.

- 2 On the **Virtual Hardware** tab, select **Serial Port** from the **New device** drop-down menu, and click **Add**.
The serial port appears at the bottom of the virtual device list.
- 3 Expand **New Serial Port**.
- 4 On the **Virtual Hardware** tab, expand **Serial port**, and select a connection type.

| Option | Action |
|---------------------------------|--|
| Use physical serial port | Select this option to have the virtual machine use a physical serial port on the host computer. Select the serial port from the drop-down menu. |
| Use output file | Select this option to send output from the virtual serial port to a file on the host computer. Browse to select an output file to connect the serial port to. |
| Use named pipe | Select this option to set a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. <ol style="list-style-type: none"> a Type a name for the pipe in the Pipe Name field. b Select the Near end and Far end of the pipe from the drop-down menus. |
| Connect over the network | Select Use network to connect through a remote network. <ol style="list-style-type: none"> a Select the network backing. <ul style="list-style-type: none"> ■ Select Server to have the virtual machine monitor incoming connections from other hosts. ■ Select Client to have the virtual machine initiate a connection to another host. b Enter a Port URI. The URI is the remote end of the serial port to which the virtual machine's serial port should connect. c If vSPC is used as an intermediate step to access all virtual machines through a single IP address, select Use Virtual Serial Port Concentrator and enter the vSPC URI location. |
| Printer | Select Printer to connect to a remote printer. |

- 5 (Optional) Select **Yield on poll**.
Select this option only for guest operating systems that use serial ports in polled mode. This option prevents the guest from consuming excessive CPUs.
- 6 Select **Connect at power on** to connect the serial port when the virtual machine powers on.
- 7 Click **OK**.

Example: Establishing Serial Port Network Connections to a Client or Server Without Authentication Parameters

If you do not use vSPC and you configure your virtual machine with a serial port connected as a server with a `telnet://:12345` URI, you can connect to your virtual machine's serial port from your Linux or Windows operating system.

```
telnet yourESXiServerIPAddress 12345
```

Similarly, if you run the Telnet Server on your Linux system on port 23 (`telnet://yourLinuxBox:23`), you configure the virtual machine as a client URI.

```
telnet://yourLinuxBox:23
```

The virtual machine initiates the connection to your Linux system on port 23.

Change the Parallel Port Configuration in the vSphere Web Client

You can change the output file for peripheral device output and schedule the parallel port to connect when the virtual machine powers on.

NOTE If you are changing the parallel port on a virtual machine that runs on an ESXi 4.1 or earlier host, you can send output to a physical parallel port on the host or to an output file on the host. This option is not available with ESXi 5.0 and later.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Parallel port**.
- 3 For virtual machines running on ESXi 4.1 and earlier hosts, select the type of media for the parallel port to access.
- 4 Click **Browse** to navigate to the file location.
- 5 Type a name for the file in the **Save As** text box and click **OK**.
The file path appears in the **Connection** text box.
- 6 Select whether to connect the device whenever you power on the virtual machine.
You can change this setting when the virtual machine is either powered on or powered off.
- 7 Click **OK**.

Add a Parallel Port to a Virtual Machine in the vSphere Web Client

To connect peripheral devices to virtual machines, such as printers or scanners, you can use a parallel port. You send the output of such devices to a file on the host computer.

NOTE If you are adding a parallel port to a virtual machine that runs on an ESXi 4.1 or earlier host, you can also select to send output to a physical parallel port on the host. This option is not available with ESXi 5.0 and later host versions.

Prerequisites

Verify that the virtual machine is turned off. You cannot add or remove parallel ports if the virtual machine is turned on.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, select **Parallel Port** from the **New device** drop-down menu, and click **Add**.
The parallel port appears at the bottom of the virtual device list.
- 3 Expand **New Parallel port**, and click **Browse** to locate a folder to create the file in.

- 4 Type a name for the file in the **Save As** text box and click **OK**.
The file path appears in the **Connection** text box.
- 5 (Optional) Select **Connect At Power On** to connect the device when the virtual machine powers on.
- 6 Click **OK**.

Output from the attached peripheral device is read to the newly created file.

Virtual Disk Configuration

You can add virtual disks and add more space to existing disks, even when the virtual machine is running. You can set most of the virtual disk parameters during virtual machine creation or after you install the guest operating system.

You can store virtual machine data in a new virtual disk, an existing virtual disk, or a mapped SAN LUN. A virtual disk, which appears as a single hard disk to the guest operating system, is composed of one or more files on the host file system. You can copy or move virtual disks on the same hosts or between hosts.

For virtual machines running on an ESXi host, you can store the virtual machine data directly on a SAN LUN instead of storing it in a virtual disk file. This ability is useful if you are running applications in your virtual machines that must detect the physical characteristics of the storage device. Additionally, mapping a SAN LUN allows you to use existing SAN commands to manage storage for the disk.

When you map a LUN to a VMFS volume, vCenter Server creates a raw device mapping (RDM) file that points to the raw LUN. Encapsulating disk information in a file allows vCenter Server to lock the LUN so that only one virtual machine can write to it. This file has a `.vmdk` extension, but the file contains only disk information that describes the mapping to the LUN on the ESXi system. The actual data is stored on the LUN. You cannot deploy a virtual machine from a template and store its data on a LUN. You can store only its data in a virtual disk file.

About Virtual Disk Provisioning Policies

When you perform certain virtual machine management operations, such as creating a virtual disk, cloning a virtual machine to a template, or migrating a virtual machine, you can specify a provisioning policy for the virtual disk file.

NFS datastores with Hardware Acceleration and VMFS datastores support the following disk provisioning policies. On NFS datastores that do not support Hardware Acceleration, only thin format is available.

You can use Storage vMotion to transform virtual disks from one format to another.

Thick Provision 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.

Using the thick provision lazy zeroed format does not zero out or eliminate the possibility of recovering deleted files or restoring old data that might be present on this allocated space. You cannot convert a thick provision lazy zeroed disk to a thin disk.

Thick Provision Eager Zeroed

A type of 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 thick provision lazy zeroed format, the data remaining on the physical device is zeroed out when the virtual disk is created. It might take much longer to create disks in this format than to create other types of disks.

Thin Provision

Use this format to save storage space. For the thin disk, you provision as much datastore space as the disk would require based on the value that you enter for the disk size. However, the thin disk starts small and at first, uses only as much datastore space as the disk needs for its initial operations.

NOTE If a virtual disk supports clustering solutions such as Fault Tolerance, do not make the disk thin.

If the thin disk needs more space later, it can grow to its maximum capacity and occupy the entire datastore space provisioned to it. You can manually convert the thin disk into a thick disk. If disk space is exhausted and the thinly provisioned disk cannot grow, the virtual machine becomes unusable.

Change the Virtual Disk Configuration in the vSphere Web Client

If you run out of disk space, you can increase the size of the disk. You can change the virtual device node and the persistence mode for virtual disk configuration for a virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Hard disk** to view the disk options.
- 3 (Optional) To change the size of the disk, type a new value in the **Provisioned Size** text box and select the units from the drop-down menu.
- 4 (Optional) To change the way that disks are affected by snapshots, select a disk mode option.

| Option | Description |
|------------------------------------|--|
| Dependent | Dependent disks are included in snapshots. |
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you turn off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you turn off or reset the virtual machine. |

- 5 Click **OK**.

Add a Hard Disk to a Virtual Machine in the vSphere Web Client

When you create a virtual machine, a default virtual hard disk is added. You can add another hard disk if you run out of disk space, if you want to add a boot disk, or for other file management purposes. When you add a hard disk to a virtual machine, you can create a virtual disk, add an existing virtual disk, or add a mapped SAN LUN.

You can add a virtual hard disk to a virtual machine before or after you add a SCSI controller. The new disk is assigned to the first available virtual device node on the default SCSI controller, for example (0:1). Only device nodes for the default SCSI controller are available unless you add additional controllers.

The following ways to add disks can help you plan your disk configuration. These approaches show how you can optimize SCSI controller and virtual device nodes for different disks.

Add an existing hard disk that is configured as a boot disk during virtual machine creation.

To ensure that the virtual machine can boot, remove the existing disk before you add the boot disk. After you add a new SCSI disk to the virtual machine, you might need to go into the BIOS setup to ensure that the disk you were using to boot the virtual machine is still selected as the boot disk. You can avoid this problem by not mixing adapter types, and by using device node 0 on the first SCSI adapter as the boot disk.

Keep the default boot disk and add a new disk during virtual machine creation.

The new disk is assigned to the next available virtual device node, for example (0:1). You can add a new SCSI controller and assign the disk to a virtual device node on that controller, for example (1:0) or (1:1).

Add multiple hard disks to an existing virtual machine.

If you add multiple hard disks to a virtual machine, you can assign them to several SCSI controllers to improve performance. The SCSI controller must be available before you can select a virtual device node. For example, if you add SCSI controllers 1, 2, and 3, and add four hard disks, you might assign the fourth disk to virtual device node (3:1).

For SCSI controller maximums and virtual device node behavior, see [“SCSI Controller Configuration,”](#) on page 141.

- [Add a New Hard Disk to a Virtual Machine in the vSphere Web Client](#) on page 135

You can add a virtual hard disk to an existing virtual machine, or you can add a hard disk when you customize the virtual machine hardware during the virtual machine creation process. For example, you might need to provide additional disk space for an existing virtual machine with a heavy work load. During virtual machine creation, you might want to add a hard disk that is preconfigured as a boot disk.

- [Add an Existing Hard Disk to a Virtual Machine in the vSphere Web Client](#) on page 137

You can add an existing virtual hard disk to a virtual machine when you customize the virtual machine hardware during the virtual machine creation process or after the virtual machine is created. For example, you might want to add an existing hard disk that is preconfigured as a boot disk.

- [Add an RDM Disk to a Virtual Machine in the vSphere Web Client](#) on page 138

You can use a raw device mapping (RDM) to store virtual machine data directly on a SAN LUN, instead of storing it in a virtual disk file. You can add an RDM disk to an existing virtual machine, or you can add the disk when you customize the virtual machine hardware during the virtual machine creation process.

Add a New Hard Disk to a Virtual Machine in the vSphere Web Client

You can add a virtual hard disk to an existing virtual machine, or you can add a hard disk when you customize the virtual machine hardware during the virtual machine creation process. For example, you might need to provide additional disk space for an existing virtual machine with a heavy work load. During virtual machine creation, you might want to add a hard disk that is preconfigured as a boot disk.

During virtual machine creation, a hard disk and SCSI controller are added to the virtual machine by default, based on the guest operating system that you select. If this disk does not meet your needs, you can remove it and add a new hard disk from the Customize Hardware page of the New Virtual Machine wizard. For example, you might want to add an existing hard disk that is preconfigured as a boot disk.

If you add multiple hard disks to a virtual machine, you can assign them to several SCSI controllers to improve performance. For SCSI controller and bus node behavior, see [“Add a SCSI Controller in the vSphere Web Client,”](#) on page 141.

Prerequisites

Required privilege: **Virtual machine.Configuration.Add new disk**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 (Optional) To delete the existing hard disk, move your cursor over the disk and click the **Remove** icon.

The disk is removed from the virtual machine. If other virtual machines share the disk, the disk files are not deleted.
- 3 On the **Virtual Hardware** tab, select **New Hard Disk** from the **New device** drop-down menu and click **Add**.

The hard disk appears in the Virtual Hardware devices list.
- 4 Expand **New hard disk**.
- 5 (Optional) Type a value for the hard disk and select the units from the drop-down menu.

- 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. | <p>a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu.</p> <p>The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile.</p> <p>b Select a datastore and click Next.</p> |
| Store all virtual machine files in the same datastore cluster. | <p>a (Optional) Apply a virtual machine storage profile for the virtual machine home files and the virtual disks from the VM Storage Profile drop-down menu.</p> <p>The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile.</p> <p>b Select a datastore cluster.</p> <p>c (Optional) If you 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 datastore cluster.</p> <p>d Click Next.</p> |
| Store virtual machine configuration files and disks in separate locations. | <p>a Click Advanced.</p> <p>b For the virtual machine configuration file and for each virtual disk, click Browse and select a datastore or datastore cluster.</p> <p>c (Optional) Apply a virtual machine storage profile from the VM Storage Profile drop-down menu.</p> <p>The list shows which datastores are compatible and which are incompatible with the selected virtual machine storage profile.</p> <p>d (Optional) If you selected a datastore 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 datastore cluster.</p> <p>e Click Next.</p> |

- 7 Select the format for the virtual machine's disks and click **Next**.

| Option | Action |
|-------------------------------------|--|
| 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 flat format, the data remaining on the physical device is zeroed out during creation. It might take much 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. |

- 8 In the **Shares** drop-down menu, select a value for the shares to allocate to the virtual disk.
- Shares is a value that represents the relative metric for controlling disk bandwidth. The values Low, Normal, High, and Custom are compared to the sum of all shares of all virtual machines on the host.

- 9 If you selected **Custom**, type a number of shares in the text box.

- 10 In the **Limit - IOPs** box, enter the upper limit of storage resources to allocate to the virtual machine, or select **Unlimited**.

This value is the upper limit of I/O operations per second allocated to the virtual disk.

- 11 Accept the default or select a different virtual device node.

In most cases, you can accept the default device node. For a hard disk, a nondefault device node is useful to control the boot order or to have different SCSI controller types. For example, you might want to boot from an LSI Logic controller and share a data disk with another virtual machine that is using a Buslogic controller with bus sharing turned on.

- 12 (Optional) Select a disk mode and click **OK**.

| Option | Description |
|------------------------------------|--|
| Dependent | Dependent disks are included in snapshots. |
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

Add an Existing Hard Disk to a Virtual Machine in the vSphere Web Client

You can add an existing virtual hard disk to a virtual machine when you customize the virtual machine hardware during the virtual machine creation process or after the virtual machine is created. For example, you might want to add an existing hard disk that is preconfigured as a boot disk.

During virtual machine creation, a hard disk and SCSI controller are added to the virtual machine by default, based on the guest operating system that you select. If this disk does not meet your needs, you can remove it and add an existing hard disk from the Customize Hardware page of the New Virtual Machine wizard.

Prerequisites

- Make sure that you are familiar with SCSI controller and virtual device node behavior for different virtual hard disk configurations. See [“Add a Hard Disk to a Virtual Machine in the vSphere Web Client,”](#) on page 134.
- Required privilege: **Virtual machine.Configuration.Add existing disk**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 (Optional) To delete the existing hard disk, move your cursor over the disk and click the **Remove** icon.

The disk is removed from the virtual machine. If other virtual machines share the disk, the disk files are not deleted.
- 3 On the **Virtual Hardware** tab, select **Existing Hard Disk** from the **New device** drop-down menu and click **Add**.
- 4 In the Datastores column, expand a datastore, select a virtual machine folder, and select the disk to add.

The disk file appears in the Contents column. The **File Type** drop-down menu shows the compatibility file types for this disk.
- 5 Click **OK**.

What to do next

- (Optional) Change the virtual disk configuration. See [“Change the Virtual Disk Configuration in the vSphere Web Client,”](#) on page 133.
- (Optional) Use disk shares to prioritize virtual machine access to this disk. See [“Use Disk Shares to Prioritize Virtual Machines in the vSphere Web Client,”](#) on page 139.

Add an RDM Disk to a Virtual Machine in the vSphere Web Client

You can use a raw device mapping (RDM) to store virtual machine data directly on a SAN LUN, instead of storing it in a virtual disk file. You can add an RDM disk to an existing virtual machine, or you can add the disk when you customize the virtual machine hardware during the virtual machine creation process.

When you give a virtual machine direct access to an RDM disk, you create a mapping file that resides on a VMFS datastore and points to the LUN. Although the mapping file has the same `.vmdk` extension as a regular virtual disk file, the mapping file contains only mapping information. The virtual disk data is stored directly on the LUN.

During virtual machine creation, a hard disk and SCSI controller are added to the virtual machine by default, based on the guest operating system that you select. If this disk does not meet your needs, you can remove it and add an RDM disk on the Customize Hardware page of the New Virtual Machine wizard.

Prerequisites

- Ensure that you are familiar with SCSI controller and virtual device node behavior for different virtual hard disk configurations. See [“Add a Hard Disk to a Virtual Machine in the vSphere Web Client,”](#) on page 134.
- Required privilege: **Virtual machine.Configuration.Raw device**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 (Optional) To delete the existing hard disk, move your cursor over the disk and click the **Remove** icon.

The disk is removed from the virtual machine. If other virtual machines share the disk, the disk files are not deleted.
- 3 On the **Virtual Hardware** tab, select **RDM Disk** from the **New device** drop-down menu and click **Add**.
- 4 Select the target LUN for the raw device mapping and click **OK**.

The disk appears in the virtual device list.
- 5 Select the location for the mapping file.
 - To store the mapping file with the virtual machine configuration file, select **Store with the virtual machine**.
 - To select a location for the mapping file, select **Browse** and select the datastore location for the disk.

- 6 Select a compatibility mode.

| Option | Description |
|-----------------|---|
| Physical | Allows the guest operating system to access the hardware directly. Physical compatibility is useful if you are using SAN-aware applications on the virtual machine. However, a virtual machine with a physical compatibility RDM cannot be cloned, made into a template, or migrated if the migration involves copying the disk. |
| Virtual | Allows the RDM to behave as if it were a virtual disk, so that you can use such features as taking snapshots, cloning, and so on. When you clone the disk or make a template out of it, the contents of the LUN are copied into a .vmdk virtual disk file. When you migrate a virtual compatibility mode RDM, you can migrate the mapping file or copy the contents of the LUN into a virtual disk. |

- 7 Accept the default or select a different virtual device node.

In most cases, you can accept the default device node. For a hard disk, a nondefault device node is useful to control the boot order or to have different SCSI controller types. For example, you might want to boot from an LSI Logic controller and share a data disk with another virtual machine using a BusLogic controller with bus sharing turned on.

- 8 (Optional) If you selected virtual compatibility mode, select a disk mode to change the way that disks are affected by snapshots.

Disk modes are not available for RDM disks using physical compatibility mode.

| Option | Description |
|------------------------------------|--|
| Dependent | Dependent disks are included in snapshots. |
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 9 Click OK.

Use Disk Shares to Prioritize Virtual Machines in the vSphere Web Client

You can change the disk resources for a virtual machine. If multiple virtual machines access the same VMFS datastore and the same logical unit number (LUN), use disk shares to prioritize the disk accesses from the virtual machines. Disk shares distinguish high-priority from low-priority virtual machines.

You can allocate the host disk's I/O bandwidth to the virtual hard disks of a virtual machine. Disk I/O is a host-centric resource so you cannot pool it across a cluster.

Shares is a value that represents the relative metric for controlling disk bandwidth to all virtual machines. The values are compared to the sum of all shares of all virtual machines on the server.

Disk shares are relevant only within a given host. The shares assigned to virtual machines on one host have no effect on virtual machines on other hosts.

You can select an IOP limit, which sets an upper bound for storage resources that are allocated to a virtual machine. IOPs are the number of I/O operations per second.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Hard disk** to view the disk options.
- 3 In the **Shares** drop-down menu, select a value for the shares to allocate to the virtual machine.
- 4 If you selected **Custom**, enter a number of shares in the text box.
- 5 In the **Limit - IOPs** box, enter the upper limit of storage resources to allocate to the virtual machine, or select **Unlimited**.
- 6 Click **OK**.

Converting Virtual Disks from Thin to Thick in the vSphere Web Client

You can determine whether a virtual disk is in the thin provision format and if required, convert it to the thick provision format.

For more information on thin provisioning and available disk formats, see the *vSphere Storage* documentation.

Determine the Disk Format of a Virtual Machine in the vSphere Web Client

You can determine whether your virtual disk is in thick or thin format.

If you have thin provisioned disks, you can change them to thick by selecting **Flat pre-initialized** disk provisioning. You change thick provisioned disks to thin by selecting **Allocate and commit space on demand**.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Hard disk**.
The disk type is displayed in the **Disk Provisioning** field.
- 3 Click **OK**.

What to do next

If your virtual disk is in the thin format, you can inflate it to its full size using the vSphere Client.

Convert a Virtual Disk from Thin to Thick in the vSphere Web Client

When the disk space is exhausted and a thin-provisioned disk cannot expand, the virtual machine cannot boot. If you created a virtual disk in the thin provision format, you can convert it to the thick provision format.

The thin provisioned disk starts small and at first, uses just as much storage space as it needs for its initial operations. After you convert the disk, it grows to its full capacity and occupies the entire datastore space provisioned to it during the disk's creation.

Procedure

- 1 Locate the virtual machine.
 - a Select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Double-click the virtual machine, click the **Related Objects** tab and click **Datastores**.
The datastore that stores the virtual machine files is listed.
- 3 Click the datastore link to open the datastore management panel.
- 4 Click the **Manage** tab and click **Files**.
- 5 Open the virtual machine folder and browse to the virtual disk file that you want to convert.
The file has the .vmdk extension.
- 6 Right-click the virtual disk file and select **Inflate**.

The inflated virtual disk occupies the entire datastore space originally provisioned to it.

SCSI Controller Configuration

To access virtual disks and SCSI devices, a virtual machine uses virtual SCSI controllers. These virtual controllers appear to a virtual machine as different types of controllers, including BusLogic Parallel, LSI Logic Parallel, LSI Logic SAS, and VMware Paravirtual SCSI. You can add a SCSI controller, change the SCSI controller type, and select bus sharing for a virtual machine.

Each virtual machine can have a maximum of four SCSI controllers. The default SCSI controller is numbered as 0. When you create a virtual machine, the default hard disk is assigned to the default SCSI controller 0 at bus node (0:0).

When you add SCSI controllers, they are numbered sequentially 1, 2, and 3. If you add a hard disk or SCSI device to a virtual machine after virtual machine creation, it is assigned to the first available virtual device node on the default SCSI Controller, for example (0:1).

If you add a SCSI controller, you can reassign an existing or new hard disk, or a SCSI device, to that controller. For example, you can assign the device to (1:z), where 1 is SCSI Controller 1 and z is a virtual device node from 0 to 15.

By default, the SCSI controller is assigned to virtual device node (z:7), so that device node is unavailable for hard disks or SCSI devices.

Add a SCSI Controller in the vSphere Web Client

Most virtual machines have a SCSI controller by default, depending on the guest operating system. If you have a heavily loaded virtual machine with multiple hard disks, you can add up to three additional SCSI controllers to assign the disks to. When you spread the disks among several controllers, you can improve performance and avoid data traffic congestion. You can also add additional controllers if you exceed the 15-device limit for a single controller.

For information about SCSI controller maximums and virtual device assignments, see [“SCSI Controller Configuration,”](#) on page 141.

Prerequisites

Required privileges: **Virtual machine.Configuration.Add or remove device**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, select **SCSI Controller** from the **New device** drop-down menu and click **Add**.
The controller appears in the Virtual Hardware devices list.
- 3 On the **Virtual Hardware** tab, expand **New SCSI Controller**, and select the type of sharing in the **SCSI Bus Sharing** drop-down menu.

| Option | Description |
|-----------------|---|
| None | Virtual disks cannot be shared by other virtual machines. |
| Virtual | Virtual disks can be shared by virtual machines on the same ESXi host. Select Thick provision eager zeroed when you create the disk. |
| Physical | Virtual disks can be shared by virtual machines on any ESXi host. Select Thick provision eager zeroed when you create the disk. |

- 4 Select the controller type from the drop-down menu.
- 5 Click **OK**.

What to do next

You can add a hard disk or other SCSI device to the virtual machine and assign it to the new SCSI controller.

Change the SCSI Bus Sharing Configuration in the vSphere Web Client

You can set the type of SCSI bus sharing for a virtual machine and indicate whether the SCSI bus is shared. Depending on the type of sharing, virtual machines can access the same virtual disk simultaneously if the virtual machines reside on the same ESXi host or on a different host.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **SCSI controller**, and select the type of sharing in the **SCSI Bus Sharing** drop-down menu.

| Option | Description |
|-----------------|--|
| None | Virtual disks cannot be shared by other virtual machines. |
| Virtual | Virtual disks can be shared by virtual machines on the same ESXi host. |
| Physical | Virtual disks can be shared by virtual machines on any ESXi host. |

For virtual or physical bus sharing, select **Thick provision eager zeroed** when you create the disk.

- 3 Click **OK**.

Change the SCSI Controller Type in the vSphere Web Client

You configure virtual SCSI controllers on your virtual machines to attach virtual disks and RDMs to.

The choice of SCSI controller does not affect whether your virtual disk is an IDE or SCSI disk. The IDE adapter is always ATAPI. The default for your guest operating system is already selected.

If you create an LSI Logic SAS virtual machine and add a virtual disk that uses BusLogic or LSI Logic adapters, the virtual machine boots from the BusLogic adapters disk. LSI Logic SAS is available only for virtual machines with ESXi 4.x and later compatibility. Disks with snapshots might not experience performance gains when used on LSI Logic SAS, VMware Paravirtual, and LSI Logic Parallel adapters.



CAUTION Changing the SCSI controller type might result in a virtual machine boot failure.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **SCSI controller**, and select a SCSI controller type from the **Change Type** drop-down menu.

The vSphere Web Client displays information about what will happen if you change the controller type. If you have selected a controller type that is not recommended for the virtual machine's guest operating system, a warning is displayed.
- 3 Select whether to change the controller type.
 - Click **Change Type** to change the controller type.
 - Click **Don't change** to cancel the change and keep the original controller type.
- 4 Click **OK**.

About VMware Paravirtual SCSI Controllers

VMware Paravirtual SCSI controllers are high performance storage controllers that can result in greater throughput and lower CPU use. These controllers are best suited for high performance storage environments.

VMware Paravirtual SCSI controllers are available for virtual machines with ESXi 4.x and later compatibility. Disks on such controllers might not experience optimal performance gains if they have snapshots or if memory on the ESXi host is over committed. This behavior does not mitigate the overall performance gain of using VMware Paravirtual SCSI controllers as compared to other SCSI controller options.

If you have virtual machines with VMware Paravirtual SCSI controllers, those virtual machines cannot be part of an MSCS cluster.

For platform support for VMware Paravirtual SCSI controllers, see the *VMware Compatibility Guide*.

Add a Paravirtualized SCSI Adapter in the vSphere Web Client

You can add a VMware Paravirtual SCSI high performance storage controller to a virtual machine to provide greater throughput and lower CPU use.

VMware Paravirtual SCSI controllers are best suited for environments, especially SAN environments, running I/O-intensive applications.

For information about SCSI controller maximums and virtual device assignments, see [“SCSI Controller Configuration,”](#) on page 141.

Prerequisites

- Verify that the virtual machine has a guest operating system with VMware Tools installed.
- Verify that the virtual machine compatibility is ESXi 4.x and later.
- Ensure that you are familiar with VMware Paravirtual SCSI limitations. See [“About VMware Paravirtual SCSI Controllers,”](#) on page 143.
- To access boot disk devices attached to a VMware Paravirtual SCSI controller, verify that the virtual machine has a Windows 2003 or Windows 2008 guest operating system.
- In some operating systems, before you change the controller type, create a virtual machine with an LSI Logic controller, install VMware Tools, and then change to paravirtual mode.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, select **SCSI Controller** from the **New device** drop-down menu and click **Add**.
The controller appears at the bottom of the Virtual Hardware device list.
- 3 Expand SCSI controller and select **VMware Paravirtual** from the **Change Type** drop-down menu.
- 4 Click **OK**.

Other Virtual Machine Device Configuration

In addition to configuring virtual machine CPU and Memory and adding a hard disk and virtual NICs, you can also add and configure virtual hardware, such as DVD/CD-ROM drives, floppy drives, and SCSI devices. Not all devices are available to add and configure. For example, you cannot add a video card, but you can configure available video cards and PCI devices.

Change the CD/DVD Drive Configuration in the vSphere Web Client

You can configure DVD or CD devices to connect to client devices, host devices, or Datastore ISO files.

- [Configure a Datastore ISO File for the CD/DVD Drive in the vSphere Web Client](#) on page 145
To install a guest operating system and its applications on a new virtual machine, you can connect the CD/DVD device to an ISO file that is stored on a datastore accessible to the host.
- [Configure a Host Device Type for the CD/DVD Drive in the vSphere Web Client](#) on page 145
You can connect a CD/DVD device on the virtual machine to a physical CD or DVD device that resides on the host. This is useful for installing guest operating systems, VMware Tools, or other applications on the virtual machine.
- [Configure a Client Device Type for the CD/DVD Drive in the vSphere Web Client](#) on page 146
To install a guest operating system and its applications or other media on a virtual machine, you connect the CD/DVD device to a physical DVD or CD device on the system from which you access the vSphere Web Client

Configure a Datastore ISO File for the CD/DVD Drive in the vSphere Web Client

To install a guest operating system and its applications on a new virtual machine, you can connect the CD/DVD device to an ISO file that is stored on a datastore accessible to the host.

If an ISO image file is not available on a local or shared datastore, upload an ISO image to a datastore from your local system by using the datastore file browser. See [“Upload ISO Image Installation Media for a Guest Operating System,”](#) on page 26.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Expand **CD/DVD drive**, and select **Datastore ISO File** from the drop-down menu.
- 3 Browse to select the file and click **OK**.
- 4 In the **Virtual Device Node** drop-down menu, select the node that the drive uses in the virtual machine.
- 5 (Optional) Select **Connect At Power On** to connect the device when the virtual machine powers on.
- 6 Click **OK**.
- 7 Turn on the virtual machine.
- 8 Click **Edit** and select **Connected** next to the datastore ISO file to connect the device.
- 9 Click **OK**.

Configure a Host Device Type for the CD/DVD Drive in the vSphere Web Client

You can connect a CD/DVD device on the virtual machine to a physical CD or DVD device that resides on the host. This is useful for installing guest operating systems, VMware Tools, or other applications on the virtual machine.

If you connect to media that does not require you to turn off the virtual machine, you can select the media to connect to from the CD/DVD drive connection icon on the virtual machine **Summary** tab.

When you add a CD/DVD drive that is backed by a USB CD/DVD drive on the host, you must add the drive as a SCSI device. Hot adding and removing SCSI devices is not supported.

Prerequisites

- Verify that the virtual machine is turned off.
- Ensure that the host is turned off before you add USB CD/DVD devices.
- You cannot use vMotion to migrate virtual machines that have CD drives that are backed by the physical CD drive on the host. You must disconnect these devices before you migrate the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **CD/DVD** and select **Host Device** from the drop-down menu.
- 3 (Optional) Select **Connect At Power On** to connect the device when the virtual machine powers on.
- 4 If more than one type of CD/DVD media is available on the host, select the media.

- 5 In the **Virtual Device Node** drop-down menu, select the node the drive uses in the virtual machine. The first available IDE node is selected by default. You do not typically need to change the default.
- 6 Click **OK**.
- 7 Turn the virtual machine on and click the **Summary** tab.

The connected CD/DVD device appears in the VM Hardware list.

Configure a Client Device Type for the CD/DVD Drive in the vSphere Web Client

To install a guest operating system and its applications or other media on a virtual machine, you connect the CD/DVD device to a physical DVD or CD device on the system from which you access the vSphere Web Client

Prerequisites

- Verify that the virtual machine is turned on.
- Verify that the Client Integration Plug-In is installed.

Procedure

- 1 Select a datacenter, folder, cluster, resource pool, host, or vApp and click the **Related Objects** tab.
- 2 Click **Virtual Machines** and select a virtual machine from the list and click it.
- 3 Click the **Manage** tab, and click the **CD/DVD drive** connection icon.
- 4 Select an available drive to connect to, and browse for the CD/DVD media.

An Access Control dialog box opens. Click **allow** to proceed. To change your selection, click the connection icon, select **Disconnect**, and select a different option.

- 5 (Optional) Click **Edit**, expand **CD/DVD drive**, and select the mode to use for the connection.

| Option | Description |
|------------------------|--|
| Passthrough IDE | Use only for remote client device access. You can write or burn a remote CD only through passthrough mode access. |
| Emulate IDE | Use to access a local host CD-ROM device. In emulation mode, you can only read a CD-ROM from a local host CD-ROM device. |

- 6 (Optional) To change the device node from the default, select a new mode from the **Virtual Device Node** drop-down menu.
- 7 Click **OK**.
- 8 Turn on the virtual machine, click **Edit**, and select **Connected** next to the datastore ISO file to connect the device.

Add a CD or DVD Drive to a Virtual Machine in the vSphere Web Client

You can use a physical drive on a client or host or you can use an ISO image to add a CD/DVD drive to a virtual machine. CD/DVD drives are necessary for installing a guest operating system and VMware Tools.

The following conditions exist:

- If you add a CD/DVD drive that is backed by a USB CD/DVD drive on the host, you must add the drive as a SCSI device. Hot adding and removing SCSI devices is not supported.
- You must disconnect virtual machines that have CD drives that are backed by the physical CD drive on the host, before you migrate the virtual machine.

- You access the host CD-ROM device through emulation mode. Passthrough mode is not functional for local host CD-ROM access. You can write or burn a remote CD only through passthrough mode access, but in emulation mode you can only read a CD-ROM from a host CD-ROM device.

Prerequisites

- Verify that the virtual machine is turned off.
- To connect to a client device, verify that Client Integration Plug-in is installed.
- If an ISO image file is not available on a local or shared datastore, upload an ISO image to a datastore from your local system by using the datastore file browser. See [“Upload ISO Image Installation Media for a Guest Operating System,”](#) on page 26.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 From the **New device** drop-down menu, select **CD/DVD Drive** and click **Add**.
The new drive appears at the bottom of the Virtual Hardware list.
- 3 Expand **New CD/DVD Drive** and select the device type.

| Option | Action |
|---------------------------|--|
| Client Device | <ol style="list-style-type: none"> a Select to connect the CD/DVD device to a physical DVD or CD device on the system from which you access the vSphere Web Client. b From the Device Mode drop-down menu, select Passthrough IDE. When you turn on the virtual machine, you select the media to connect to from the VM Hardware panel on the virtual machine Summary tab. |
| Host Device | <ol style="list-style-type: none"> a Select to connect the CD/DVD device to a physical DVD or CD device on the host. b From the CD/DVD Media drop-down menu, select the media to connect to . c From the Device Mode drop-down menu, select Emulate IDE. |
| Datastore ISO File | <ol style="list-style-type: none"> a Select to connect the CD/DVD device to an ISO file that is stored on a datastore accessible to the host. b Browse to the file containing the ISO image to connect to and click OK. |

- 4 (Optional) Select **Connect At Power On** to connect the device when the virtual machine turns on.
- 5 (Optional) To change the device node from the default, select a new mode from the **Virtual Device Node** drop-down menu.
- 6 Click **OK**.

What to do next

Turn on the virtual machine and install the guest operating system or other applications.

Change the Floppy Drive Configuration in the vSphere Web Client

You can configure a virtual floppy drive device to connect to a client device or to an existing or new floppy image.

ESXi does not support floppy drives that are backed by a physical floppy drive on the host.

NOTE You cannot use vMotion to migrate virtual machines that have floppy drives backed by a physical floppy drive on ESX 3.5, 4.0, and 4.x hosts that vCenter Server 5.0 manages. You must disconnect these devices before you migrate the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Floppy drive**.
- 3 Select the device type to use for this virtual device.

| Option | Action |
|----------------------------------|--|
| Client Device | Select this option to connect the floppy device to a physical floppy device or a .flp floppy image on the system from which you access the vSphere Web Client. |
| Use existing floppy image | <ol style="list-style-type: none"> a Select this option to connect the virtual device to an existing floppy image on a datastore accessible to the host. b Click Browse and select the floppy image. |
| Create new floppy image | <ol style="list-style-type: none"> a Select this option to create a floppy image on a datastore accessible to the host. b Click Browse and browse to the location for the floppy image. c Enter a name for the floppy image and click OK. |

- 4 (Optional) Select or deselect the **Connected** check box to connect or disconnect the device.
- 5 (Optional) Select **Connect At Power On** to connect the device when the virtual machine powers on.
- 6 Click **OK**.

Add a Floppy Drive to a Virtual Machine in the vSphere Web Client

Use a physical floppy drive or a floppy image to add a floppy drive to a virtual machine.

ESXi does not support floppy drives that are backed by a physical floppy drive on the host.

NOTE You cannot use vMotion to migrate virtual machines that have floppy drives backed by a physical floppy drive on ESX 3.5, 4.0, and 4.x hosts that vCenter Server 5.0 manages. You must disconnect these devices before you migrate the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, select **Floppy Drive** from the **New device** drop-down menu, and click **Add**.

- 3 Expand **New Floppy drive** and select the device type to use for this virtual device.

| Option | Description |
|--------------------------------|--|
| Client Device | Select this option to connect the floppy device to a physical floppy device or a .flp floppy image on the system from which you access the vSphere Web Client. |
| Existing File | <ol style="list-style-type: none"> a Select this option to connect the virtual device to an existing floppy image on a datastore accessible to the host. b Click Browse and select the floppy image. |
| Create new floppy image | <ol style="list-style-type: none"> a Select this option to create a floppy image on a datastore accessible to the host. b Click Browse and browse to the location for the floppy image. c Enter a name for the floppy image and click OK. |

- 4 (Optional) Select or deselect the **Connected** check box to connect or disconnect the device.
- 5 (Optional) Select **Connect At Power On** to connect the device when the virtual machine powers on.
- 6 Click **OK**.

Change the SCSI Device Configuration in the vSphere Web Client

You can change the physical device and configure the virtual device node. This is useful if you no longer need an existing device and want to connect to another device.

To prevent data congestion, you can assign a SCSI device to a SCSI controller and virtual device node other than the default. The new device is assigned to the first available virtual device node on the default SCSI controller, for example (0:1). Only device nodes for the default SCSI controller are available unless you add additional controllers.

For SCSI controller and virtual device node behavior, see [“SCSI Controller Configuration,”](#) on page 141.

Prerequisites

- Power off the virtual machine.
- Required privilege: **Virtual machine.Configuration.Raw device**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **SCSI device**.
- 3 From the **Connection** drop-down menu, select the physical SCSI device to connect to.
- 4 (Optional) From the **Virtual Device Node** drop-down menu, select the virtual device node.
- 5 Click **OK**.

Add a SCSI Device to a Virtual Machine in the vSphere Web Client

To use peripheral SCSI devices, such as printers or storage devices, you must add the device to the virtual machine. When you add a SCSI device to a virtual machine, you select the physical device to connect to and the virtual device node.

The SCSI device is assigned to the first available virtual device node on the default SCSI controller, for example (0:1). To avoid data congestion, you can add another SCSI controller and assign the SCSI device to a virtual device node on that controller. Only device nodes for the default SCSI controller are available unless you add additional controllers.

For SCSI controller and virtual device node assignments and behavior, see [“SCSI Controller Configuration,”](#) on page 141.

Prerequisites

Required privileges: **Virtual machine.Configuration.Raw device**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, select **SCSI Device** from the **New device** drop-down menu and click **Add**.

The SCSI device appears in the Virtual Hardware devices list.

- 3 Expand **New SCSI device** to change the device options.
- 4 (Optional) From the **Virtual Device Node** drop-down menu, select the virtual device node.
- 5 Click **OK**.

The virtual machine can access the device.

Add a PCI Device in the vSphere Web Client

vSphere DirectPath I/O allows a guest operating system on a virtual machine to directly access physical PCI and PCIe devices connected to a host. This action gives you direct access to devices such as high-performance graphics or sound cards. You can connect each virtual machine to up to six PCI devices.

You configure PCI devices on the host to make them available for passthrough to a virtual machine. See the *vCenter Server and Host Management* documentation.

When PCI vSphere DirectPath I/O devices are available to a virtual machine, you cannot suspend, migrate with vMotion, or take or restore Snapshots of such virtual machines.

Prerequisites

- To use DirectPath, verify that the host has Intel Virtualization Technology for Directed I/O (VT-d) or AMD I/O Virtualization Technology (IOMMU) enabled in the BIOS.
- Verify that the PCI devices are connected to the host and marked as available for passthrough.
- Verify that the virtual machine is compatible with ESXi 4.x and later.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, select **PCI Device** from the **New Device** drop-down menu, and click **Add**.
- 3 Expand **New PCI device** and select the passthrough device to connect to the virtual machine from the drop-down list and click **Next**.
- 4 Click **OK**.

Configure Video Cards in the vSphere Web Client

You can change the number of monitor displays for a virtual machine, allocate memory for the displays, and enable 3D support.

The default setting for total video RAM is adequate for minimal desktop resolution. For more complex situations, you can change the default memory.

Some 3D applications require a minimum video memory of 64MB.

Prerequisites

- Verify that the virtual machine is powered off.
- To enable 3D support, the virtual machine compatibility must be ESXi 5.0 and later.
- To use a hardware 3D renderer, ensure that graphics hardware is available. Otherwise, the virtual machine will not power on.
- Required privilege: **Virtual machine.Configuration.Modify device settings**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, expand **Video Card**.
- 3 Select the display settings type from the **Specify custom settings** drop-down menu and configure the available settings.

| Option | Description |
|-----------------------------------|--|
| Auto-detect video settings | Applies common video settings to the guest operating system. |
| Specify custom settings | Lets you select the number of displays and the total video memory. |

- 4 Select the number of displays from the drop-down menu.
You can set a number of displays and extend the screen across them.
- 5 Enter the video memory required for the displays.
- 6 (Optional) Click **Video Memory Calculator** to calculate the required video memory based on the maximum number of displays and resolution that the guest operating system must support, and click **OK**.
- 7 (Optional) Click **Enable 3D support**.

This check box is active only for guest operating systems on which VMware supports 3D.

- 8 (Optional) Select a 3D Renderer.

| Option | Description |
|------------------|--|
| Automatic | Selects the appropriate option (software or hardware) for this virtual machine. |
| Software | Uses normal CPU processing for 3D calculations. |
| Hardware | Requires graphics hardware (GPU) for faster 3D calculations. NOTE The virtual machine will not power on if graphics hardware is not available. |

- 9 Click **OK**.

Sufficient memory allocation is set for this virtual machine's video display.

Configure the Virtual Machine Communication Interface in the vSphere Web Client

The Virtual Machine Communication Interface (VMCI) provides a high-speed communication channel between a virtual machine and the ESXi host that it runs on. You can also enable VMCI for communication between virtual machines that run on the same host.

For maximum security, enable VMCI between virtual machines only when applications that use VMCI for communication between virtual machines are installed on the virtual machines. When you disable VMCI communication, no vSphere or VMware Tools features are affected.

Prerequisites

Verify that the virtual machine is compatible with ESXi 4.x and later. With ESXi 5.1, VMCI is available only for communication between a virtual machine and the ESXi host it runs on.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the **Virtual Hardware** tab, select **Enable VMCI between VMs**.
- 3 Click **OK**.

Virtual machine communication is no longer restricted to the host it runs on. Other virtual machines that run on the same host can now communicate with the unrestricted virtual machine.

USB Configuration from an ESXi Host to a Virtual Machine

You can add multiple USB devices to a virtual machine when the physical devices are connected to an ESXi host. USB passthrough technology supports adding USB devices, such as security dongles and mass storage devices to virtual machines that reside on the host to which the devices are connected.

How USB Device Passthrough Technology Works

When you attach a USB device to a physical host, the device is available only to virtual machines that reside on that host. The device cannot connect to virtual machines that reside on another host in the datacenter.

A USB device is available to only one virtual machine at a time. When a device is connected to a powered-on virtual machine, it is not available to connect to other virtual machines that run on the host. When you remove the active connection of a USB device from a virtual machine, it becomes available to connect to other virtual machines that run on the host.

Connecting a USB passthrough device to a virtual machine that runs on the ESXi host to which the device is physically attached requires an arbitrator, a controller, and a physical USB device or device hub.

USB Arbitrator

Manages connection requests and routes USB device traffic. The arbitrator is installed and enabled by default on ESXi hosts. It scans the host for USB devices and manages device connection among virtual machines that reside on the host. It routes device traffic to the correct virtual machine instance for delivery to the guest operating system. The arbitrator monitors the USB device and prevents other virtual machines from using it until you release it from the virtual machine it is connected to.

USB Controller

The USB hardware chip that provides USB function to the USB ports that it manages. The virtual USB Controller is the software virtualization of the USB host controller function in the virtual machine.

USB controller hardware and modules that support USB 2.0 and USB 1.1 devices must exist on the host. Two virtual USB controllers are available to each virtual machine. A controller must be present before you can add USB devices to the virtual computer.

The USB arbitrator can monitor a maximum of 15 USB controllers. Devices connected to controllers numbered 16 or greater are not available to the virtual machine.

USB Devices

You can add up to 20 USB devices to a virtual machine. This is the maximum number of devices supported for simultaneous connection to one virtual machine. The maximum number of USB devices supported on a single ESXi host for simultaneous connection to one or more virtual machines is also 20. For a list of supported USB devices, see the VMware knowledge base article at <http://kb.vmware.com/kb/1021345>.

USB Autoconnect Feature

When you add a USB device connection from an ESXi host to a virtual machine, the autoconnect feature is enabled for the device connection. It is not disabled until you remove the device connection from the virtual machine.

With autoconnect enabled, the device connection re-establishes in the following cases:

- The virtual machine is cycling through power operations, such as Power Off/Power On, Reset, Pause/Resume.
- The device is unplugged from the host then plugged back in to the same USB port.
- The device is power cycled but has not changed its physical connection path.
- The device is mutating identity during usage.

The USB passthrough autoconnect feature identifies the device by using the USB path of the device on the host. It uses the physical topology and port location, rather than the device identity. This feature can seem confusing if you expect the autoconnect feature to match the connection target by device ID.

If the same device is plugged back in to the host through a different USB port, it cannot re-establish connection with the virtual machine. If you unplug the device from the host and plug in a different device to the same USB path, the new device appears and is connected to the virtual machine by the autoconnect feature that the previous device connection enabled.

Autoconnect is useful in cases where devices mutate during usage. For example, for iPhones and other such devices, the device VID:PID changes during software or firmware upgrades. The upgrade process disconnects and reconnects the devices to the USB port.

The USB port is speed-specific. The autoconnect feature assumes that devices do not transition from USB 1.1 (low-full speed) to USB 2.0 (high speed) or the reverse. You cannot interchange USB 2.0 high-speed devices with USB 1.1 devices. For example, you might connect a USB 2.0 high-speed device to a port and connect that device to the virtual machine. If you unplug the device from the host and plug a USB 1.1 device into the same port, the device does not connect to the virtual machine.

For a list of supported USB devices for passthrough from an ESXi host to a virtual machine, see the VMware knowledge base article at <http://kb.vmware.com/kb/1021345>.

vSphere Features Available with USB Passthrough

Migrations with vMotion and DRS are supported with USB device passthrough from an ESXi host to a virtual machine.

Table 7-4. vSphere Features Available for USB Passthrough from an ESXi Host to a Virtual Machine

| Feature | Supported with USB Device Passthrough |
|--|---------------------------------------|
| vSphere Distributed Power Management (DPM) | No |
| vSphere Distributed Resource Scheduler (DRS) | Yes |
| vSphere Fault Tolerance | No |
| vSphere vMotion | Yes |

For details about migration with vMotion, see “[Configuring USB Devices for vMotion](#),” on page 154.

If a host with connected USB devices resides in a DRS cluster with DPM enabled, you must disable DPM for that host. Otherwise DPM might turn off the host with the device, which disconnects the device from the virtual machine.

Configuring USB Devices for vMotion

With USB passthrough from a host to a virtual machine, you can migrate a virtual machine to another ESXi host in the same datacenter and maintain the USB passthrough device connections to the original host.

If a virtual machine has USB devices attached that pass through to an ESXi host, you can migrate that virtual machine with the devices attached.

For a successful migration, review the following conditions:

- You must configure all USB passthrough devices connected to a virtual machine for vMotion. If one or more devices is not configured for vMotion, the migration cannot proceed. For troubleshooting details, see the *vSphere Troubleshooting* documentation.
- When you migrate a virtual machine with attached USB devices away from the host to which the devices are connected, the devices remain connected to the virtual machine. However, if you suspend or power off the virtual machine, the USB devices are disconnected and cannot reconnect when the virtual machine is resumed. The device connections can be restored only if you move the virtual machine back to the host to which the devices are attached.
- If you resume a suspended virtual machine that has a Linux guest operating system, the resume process might mount the USB devices at a different location on the file system.
- If a host with attached USB devices resides in a DRS cluster with distributed power management (DPM) enabled, disable DPM for that host. Otherwise DPM might turn off the host with the attached device. This action disconnects the device from the virtual machine because the virtual machine migrated to another host.

- Remote USB devices require that the hosts be able to communicate over the management network following migration with vMotion, so 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.

Avoiding Data Loss with USB Devices

When a virtual machine connects to a physical USB device on an ESXi host, virtual machine functions can affect USB device behavior and connections.

- Before you hot add memory, CPU, or PCI devices, you must remove any USB devices. Hot adding these resources disconnects USB devices, which might result in data loss.
- Before you suspend a virtual machine, make sure that a data transfer is not in progress. During the suspend or resume process, USB devices behave as if they have been disconnected, then reconnected. For information about suspend and resume behavior after migration with vMotion, see [“Configuring USB Devices for vMotion,”](#) on page 154.
- Before you change the state of the arbitrator, make sure that USB devices residing on the host are not attached to a virtual machine. If USB devices become unavailable to a virtual machine, a host administrator might have disabled the arbitrator. When an administrator stops or disconnects the arbitrator for troubleshooting or other purposes, USB devices attached to that host become unavailable to the virtual machine. If a data transfer is taking place at this time, you might lose the data. To reestablish the arbitrator, you must reboot the host.

Connecting USB Devices to an ESXi Host

You can connect and chain multiple USB hubs and devices to an ESXi host. Careful planning and knowledge of hub behavior and limitations can help ensure that your devices work optimally.

USB physical bus topology defines how USB devices connect to the host. Support for USB device passthrough to a virtual machine is available if the physical bus topology of the device on the host does not exceed tier seven. The first tier is the USB host controller and root hub. The last tier is the target USB device. You can cascade up to five tiers of external or internal hubs between the root hub and the target USB device. An internal USB hub attached to the root hub or built into a compound device counts as one tier.

The quality of the physical cables, hubs, devices, and power conditions can affect USB device performance. To ensure the best results, keep the host USB bus topology as simple as possible for the target USB device, and use caution when you deploy new hubs and cables into the topology. The following conditions can affect USB behavior:

- Communication delay between the host and virtual machine increases as the number of cascading hubs increases.
- Connecting or chaining multiple external USB hubs increases device enumeration and response time, which can make the power support to the connected USB devices uncertain.
- Chaining hubs together also increases the chance of port and hub error, which can cause the device to lose connection to a virtual machine.
- Certain hubs can cause USB device connections to be unreliable, so use care when you add a new hub to an existing setup. Connecting certain USB devices directly to the host rather than to a hub or extension cable might resolve their connection or performance issues.

NOTE To prevent additional problems, be aware of the physical constraints of long-term deployment in a machine room environment. Small devices are easily damaged by being stepped on or knocked loose.

In some cases, you must hard reset the device and hub to restore the device to a working state.

For a list of supported USB devices for passthrough from an ESXi host to a virtual machine, see the VMware knowledge base article at <http://kb.vmware.com/kb/1021345>.

USB Compound Devices

For compound devices, the virtualization process filters out the USB hub so that it is not visible to the virtual machine. The remaining USB devices in the compound appear to the virtual machine as separate devices. You can add each device to the same virtual machine or to different virtual machines if they run on the same host.

For example, the Aladdin HASP HL Drive USB dongle package contains three devices (0529:0001 HASP dongle, 13fe:1a00 Hub, 13fe:1d00 Kingston Drive). The virtualization process filters out the USB hub. The remaining Aladdin HASP HL Drive USB dongle devices (one Aladdin HASP dongle and one Kingston Drive) appear to the virtual machine as individual devices. You must add each device separately to make it accessible to the virtual machine.

Connect USB Devices to an ESXi Host

You can connect multiple USB devices to ESXi hosts so that virtual machines that run on the hosts can access the devices. The number of devices that you can connect depends on several factors, such as how the devices and hubs chain together and the device type.

Each ESXi host has several USB ports. The number of ports on each host depends on the physical setup of the host. When you calculate the depth of hub chaining, remember that on a typical server the front ports connect to an internal hub.

The USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

The host treats USB CD/DVD-ROM devices as SCSI devices. Hot adding and removing these devices is not supported.

Prerequisites

- If a host has attached USB devices and resides in a DRS cluster with DPM enabled, disable DPM for that host. See the *vSphere Resource Management* documentation for instructions about overriding the default DPM setting for an individual host.
- Verify that you know the virtual machine requirements for USB devices. See [“Connecting USB Devices to an ESXi Host,”](#) on page 155.
- Verify that the ESXi host is powered off before you add USB CD/DVD-ROM devices.

Procedure

- ◆ To add a USB device to an ESXi host, connect the device to an available port or hub.

The USB device appears in the virtual machine Add Hardware wizard device list.

What to do next

You can now add the device to the virtual machine.

Add a USB Controller to a Virtual Machine in the vSphere Web Client

USB controllers are available to add to virtual machines to support USB passthrough from an ESXi host or from a client computer to a virtual machine.

You can add two USB controllers to a virtual machine. The xHCI controller, available for Linux guest operating systems only, supports USB 3.0 superspeed, 2.0, and 1.1 devices. The EHCI+UHCI controller supports USB 2.0 and 1.1 devices.

The conditions for adding a controller vary, depending on the device version, the type of passthrough (host or client computer), and the guest operating system.

Table 7-5. USB Controller Support

| Controller type | Supported USB Device Version | Supported for Passthrough from ESXi Host to VM | Supported for Passthrough from Client Computer to VM |
|-----------------|------------------------------|--|--|
| EHCI+UHCI | 2.0 and 1.1 | Yes | Yes |
| xHCI | 3.0, 2.0, and 1.1 | Yes (USB 2.0 and 1.1 devices only) | Yes (Linux guests only) |

For Mac OS X systems, the EHCI+UHCI controller is enabled by default and is required for USB mouse and keyboard access.

For virtual machines with Linux guests, you can add one or both controllers, but 3.0 superspeed devices are not supported for passthrough from an ESXi host to a virtual machine. You cannot add two controllers of the same type.

For USB passthrough from an ESXi host to a virtual machine, the USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

Prerequisites

- ESXi hosts must have USB controller hardware and modules that support USB 2.0 and 1.1 devices present.
- Client computers must have USB controller hardware and modules that support USB 3.0, 2.0, and 1.1 devices present.
- To use the xHCI controller on a Linux guest, ensure that the Linux kernel version is 2.6.35 or later.
- Verify that the virtual machine is powered on.
- Required Privilege (ESXi host passthrough): **Virtual Machine.Configuration.Add or Remove Device**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the Virtual Hardware tab, select **USB Controller** from the **New device** drop-down menu, and click **Add**.

The new USB controller appears at the bottom of the Virtual Hardware device list.

- 3 Expand **New USB Controller** to change the USB controller type.

If compatibility errors appear, fix them before you can add the controller.
- 4 Click **OK**.

What to do next

Add one or more USB devices to the virtual machine.

Add USB Devices from an ESXi Host to a Virtual Machine in the vSphere Web Client

You can add one or more USB passthrough devices from an ESXi host to a virtual machine if the physical devices are connected to the host on which the virtual machine runs.

If a USB device is connected to another virtual machine, you cannot add it until that machine releases it.

NOTE If you have the Apple Frontpanel Controller device in your environment, you can safely add it to a virtual machine. However, this device has no documented function and no known use. ESXi hosts do not use it and do not provide Xserver functionality for USB passthrough.

Prerequisites

- Verify that the virtual machine is compatible with ESXi 4.x and later.
- Verify that a USB controller is present. See [“Add a USB Controller to a Virtual Machine in the vSphere Web Client,”](#) on page 156.
- To use vMotion to migrate a virtual machine with multiple USB devices, enable all attached USB devices for vMotion. You cannot migrate individual USB devices. For vMotion limitations, see [“Configuring USB Devices for vMotion,”](#) on page 154.
- When you add a CD/DVD-ROM drive that is backed by a USB CD/DVD drive on the host, add the drive as a SCSI device. Hot adding and removing SCSI devices is not supported.
- Verify that you know the virtual machine requirements for USB devices. See [“USB Configuration from an ESXi Host to a Virtual Machine,”](#) on page 152.
- Required privileges: **Virtual Machine.Configuration.HostUSBDevice**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the Virtual Hardware tab, select **Host USB Device** from the **New device** drop-down menu, and click **Add**.

The new USB device appears at the bottom of the Virtual Hardware device list.
- 3 Expand **New USB Device**, and select the device to add.

You can add multiple USB devices, but only one device at a time.
- 4 If you do not plan to migrate a virtual machine with USB devices attached, deselect the **Support vMotion** option.

This action reduces migration complexity, which results in better performance and stability.
- 5 Click **OK**.

Remove USB Devices That Are Connected Through an ESXi Host

When you remove USB devices from a virtual machine, devices that use passthrough technology from a host to the virtual machine revert to the host. The devices become available to other virtual machines that run on that host.

Prerequisites

- Verify that the devices are not in use.

- To minimize the risk of data loss, follow the instructions to safely unmount or eject hardware for your operating system. Safely removing hardware allows accumulated data to be transmitted to a file. Windows operating systems typically include a Remove Hardware icon located in the System Tray. Linux operating systems use the **umount** command.

NOTE You might need to use the `sync` command instead of or in addition to the `umount` command, for example, after you issue a `dd` command on Linux or other UNIX operating systems.

Procedure

- 1 Unmount or eject the USB device from the guest operating system.
- 2 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 3 To remove the device, move your cursor over the device and click the **Remove** icon.
- 4 Click **OK** to save your changes.

Remove USB Devices from an ESXi Host

You can remove USB devices from the host if you must shut down the host for maintenance or if you do not want those devices to be available to virtual machines that run on the host. When you detach a USB device from the host, the device disconnects from the virtual machine.



CAUTION If data transfer is taking place when you remove USB devices from a host, you can lose data.

Prerequisites

Verify that the USB devices are not in use.

Procedure

- ◆ Follow the device manufacturers instructions to safely remove the device.

When you remove the device from the host, it is no longer available to the virtual machines that run on the host.

USB Configuration from a Client Computer to a Virtual Machine in the vSphere Web Client

You can add multiple USB devices to a virtual machine when the physical devices connect to a client computer on which the vSphere Web Client is running. The vSphere Web Client must be logged in to an instance of vCenter Server that manages the ESXi host where the virtual machines reside. USB passthrough technology supports adding multiple USB devices, such as security dongles, mass storage devices, and smartcard readers to virtual machines.

How USB Device Passthrough Technology Works

The USB controller is the USB hardware chip that provides USB function to the USB ports that it manages. USB controller hardware and modules that support USB 3.0, 2.0, and USB 1.1 devices must exist in the virtual machine. Two USB controllers are available for each virtual machine. The controllers support multiple USB 3.0, 2.0, and 1.1 devices. The controller must be present before you can add USB devices to the virtual machine.

You can add up to 20 USB devices to a virtual machine. This is the maximum number of devices supported for simultaneous connection to one virtual machine.

You can add multiple devices to a virtual machine, but only one at a time. The virtual machine retains its connection to the device while in S1 standby. USB device connections are preserved when you migrate virtual machines to another host in the datacenter.

A USB device is available to only one powered-on virtual machine at a time. When a virtual machine connects to a device, that device is no longer available to other virtual machines or to the client computer. When you disconnect the device from the virtual machine or shut the virtual machine down, the device returns to the client computer and becomes available to other virtual machines that the client computer manages.

For example, when you connect a USB mass storage device to a virtual machine, it is removed from the client computer and does not appear as a drive with a removable device. When you disconnect the device from the virtual machine, it reconnects to the client computer's operating system and is listed as a removable device.

USB 3.0 Device Limitations

USB 3.0 devices have the following requirements and limitations:

- The virtual machine that you connect the USB 3.0 device to must be configured with an xHCI controller and have a Linux guest operating system with a 2.6.35 or later kernel.
- You can connect only one USB 3.0 device operating at superspeed to a virtual machine at a time.
- USB 3.0 devices are available only for passthrough from a client computer to a virtual machine. They are not available for passthrough from an ESXi host to a virtual machine.

Avoiding Data Loss

Before you connect a device to a virtual machine, make sure the device is not in use on the client computer.

If the vSphere Client disconnects from the vCenter Server or host, or if you restart or shut down the client computer, the device connection breaks. It is best to have a dedicated client computer for USB device use or to reserve USB devices connected to a client computer for short-term use, such as updating software or adding patches to virtual machines. To maintain USB device connections to a virtual machine for an extended time, use USB passthrough from an ESXi host to the virtual machine.

Connecting USB Devices to a Client Computer

You can connect and chain any multiple low, full, and high- or super-speed USB hubs and devices to a client computer. Careful planning and knowledge of hub behavior and limitations can help ensure that your devices work optimally.

USB physical bus topology defines how USB devices connect to the client computer. Support for USB device passthrough to a virtual machine is available if the physical bus topology of the device on the client computer does not exceed tier seven. The first tier is the USB host controller and root hub. The last tier is the target USB device. You can cascade up to five tiers of external or internal hubs between the root hub and the target USB device. An internal USB hub attached to the root hub or built into a compound device counts as one tier.

The quality of the physical cables, hubs, devices, and power conditions can affect USB device performance. To ensure the best results, keep the client computer USB bus topology as simple as possible for the target USB device, and use caution when you deploy new hubs and cables into the topology. The following conditions can affect USB behavior:

- Connecting or chaining multiple external USB hubs increases device enumeration and response time, which can make the power support to the connected USB devices uncertain.
- Chaining hubs together increases the chance of port and hub error, which can cause the device to lose connection to a virtual machine.

- Certain hubs can cause USB device connections to be unreliable, so use care when you add a new hub to an existing setup. Connecting certain USB devices directly to the client computer rather than to a hub or extension cable might resolve their connection or performance issues. In some cases, you must remove and reattach the device and hub to restore the device to a working state.

USB Compound Devices

For compound devices, the virtualization process filters out the USB hub so that it is not visible to the virtual machine. The remaining USB devices in the compound appear to the virtual machine as separate devices. You can add each device to the same virtual machine or to different virtual machines if they run on the same host.

For example, the Aladdin HASP HL Drive USB dongle package contains three devices (0529:0001 HASP dongle, 13fe:1a00 Hub, 13fe:1d00 Kingston Drive). The virtualization process filters out the USB hub. The remaining Aladdin HASP HL Drive USB dongle devices (one Aladdin HASP dongle and one Kingston Drive) appear to the virtual machine as individual devices. You must add each device separately to make it accessible to the virtual machine.

Connect USB Devices to a Client Computer

You can connect multiple USB devices to a client computer so that virtual machines can access the devices. The number of devices that you can add depends on several factors, such as how the devices and hubs chain together and the device type.

The number of ports on each client computer depends on the physical setup of the client. When you calculate the depth of hub chaining, remember that on a typical server the front ports connect to an internal hub.

The USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

Prerequisites

Verify that you know the requirements for configuring USB devices from a remote computer to a virtual machine.

Procedure

- ◆ To add a USB device to a client computer, connect the device to an available port or hub.

The USB device appears in the virtual machine toolbar menu.

What to do next

You can now add the USB device to the virtual machine.

Add a USB Controller to a Virtual Machine in the vSphere Web Client

USB controllers are available to add to virtual machines to support USB passthrough from an ESXi host or from a client computer to a virtual machine.

You can add two USB controllers to a virtual machine. The xHCI controller, available for Linux guest operating systems only, supports USB 3.0 superspeed, 2.0, and 1.1 devices. The EHCI+UHCI controller supports USB 2.0 and 1.1 devices.

The conditions for adding a controller vary, depending on the device version, the type of passthrough (host or client computer), and the guest operating system.

Table 7-6. USB Controller Support

| Controller type | Supported USB Device Version | Supported for Passthrough from ESXi Host to VM | Supported for Passthrough from Client Computer to VM |
|-----------------|------------------------------|--|--|
| EHCI+UHCI | 2.0 and 1.1 | Yes | Yes |
| xHCI | 3.0, 2.0, and 1.1 | Yes (USB 2.0 and 1.1 devices only) | Yes (Linux guests only) |

For Mac OS X systems, the EHCI+UHCI controller is enabled by default and is required for USB mouse and keyboard access.

For virtual machines with Linux guests, you can add one or both controllers, but 3.0 superspeed devices are not supported for passthrough from an ESXi host to a virtual machine. You cannot add two controllers of the same type.

For USB passthrough from an ESXi host to a virtual machine, the USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

Prerequisites

- ESXi hosts must have USB controller hardware and modules that support USB 2.0 and 1.1 devices present.
- Client computers must have USB controller hardware and modules that support USB 3.0, 2.0, and 1.1 devices present.
- To use the xHCI controller on a Linux guest, ensure that the Linux kernel version is 2.6.35 or later.
- Verify that the virtual machine is powered on.
- Required Privilege (ESXi host passthrough): **Virtual Machine.Configuration.Add or Remove Device**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 On the Virtual Hardware tab, select **USB Controller** from the **New device** drop-down menu, and click **Add**.

The new USB controller appears at the bottom of the Virtual Hardware device list.

- 3 Expand **New USB Controller** to change the USB controller type.

If compatibility errors appear, fix them before you can add the controller.
- 4 Click **OK**.

What to do next

Add one or more USB devices to the virtual machine.

Add USB Devices From a Client Computer to a Virtual Machine in the vSphere Web Client

You can add one or more USB passthrough devices from a client computer to a virtual machine on the virtual machine **Summary** page in the vSphere Web Client. The devices must be connected to a client computer that connects to the ESXi host on which the virtual machine resides.

The devices maintain their virtual machine connections in S1 standby, if the vSphere Web Client is running and connected. After you add the USB device to the virtual machine, an information message appears on the client computer stating that the device is disconnected. The device remains disconnected from the client computer until the virtual machine releases it.

FT is not supported with USB passthrough from a client computer to a virtual machine.

Prerequisites

- Verify that the Client Integration Plug-in is installed.
- Verify that a USB Controller is present.
- Verify that the vSphere Web Client has access to the ESXi host on which the virtual machines are running.
- Required Privilege: **Virtual Machine.Interaction.Add or Remove Device**

Procedure

- 1 Navigate to a datacenter, folder, cluster, resource pool, host, or vApp, and click the **Related Options** tab and click **Virtual Machines**.
- 2 Select a virtual machine, click it again, and click the **Summary** tab.
- 3 Click the USB icon to the right of **USB Devices** under **VM Hardware** and select an available device from the drop-down menu.

A **Connecting** label and a spinner appear, which indicates that a connection is in progress. When the device has successfully connected and the Summary tab refreshes, the device is connected and the device name appears next to USB Devices.

Remove USB Devices That Are Connected Through a Client Computer in the vSphere Web Client

You can remove USB devices from a virtual machine if the devices are no longer needed. When you disconnect a USB device from a virtual machine, the device is released from the virtual machine and is given back to the client computer, which starts using it.

Prerequisites

- To minimize the risk of data loss, follow the instructions to safely unmount or eject hardware for your operating system. Safely removing hardware allows accumulated data to be transmitted to a file. Windows operating systems typically include a Remove Hardware icon located in the System Tray. Linux operating systems use the **umount** command.

NOTE You might need to use the `sync` command instead of or in addition to the `umount` command, for example after you run a `dd` command on Linux or other UNIX operating systems.

- Required Privilege: **Virtual Machine.Interaction.Add or Remove Device**

Procedure

- 1 Unmount or eject the USB device from the guest operating system.
- 2 On the virtual machine **Summary** tab, click the disconnect icon on the right side of the USB device entry.

- 3 Select a device to disconnect from the drop-down menu.

A **Disconnecting** label and a spinner appear, indicating that a disconnection is in progress. When the device is disconnected, after a slight delay, the **Summary** tab refreshes and the device is removed from the virtual machine configuration.

The device reconnects to the client computer and is available to add to another virtual machine. In some cases, Windows Explorer detects the device and opens a dialog box on the client computer. You can close this dialog box.

Remove a USB Controller from a Virtual Machine in the vSphere Web Client

You can remove a USB controller from the virtual machine if you do not want to connect to USB devices.

Prerequisites

- Verify that all USB devices are disconnected from the virtual machine.
- Required Privilege: **Virtual Machine.Configuration.Add or Remove Device**

Procedure

- 1 Navigate to a datacenter, folder, cluster, resource pool, host, or vApp, and click the **Related Options** tab and click **Virtual Machines**.
- 2 Select a virtual machine, click it again, and click the **Summary** tab.
- 3 Select **Virtual Hardware** and expand the **USB controller** menu.
- 4 Click **Remove**.
- 5 Click **OK** to save your changes and close the dialog box.

The controller is no longer connected to the virtual machine, but remains available to add at a later time.

Remove USB Devices from a Client Computer

You can remove USB devices from a client computer if you do not want those devices to be available to virtual machines.

When you detach a USB device from the remote client, the device disconnects from the virtual machine. Ensure that data transfer is not taking place before you remove the device.

Prerequisites

Verify that the devices are not in use.

Procedure

- ◆ To minimize the risk of data loss, follow the instructions to safely unmount or eject hardware for your operating system. Safely removing hardware allows accumulated data to be transmitted to a file. Windows operating systems typically include a Remove Hardware icon located in the System Tray. Linux operating systems use the **umount** command.

You might need to use the `sync` command instead of or in addition to the `umount` command, for example after you issue a `dd` command on Linux or other UNIX operating systems.

When you remove the device from the client computer, it is no longer available to virtual machines.

Add a Shared Smart Card Reader to Virtual Machines in the vSphere Web Client

You can configure multiple virtual machines to use a virtual shared smart card reader for smart card authentication. The smart card reader must be connected to a client computer on which the vSphere Web Client runs. All smart card readers are treated as USB devices.

A license is required for the shared smart card feature. See *vCenter Server and Host Management*.

When you log out of Windows XP guest operating systems, to log back in, you must remove the smart card from the smart card reader and re-add it. You can also disconnect the shared smart card reader and reconnect it.

If the vSphere Web Client disconnects from the vCenter Server or host, or if the client computer is restarted or shut down, the smart card connection breaks. For this reason, it is best to have a dedicated client computer for smart card use.

To connect a USB smart card reader that is not shared, see [“USB Configuration from a Client Computer to a Virtual Machine in the vSphere Web Client,”](#) on page 159.

Prerequisites

- Verify that the smart card reader is connected to the client computer.
- Verify that the virtual machine is powered on.
- Verify that a USB controller is present.
- Required Privilege: **Virtual Machine.Interaction.Add or Remove Device**

Procedure

- 1 Navigate to a datacenter, folder, cluster, resource pool, host, or vApp, and click the **Related Options** tab and click **Virtual Machines**.
- 2 Select a virtual machine, click it again, and click the **Summary** tab.
- 3 Click the USB icon on the right side of **USB Devices** under **VM Hardware**, and select an available shared smart card reader from the drop down menu.

Select a device that appears as **Shared***the model name of your smart card reader* followed by a number.

A **Connecting** label and a spinner appear showing that a connection is in progress. When the device has successfully connected and the Summary tab refreshes, the device is connected and the device name appears next to **USB Devices**.

You can now use smart card authentication to log in to virtual machines in the vSphere Client inventory.

Configuring Virtual Machine Options in the vSphere Web Client

8

You can set or change virtual machine options to run VMware Tools scripts, control user access to the remote console, configure startup behavior, and more. The virtual machine options define a range of virtual machine properties, such as the virtual machine name and the virtual machine behavior with the guest operating system and VMware Tools. In addition, the options define vApp functionality and other options that you rarely need to change from their defaults.

Change the virtual machine settings on the **Options** tab of the Virtual Machine Properties Editor. You cannot configure some of the options. For example, you can add a guest operating system when you create a virtual machine, but you cannot change the guest operating system type and version after you create the virtual machine.

Table 8-1. Virtual Machine Options

| Options | Description |
|-------------------------------|---|
| General Options | Display name and type and version of guest operating system. Location of the virtual machine configuration file and the virtual machine working location. |
| VMware Remote Console Options | Lock the guest operating system when the last remote user disconnects and limit the number of simultaneous connections to the virtual machine. |
| vApp Options | Options for functionality, product information, properties, and OVF settings specific to virtual appliances. |
| VMware Tools | Power Controls behavior, VMware Tools scripts, automatic upgrades, and time synchronization between the guest and host. |
| Power Management | Virtual machine Suspend behavior and wake on LAN. |
| Boot Options | Virtual machine boot options. Add a delay before booting or force entry into the BIOS or EFI setup screen. |
| Fibre Channel NPIV | Virtual node and port World Wide Names (WWNs). |

You can change advanced virtual machine settings on the **Options** tab.

Table 8-2. Advanced Virtual Machine Options

| Advanced Options | Description |
|--------------------------|--|
| General | Acceleration, logging, debugging and statistics. |
| Swap file Location | Swap file location options. |
| Configuration Parameters | View, modify, or add configuration parameters. |

This chapter includes the following topics:

- [“Change the Virtual Machine Name in the vSphere Web Client,”](#) on page 168
- [“View the Virtual Machine Configuration and Working File Location in the vSphere Web Client,”](#) on page 168
- [“Change the Virtual Machine Console Options for Remote Users in the vSphere Web Client,”](#) on page 169
- [“Configure the Virtual Machine Power States in the vSphere Web Client,”](#) on page 169
- [“Configure Virtual Machines to Automatically Upgrade VMware Tools in the vSphere Web Client,”](#) on page 170
- [“Manage Power Management Settings for a Virtual Machine in the vSphere Web Client,”](#) on page 171
- [“Delay the Boot Sequence in the vSphere Web Client,”](#) on page 172
- [“Disable Virtual Machine Acceleration in the vSphere Web Client,”](#) on page 172
- [“Enable Virtual Machine Logging in the vSphere Web Client,”](#) on page 173
- [“Configure Virtual Machine Debugging and Statistics in the vSphere Web Client,”](#) on page 173
- [“Change the Swap File Location in the vSphere Web Client,”](#) on page 174
- [“Edit Configuration File Parameters in the vSphere Web Client,”](#) on page 174
- [“Configure Fibre Channel NPIV Settings in the vSphere Web Client,”](#) on page 175

Change the Virtual Machine Name in the vSphere Web Client

If you move a virtual machine to a different datastore folder or move the virtual machine to a host that has an existing virtual machine of the same name, you can change the virtual machine's name to keep it unique. When you change the name of a virtual machine, you change the name used to identify the virtual machine in the vCenter Server inventory. This action does not change the name used as the computer name by the guest operating system.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **General Options**.
- 3 Delete the existing name and type a new name for the virtual machine in the **VM Name** text box.
- 4 Click **OK**.

View the Virtual Machine Configuration and Working File Location in the vSphere Web Client

You can view the location of the virtual machine configuration and working files. You can use this information when you configure backup systems.

Prerequisites

Verify that the virtual machine is powered off.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click **VM Options** tab and expand **General Options**.

The path to the location of the virtual machine configuration file appears in the **VM Config File** text box. The path to the virtual machine working location appears in the **VM Working Location** text box.

Change the Virtual Machine Console Options for Remote Users in the vSphere Web Client

To control access to the virtual machine, you can limit the number of simultaneous connections to a virtual machine and lock the guest operating system when the last remote user disconnects from the virtual machine console.

Prerequisites

- Verify that VMware Tools is installed and running.
- To use the **Guest OS lock** option, verify that you have a Windows XP or later guest operating system.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab, and expand **VMware Remote Console Options**.
- 3 (Optional) Select **Guest OS lock** to lock the guest operating system when the last remote user disconnects.
- 4 (Optional) Select **Maximum number of sessions** to limit the number of simultaneous connections to this virtual machine, and enter a number.
- 5 Click **OK**.

Configure the Virtual Machine Power States in the vSphere Web Client

Changing virtual machine power states is useful when you do maintenance on the host. You can use the system default settings for the virtual machine power controls, or you can configure the controls to interact with the guest operating system. For example, you can configure the **Power off** control to power off the virtual machine or shut down the guest operating system.

You can modify many virtual machine configurations while the virtual machine is running, but you might need to change the virtual machine power state for some configurations.

You cannot configure a **Power on** () action. This action powers on a virtual machine when a virtual machine is stopped, or resumes the virtual machine and runs a script when it is suspended and VMware Tools is installed and available. If VMware Tools is not installed, it resumes the virtual machine and does not run a script.

Prerequisites

- Verify that you have privileges to perform the intended power operation on the virtual machine.
- To set optional power functions, install VMware Tools in the virtual machine.
- Power off the virtual machine before editing the VMware Tools options.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **VMware Tools**.
- 3 Select an option for the virtual machine **Power Off** () control from the drop-down menu.

| Option | Description |
|------------------------|---|
| Shut Down Guest | Uses VMware Tools to initiate an orderly system shut down of the virtual machine. Soft power operations are possible only if the tools are installed in the guest operating system. |
| Power Off | Immediately stops the virtual machine. A Power Off action shuts down the guest operating system or powers off the virtual machine. A message indicates that the guest operating system might not shut down properly. Use this power off option only when necessary. |
| Default | Follows system settings. The current value of the system settings appears in parentheses. |

- 4 Select an option for the **Suspend** () control from the drop-down menu.

| Option | Description |
|-----------------------|---|
| Suspend | Pauses all virtual machine activity. When VMware Tools is installed and available, a suspend action runs a script and suspends the virtual machine. If VMware Tools is not installed, a Suspend action suspends the virtual machine without running a script. |
| System Default | Follows system settings. The current value of the system setting appears in parentheses. |

- 5 Select an option for the **Reset** () control from the drop-down menu.

| Option | Description |
|-----------------------|---|
| Restart Guest | Uses VMware Tools to initiate an orderly reboot. Soft power operations are possible only if the tools are installed in the guest operating system. |
| Reset | Shuts down and restarts the guest operating system without powering off the virtual machine. If VMWare Tools is not installed, a Reset action resets the virtual machine. |
| System Default | Follows system settings. The current value of the system setting appears in parentheses. |

- 6 Click **OK** to save your changes.

Configure Virtual Machines to Automatically Upgrade VMware Tools in the vSphere Web Client

You can configure virtual machines to automatically update VMware Tools before you start the virtual machines. This action helps to eliminate unnecessary shut downs by taking advantage of other updates or activities that require you to restart the virtual machine.

NOTE Automatic VMware Tools upgrade is not supported for virtual machines with Solaris or NetWare guest operating systems.

Prerequisites

- Verify that the virtual machines have a version of VMware Tools shipped with ESX/ESXi 3.5 or later installed.
- Verify that the virtual machines are hosted on ESX/ESXi 3.5 or later and vCenter Server 3.5 or later.
- Verify that the virtual machines are running a Linux or Windows guest OS that ESX/ESXi 3.5 or later and vCenter Server 3.5 or later support.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **VMware Tools**.
- 3 Select the **Check and upgrade VMware Tools before each power on** check box.
- 4 Click **OK** to save your changes.

Manage Power Management Settings for a Virtual Machine in the vSphere Web Client

You can set the power options so that a virtual machine is suspended or remains powered on if the guest operating system is placed on standby. Some desktop-based guests, such as Windows 7, have standby enabled by default, so that the guest goes into standby after a predetermined time.

The following conditions apply:

- **Power Management** options are not available on every guest operating system.
- **Wake on LAN** supports only Windows guest operating systems and is not available on Vlance NICs or when a Flexible NIC is operating in Vlance mode. That is, the current VMware Tools are not installed on the guest operating system.
- **Wake on LAN** can resume virtual machines that are in an S1 sleep state only. It cannot resume suspended, hibernated, or powered off virtual machines.
- NICs that support **Wake on LAN** include Flexible (VMware Tools required), vmxnet, Enhanced vmxnet, and vmxnet 3.

NOTE To avoid having the guest operating system go into standby mode unintentionally, verify the settings before you deploy the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **Power Management**.

- 3 Select a power option.

| Option | Description |
|--|---|
| Suspend the virtual machine | Stops all processes, which saves resources, and copies the contents of the virtual machine's memory to the virtual machine's .vmss file. Writing the memory to the .vmss file is useful if you need to copy the file to help with a troubleshooting scenario. |
| Put the guest operating system in standby mode and leave the virtual machine powered on | All processes stop running, but virtual devices remain connected. |

- 4 (Optional) Select **Wake on LAN for virtual machine traffic on** and select the virtual NICs to trigger this action.

Unsupported NICs might be listed, but are unavailable to connect.

- 5 Click **OK** to save your changes.

Delay the Boot Sequence in the vSphere Web Client

Delaying the boot operation is useful when you change BIOS or EFI settings such as the boot order. For example, you can change the BIOS or EFI settings to force a virtual machine to boot from a CD-ROM.

Prerequisites

- Verify that vSphere Web Client is logged in to a vCenter Server.
- Verify that you have access to at least one virtual machine in the inventory.
- Verify that you have privileges to edit boot options for the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click **VM Options** tab and expand **Boot Options**.
- 3 Select the time in milliseconds to delay the boot operation.
- 4 (Optional) Select whether to force entry into the BIOS or EFI setup screen the next time the virtual machine boots.
- 5 (Optional) Select whether to try to reboot after a boot failure.
- 6 Click **OK**.

Disable Virtual Machine Acceleration in the vSphere Web Client

You might find that when you install or run software in a virtual machine, the virtual machine appears to stop responding. The problem occurs early in the program's execution. You can get past the problem by temporarily disabling acceleration in the virtual machine.

This setting slows down virtual machine performance, so use it only for getting past the problem with running the program. After the program stops encountering problems, deselect **Disable acceleration**. You might be able to run the program with acceleration.

You can enable and disable acceleration when the virtual machine is running.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **Advanced**.
- 3 Click **VM Options** and expand **Advanced**.
- 4 Select **Disable acceleration**.
- 5 Click **OK**.

You should be able to install or run the software successfully.

Enable Virtual Machine Logging in the vSphere Web Client

You can enable logging to collect log files to help troubleshoot problems with your virtual machine.

ESXi hosts store virtual machine log files in the same directory as the virtual machine's configuration files. By default, the log file name is `vmware.log`. Archived log files are stored as `vmware-n.log`, where *n* is a number in sequential order beginning with 1.

Prerequisites

Required privilege: **Virtual machine.Configuration.Settings**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **Advanced**.
- 3 In the Settings row, select **Enable logging** and click **OK**.

You can view and compare log files in the same storage location as the virtual machine configuration files.

Configure Virtual Machine Debugging and Statistics in the vSphere Web Client

You can run a virtual machine so that it collects additional debugging information that is helpful to VMware technical support in resolving issues.

Prerequisites

Power off the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **Advanced**.

- 3 Select a debugging and statistics option from the drop-down menu.
 - **Run normally**
 - **Record Debugging Information**
 - **Record Statistics**
 - **Record Statistics and Debugging Information**

The number of debugging and statistics options available depends on the host software type and version. On some hosts, some options are not available.

- 4 Click OK.

Change the Swap File Location in the vSphere Web Client

When a virtual machine is powered on, the system creates a VMkernel swap file to serve as a backing store for the virtual machine's RAM contents. You can accept the default swap file location or save the file to a different location. By default, the swap file is stored in the same location as the virtual machine's configuration file.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **Advanced**.
- 3 Select a swap file location option.

| Option | Description |
|---|--|
| Default | Stores the virtual machine swap file at the default location defined by the host or cluster swap file settings. |
| Always store with the virtual machine | Stores the virtual machine swap file in the same folder as the virtual machine configuration file. |
| Store in the host's swapfile datastore | If the host or cluster settings define a location for the swap file, this location is used. Otherwise, the swap file is stored with the virtual machine. |

- 4 Click OK.

Edit Configuration File Parameters in the vSphere Web Client

You can change or add virtual machine configuration parameters when instructed by a VMware technical support representative, or if you see VMware documentation that instructs you to add or change a parameter to fix a problem with your system.

IMPORTANT Changing or adding parameters when a system does not have problems might lead to decreased system performance and instability.

The following conditions apply:

- To change a parameter, you change the existing value for the keyword/value pair. For example, if you start with the keyword/value pair, keyword/value, and change it to keyword/value2, the result is keyword=value2.
- You cannot delete a configuration parameter entry.



CAUTION You must assign a value to configuration parameter keywords. If you do not assign a value, the keyword can return a value of 0, false, or disable, which can result in a virtual machine that cannot power on.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the **VM Options** tab and expand **Advanced**.
- 3 Click **Edit Configuration**.
- 4 (Optional) To add a parameter, click **Add Row** and type a name and value for the parameter.
- 5 (Optional) To change a parameter, type a new value in the **Value** text box for that parameter.
- 6 Click **OK**.

Configure Fibre Channel NPIV Settings in the vSphere Web Client

N-port ID virtualization (NPIV) provides the ability to share a single physical Fibre Channel HBA port among multiple virtual ports, each with unique identifiers. This capability lets you control virtual machine access to LUNs on a per-virtual machine basis.

Each virtual port is identified by a pair of world wide names (WWNs): a world wide port name (WWPN) and a world wide node name (WWNN). These WWNs are assigned by vCenter Server.

For detailed information on how to configure NPIV for a virtual machine, see *vSphere Storage*.

NPIV support is subject to the following limitations:

- NPIV must be enabled on the SAN switch. Contact the switch vendor for information about enabling NPIV on their devices.
- NPIV is supported only for virtual machines with RDM disks. Virtual machines with regular virtual disks continue to use the WWNs of the host's physical HBAs.
- The physical HBAs on the ESXi host must have access to a LUN using its WWNs in order for any virtual machines on that host to have access to that LUN using their NPIV WWNs. Ensure that access is provided to both the host and the virtual machines.
- The physical HBAs on the ESXi host must support NPIV. If the physical HBAs do not support NPIV, the virtual machines running on that host will fall back to using the WWNs of the host's physical HBAs for LUN access.
- Each virtual machine can have up to 4 virtual ports. NPIV-enabled virtual machines are assigned exactly 4 NPIV-related WWNs, which are used to communicate with physical HBAs through virtual ports. Therefore, virtual machines can utilize up to 4 physical HBAs for NPIV purposes.

Prerequisites

- To edit the virtual machine's WWNs, power off the virtual machine.
- Verify that the virtual machine has a datastore containing a LUN that is available to the host.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click **VM Options** tab and expand **Fibre Channel NPIV**.
- 3 (Optional) Select the **Temporarily Disable NPIV for this virtual machine** check box.

- 4 Select an option for assigning WWNs.
 - To leave WWNs unchanged, select **Leave unchanged**.
 - To have vCenter Server or the ESXi host generate new WWNs, select **Generate New WWNs**.
 - To remove the current WWN assignments, select **Remove WWN assignment**.
- 5 Click **OK**.

Configuring Virtual Machines in the vSphere Client

9

You can add or configure most virtual machine properties during the virtual machine creation process or after you create the virtual machine and install the guest operating system.

You configure virtual machines and change nearly every characteristic that you selected when you created the virtual machine.

You can configure three types of virtual machine properties.

Hardware View existing hardware configuration and add or remove hardware.

Options View and configure a number of virtual machine properties, such as power management interaction between the guest operating system and virtual machine, and VMware Tools settings.

Resources Configure CPUs, CPU hyperthreading resources, memory and disks.

This chapter includes the following topics:

- [“Virtual Machine Hardware Versions,”](#) on page 178
- [“Locate the Hardware Version of a Virtual Machine in the vSphere Client,”](#) on page 179
- [“Change the Virtual Machine Name in the vSphere Client,”](#) on page 179
- [“View the Virtual Machine Configuration File Location in the vSphere Client,”](#) on page 180
- [“Edit Configuration File Parameters in the vSphere Client,”](#) on page 180
- [“Change the Configured Guest Operating System in the vSphere Client,”](#) on page 180
- [“Configure Virtual Machines to Automatically Upgrade VMware Tools,”](#) on page 181
- [“Virtual CPU Configuration,”](#) on page 182
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- [“USB Configuration from a Client Computer to a Virtual Machine in the vSphere Client,”](#) on page 222
- [“Add a Shared Smart Card Reader to Virtual Machines in the vSphere Client,”](#) on page 228
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Virtual Machine Hardware Versions

The hardware version of a virtual machine reflects the virtual machine's supported virtual hardware features. These features correspond to the physical hardware available on the ESXi host on which you create the virtual machine. Virtual hardware features include BIOS and EFI, available virtual PCI slots, maximum number of CPUs, maximum memory configuration, and other characteristics typical to hardware.

When you create a virtual machine, you can accept the default hardware version, which corresponds to the host on which you create the virtual machine, or an earlier version. You can use an earlier hardware version in the following situations:

- To standardize testing and deployment in your virtual environment.
- If you do not need the capabilities of the newer version.
- To maintain compatibility with older hosts.

Virtual machines with hardware versions earlier than version 8 can run on ESXi 5.0 hosts, but do not have all the capabilities available in hardware version 8. For example, you cannot use 32 virtual processors or 1011GB of memory in virtual machines with hardware versions earlier than version 8.

The vSphere Web Client or the vSphere Client allows you to upgrade virtual machines only to the latest hardware version. If virtual machines do not have to stay compatible with older ESX/ESXi hosts, you can upgrade them on ESXi 5.0 hosts. In this case, they are upgraded to version 8.

- To maintain virtual machine compatibility with ESX/ESXi 3.5 hosts, upgrade the virtual machine on an ESX/ESXi 3.5 host, which results in a virtual machine upgrade to version 4.
- To maintain virtual machine compatibility with ESX/ESXi 4.x hosts, upgrade the virtual machine on an ESX/ESXi 4.x host, which results in a virtual machine upgrade to version 7.

A virtual machine can have an earlier hardware version than that of the host on which it runs in the following cases:

- You migrate a virtual machine created on an ESX/ESXi 4.x or earlier host to an ESXi 5.0 host.
- You create a virtual machine on an ESXi 5.0 host by using an existing virtual disk that was created on an ESX/ESXi 4.x or earlier host.
- You add a virtual disk created on an ESX/ESXi 4.x or earlier host to a virtual machine created on an ESXi 5.0 host.

You can create, edit, and run different virtual machine versions on a host if the host supports that version. Sometimes, virtual machine actions on a host are limited or the virtual machine has no access to the host.

Table 9-1. ESXi Hosts and Compatible Virtual Machine Hardware Versions

| | Version 8 | Version 7 | Version 4 | Compatible with vCenter Server Version |
|----------------|-------------------|-------------------|-------------------|---|
| ESXi 5.0 | Create, edit, run | Create, edit, run | Edit, run | vCenter Server 5.0 |
| ESX/ESXi 4.x | Not supported | Create, edit, run | Create, edit, run | vCenter Server 4.x |
| ESX Server 3.x | Not supported | Not supported | Create, edit, run | VirtualCenter Server 2.x and later |

Version 3 virtual machines are not supported on ESXi 5.0 hosts. To make full use of these virtual machines, upgrade the virtual hardware.

NOTE Virtual machine hardware version 4 might be listed as VM3 in documentation for earlier versions of ESX/ESXi.

Locate the Hardware Version of a Virtual Machine in the vSphere Client

You can locate the hardware version of a virtual machine by looking in the virtual machine **Summary** tab or the Virtual Machine Properties dialog box. You can also locate the hardware version for multiple virtual machines on the **Virtual Machine** tab of a datacenter, host, or cluster.

Procedure

- 1 In the vSphere Client inventory, select the virtual machine.
- 2 Select a method for viewing the version information.

| Option | Description |
|---|---|
| Click the Summary tab. | The virtual machine hardware version appears under General on the virtual machine's Summary tab. |
| Right-click the virtual machine and select Edit Settings. | The virtual machine hardware version appears in the upper-right corner of the Virtual Machine Properties dialog box. |
| Select a datacenter, host, or cluster and click the Virtual Machine tab. | The virtual machine hardware version appears in the VM Version column. If the VM Version column is not displayed, right-click any column title and select VM Version. |

Change the Virtual Machine Name in the vSphere Client

You can change the virtual machine name in the **Virtual Machine Name** panel in the Virtual Machine Properties dialog box.

Changing the name does not change the name of any virtual machine files or the name of the directory that the files are located in.

Prerequisites

- Verify that you are connected to the vCenter Server or ESXi host on which the virtual machine runs.
- Verify that you have access to the virtual machine in the vSphere Client inventory list.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and select **General Options**.
- 3 Type a new name for the virtual machine.
- 4 Click **OK** to save your changes.

View the Virtual Machine Configuration File Location in the vSphere Client

You can view the location of the virtual machine configuration and working files. This information is useful when you are configuring backup systems.

Prerequisites

- Verify that you are connected to the vCenter Server or ESXi host on which the virtual machine runs.
- Verify that you have access to the virtual machine in the vSphere Client inventory list.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and select **General Options**.
- 3 Record the location of the configuration and working files and click OK to close the dialog box.

Edit Configuration File Parameters in the vSphere Client

You can change or add virtual machine configuration parameters if you intend to use experimental features or when instructed by a VMware technical support representative.

You also might see VMware documentation that instructs you to change or add a parameter. In such cases, you can safely follow the recommended procedure.

The following conditions apply:

- To change a parameter, you change the existing value for the keyword/value pair. For example, if you start with the keyword/value pair, keyword/value, and change it to keyword/value2, the result is keyword=value2.
- You cannot delete a configuration parameter entry.



CAUTION You must assign a value to configuration parameter keywords. If you don't assign a value, the keyword can return a value of 0, false, or disable, which can result in a virtual machine that cannot power on.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and under Advanced, click **General**.
- 3 Click **Configuration Parameters**.
- 4 (Optional) Change or add a parameter.
- 5 Click **OK** to exit the Configuration Parameters dialog box.
- 6 Click **OK** to save your changes.

Change the Configured Guest Operating System in the vSphere Client

When you change the guest operating system type in the virtual machine settings, you change the setting for the guest operating system in the virtual machine's configuration file. To change the guest operating system itself, you must install the new operating system in the virtual machine.

When you set the guest operating system type for a new virtual machine, vCenter Server chooses configuration defaults based on the guest type. Changing the guest operating system type after the virtual machine is created does not retroactively change those settings. It affects the recommendations and setting ranges offered after the change.

Prerequisites

Power off the virtual machine.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and select **General Options**.
- 3 Select a guest operating system type and version.
- 4 Click **OK** to save your changes.

The virtual machine configuration parameters for the guest operating system are changed. You can now install the guest operating system.

Configure Virtual Machines to Automatically Upgrade VMware Tools

You can configure virtual machines to automatically update VMware Tools.

NOTE Automatic VMware Tools upgrade is not supported for virtual machines with Solaris or NetWare guest operating systems.

Prerequisites

- Verify that the virtual machines have a version of VMware Tools shipped with ESX/ESXi 3.5 or later installed.
- Verify that the virtual machines are hosted on ESX/ESXi 3.5 or later and vCenter Server 3.5 or later.
- Verify that the virtual machines are running a Linux or Windows guest OS that ESX/ESXi 3.5 or later and vCenter Server 3.5 or later support.

Procedure

- 1 Right-click the virtual machine and click **Edit Settings**.
- 2 Click the **Options** tab and select **VMware Tools**.
- 3 Select **Check and upgrade Tools during power cycling** in the **Advanced** pane.
- 4 Click **OK** to save your changes and close the dialog box.

The next time the virtual machine is powered on, it checks the ESX/ESXi host for a newer version of VMware Tools. If one is available, it is installed and the guest operating system is restarted (if required).

Virtual CPU Configuration

You can add, change, or configure CPU resources to improve virtual machine performance. You can set most of the CPU parameters during virtual machine creation or after the guest operating system is installed. Some actions require you to power off the virtual machine before changing the settings.

VMware uses the following terminology. Understanding these terms can help you plan your CPU resource allocation strategy.

| | |
|--|---|
| CPU | The CPU or processor is the portion of a computer system that carries out the instructions of a computer program and is the primary element carrying out the computer's functions. CPUs contain cores. |
| CPU Socket | A physical connector on a computer motherboard that accepts a single physical CPU. Many motherboards can have multiple sockets that can in turn accept multicore processors (CPUs). The vSphere Client computes the total number of cores to give the virtual machine from the number of virtual sockets and cores per socket that you select. The vSphere Web Client computes the total number of virtual sockets from the number of cores and cores per socket that you select. |
| Core | Comprises a unit containing an L1 cache and functional units needed to run programs. Cores can independently run programs or threads. One or more cores can exist on a single CPU. |
| Corelet | An AMD processor corelet is architecturally equivalent to a logical processor. Certain future AMD processors will comprise a number of compute units, where each compute unit has a number of corelets. Unlike a traditional processor core, a corelet lacks a complete set of private, dedicated execution resources. It shares some execution resources with other corelets such as an L1 Instruction Cache or a floating-point execution unit. AMD refers to corelets as cores, but because these are unlike traditional cores, VMware uses the nomenclature of "corelets" to make resource sharing more apparent. |
| Thread | Some cores can run independent streams of instructions simultaneously. In existing implementations, cores can run one or two software threads at one time by multiplexing the functional units of the core between the software threads, as necessary. Such cores are called dual or multithreaded. |
| Resource sharing | Shares specify the relative priority or importance of a virtual machine or resource pool. If a virtual machine has twice as many shares of a resource as another virtual machine, it is entitled to consume twice as much of that resource when these two virtual machines are competing for resources. |
| Resource allocation | You can change CPU resource allocation settings, such as shares, reservation, and limit, when available resource capacity does not meet demands. For example, if at year end the workload on accounting increases, you can increase the accounting resource pool reserve. |
| vSphere Virtual Symmetric Multiprocessing (Virtual SMP) | Feature that enables a single virtual machine to have multiple cores. |

Virtual CPU Limitations

The maximum number of virtual CPUs that you can assign to a virtual machine depends on the number of logical CPUs on the host, the host license, and the type of guest operating system that is installed on the virtual machine.

Be aware of the following limitations:

- A virtual machine cannot have more virtual CPUs than the number of logical cores on the host. The number of logical cores is equal to the number of physical cores if hyperthreading is disabled or two times that number if hyperthreading is enabled.
- Not every guest operating system supports Virtual SMP, and some that do require reinstallation if the number of CPUs changes. For more information about using Virtual SMP, search the VMware Knowledge Base.
- Guest operating systems that support Virtual SMP might support fewer processors than are available on the host. For information about Virtual SMP support, see the *VMware Compatibility Guide*.
- Hyperthreaded hosts might affect virtual machine performance, depending on the workload. The best practice is to test your workload to determine whether to enable or disable hyperthreading on your hosts.

Configuring Multicore Virtual CPUs

VMware multicore virtual CPU support lets you control the number of cores per virtual socket in a virtual machine. This capability lets operating systems with socket restrictions use more of the host CPU's cores, which increases overall performance.

IMPORTANT When you configure your virtual machine for multicore virtual CPU settings, you must ensure that your configuration complies with the requirements of the guest operating system EULA.

Using multicore virtual CPUs can be useful when you run operating systems or applications that can take advantage of only a limited number of CPU sockets.

You can configure a virtual machine that runs on an ESXi host to have up to 64 virtual CPUs. A virtual machine cannot have more virtual CPUs than the actual number of logical CPUs on the host. The number of logical CPUs is the number of physical processor cores or two times that number if hyperthreading is enabled. For example, if a host has 64 logical CPUs, you can configure the virtual machine for 64 virtual CPUs.

You configure how the virtual CPUs are assigned in terms of cores and cores per socket. Determine how many CPU cores you want in the virtual machine, then select the number of cores you want in each socket, depending on whether you want a single core CPU, dual-core CPU, tri-core CPU, and so on. Your selection determines the number of sockets that the virtual machine has.

For more information about multicore CPUs, see the *vSphere Resource Management* documentation.

Change CPU Hot-Plug Settings in the vSphere Client

The CPU hot plug option lets you add CPU resources for a virtual machine while the machine is powered on.

The following conditions apply:

- For best results, use hardware version 8 virtual machines.
- Hot-adding multicore virtual CPUs is supported only with hardware version 8 virtual machines.
- Not all guest operating systems support CPU hot add. You can disable these settings if the guest is not supported.
- To use the CPU hot-add feature with hardware version 7 virtual machines, set **Number of cores per socket** to 1.

- Adding CPU resources to a running virtual machine with CPU hot plug enabled disconnects and reconnects all USB passthrough devices connected to that virtual machine.

Prerequisites

Verify that the virtual machine is running under the following conditions:

- VMware Tools is installed. This condition is required for hot plug functionality with Linux guest operating systems.
- The virtual machine has a guest operating system that supports CPU hot plug.
- The virtual machine is using hardware version 7 or later.
- The virtual machine is powered off.
- Required privileges: **Virtual Machine.Configuration.Settings** on the virtual machine

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and under **Advanced**, select **Memory/CPU Hotplug**.
- 3 Change the CPU Hot Plug setting.
- 4 Click **OK** to save your changes.

What to do next

You can now add CPUs to the powered on virtual machine.

Change the Number of Virtual CPUs in the vSphere Client

You can configure a virtual machine that runs on an ESXi host to have up to 32 virtual CPUs. You can change the number of virtual CPUs while the virtual machine is running or powered off.

Virtual CPU hot add is supported for virtual machines with multicore CPU support that are running on hardware version 8 or later. When the virtual machine is powered on, and CPU hot add is enabled, you can hot add virtual CPUs to the running virtual machine. You can add only multiples of the number of cores per socket. For multicore CPUs, the host must have a license for vSphere Virtual Symmetric Multiprocessing (Virtual SMP).

IMPORTANT When you configure your virtual machine for multicore virtual CPU settings, you must ensure that your configuration complies with the requirements of the guest operating system EULA.

Prerequisites

- If CPU hot add is not enabled, power off the virtual machine before adding CPUs.
- If CPU hot remove is not enabled, power off the virtual machine before removing CPUs.
- To hot add multicore CPUs, verify that the virtual machine has hardware version 8.
- Required privilege: **Virtual Machine.Configuration.Change CPU Count** on the virtual machine

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select **CPUs**.
- 3 Select a value from the **Number of virtual sockets** drop-down menu.

- 4 Select a value from the **Number of cores per socket** drop-down menu.

The resulting total number of cores is a number equal to or less than the number of logical CPUs on the host.

- 5 Click **OK** to save your changes.

Example: Adding Multicore CPU Resources to a Virtual Machine

You might have the following existing CPU resources, which you configured for the virtual machine while you were creating it, or after you created it and it was in a powered off state.

| CPU Resource Settings | Existing Value |
|----------------------------|----------------|
| Number of virtual sockets | 2 |
| Number of cores per socket | 2 |
| Total number of cores | 4 |

With CPU hot plug enabled and the virtual machine running, you can select the number of sockets to add from the **Number of virtual sockets** drop-down menu. The **Number of cores per socket** drop-down menu is unavailable and retains a value of 2. If you select 3 virtual sockets, you are adding 1 socket with 2 cores so that the virtual machine has 6 virtual CPUs.

| CPU Resource Settings | Existing Value | Hot-plug value |
|----------------------------|----------------|----------------|
| Number of virtual sockets | 2 | 3 |
| Number of cores per socket | 2 | 2 |
| Total Number of cores | 4 | 6 |

Allocate CPU Resources in the vSphere Client

You can change the amount of CPU resources allocated to a virtual machine by using the shares, reservations, and limits settings.

A virtual machine has the following user-defined settings that affect its CPU resource allocation.

| | |
|--------------------|---|
| Limit | Places a limit on the consumption of CPU time for a virtual machine. This value is expressed in MHz. |
| Reservation | Specifies the guaranteed minimum allocation for a virtual machine. The reservation is expressed in MHz. |
| Shares | Each virtual machine is granted a number of CPU shares. The more shares a virtual machine has, the more often it gets a time slice of a CPU when there is no CPU idle time. Shares represent a relative metric for allocating CPU capacity. |

Prerequisites

Required Privilege: **Virtual machine.Configuration.Change resource**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Resources** tab and select **CPU**.

- Allocate the CPU capacity for this virtual machine.

| Option | Description |
|--------------------|---|
| Shares | CPU shares for this virtual machine in relation to the parent's total. Sibling virtual machines share resources according to their relative share values bounded by the reservation and limit. Select Low , Normal , or High , which specify share values respectively in a 1:2:4 ratio. Select Custom to give each virtual machine a specific number of shares, which express a proportional weight. |
| Reservation | Guaranteed CPU allocation for this virtual machine. |
| Limit | Upper limit for this virtual machine's CPU allocation. Select Unlimited to specify no upper limit. |

- Click **OK** to save your changes.

Configuring Advanced CPU Scheduling Settings

You can select CPU options that involve scheduling the virtual machine processing to physical processor cores and hyperthreads. ESXi generally manages processor scheduling well, even when hyperthreading is enabled. These settings are useful only for detailed tweaking of critical virtual machines.

Configure Hyperthreaded Core Sharing in the vSphere Client

You can select how the virtual CPUs of a virtual machine share physical cores on a hyperthreaded system.

Hyperthreading technology allows a single physical processor to behave like two logical processors. The hyperthreaded core sharing option provides detailed control over whether to schedule a virtual machine to share a physical processor core. The processor can run two independent applications at the same time. Although hyperthreading does not double the performance of a system, it can increase performance by better utilizing idle resources.

Prerequisites

- The hyperthreaded core sharing option must be enabled in your system's BIOS settings. For more information, see the *Resource Management* documentation.
- Power off the virtual machine.

Procedure

- In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- Click the **Resources** tab and select **Advanced CPU**.
- Select a mode from the **Hyperthreading Sharing Mode** drop-down menu.

| Option | Description |
|----------------------|--|
| Any (default) | The virtual CPUs of this virtual machine can share cores with other virtual CPUs of this or other virtual machines. |
| None | The virtual CPUs of this virtual machine have exclusive use of a processor core whenever they are scheduled to it. The other hyperthread of the core is halted while this virtual machine is using the core. |
| Internal | On a virtual machine with exactly two virtual processors, the two virtual processors are allowed to share one physical core (at the discretion of the host scheduler), but this virtual machine never shares a core with any other virtual machine. If this virtual machine has any other number of processors other than two, this setting is the same as the None setting. |

- Click **OK** to save your changes.

Configure Processor Scheduling Affinity in the vSphere Client

The **Scheduling Affinity** option gives you detailed control over how virtual machine CPUs are distributed across the host's physical cores (and hyperthreads if hyperthreading is enabled). This panel does not appear for virtual machines in a DRS cluster or when the host has only one processor core and no hyperthreading.

Using CPU affinity, you can assign a virtual machine to a specific processor. This assignment allows you to restrict the assignment of virtual machines to a specific available processor in multiprocessor systems.

For potential issues with CPU affinity, see the *Resource Management* documentation.

Prerequisites

Power off the virtual machine.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Resources** tab and select **Advanced CPU**.
- 3 In the Scheduling Affinity panel, enter a comma-separated list of hyphenated processor ranges.
For example, "0,4-7" would indicate affinity with CPUs 0,4,5,6, and 7. Selecting all processors is identical to selecting no affinity. You must provide at least as many processor affinities as you have virtual CPUs.
- 4 Click **OK** to save your changes.

Change CPU Identification Mask Settings in the vSphere Client

CPU identification (CPU ID) masks control the CPU features visible to the virtual machine's guest operating system. Masking or hiding CPU features can make a virtual machine widely available to ESXi hosts for migration. 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 disallow migration with vMotion.

For example, masking the AMD No eXecute (NX) and the Intel eXecute Disable (XD) bits prevents the virtual machine from using these features, but provides compatibility that allows you to migrate virtual machines to ESXi hosts that do not include this capability. When the NX/XD bit is visible to the guest operating system, the virtual machine can use this feature, but you can migrate the virtual machine only to hosts on which the feature is enabled.

NOTE You rarely need to change the CPU identification mask configuration settings. Almost all changes are made only to the NX/XD bit.

See the *vCenter Server and Host Management* documentation for detailed information about vMotion compatibility and CPU masks.

Prerequisites

- Verify that you have access to the virtual machine in the vSphere Client inventory list.
- Power off the virtual machine.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and under Advanced, select **CPUID Mask**.

- 3 In the **CPU Identification Mask** panel, select an NX flag option.

| Option | Description |
|--|--|
| Hide the NX/XD flag from guest | Increases vMotion compatibility. Hiding the NX/XD flag increases vMotion compatibility between hosts, but might disable certain CPU security features. |
| Expose the NX/XD flag to guest | Keeps all CPU security features enabled. |
| Keep current Advanced setting values for the NX/XD flag | Uses the NX/XD flag settings specified in the CPU Identification Mask dialog box. Enabled only when current settings specify something other than what is specified in the other NX/XD flag options, for example, if the NX/XD flag bit setting varies with processor brand. |

- 4 (Optional) To edit mask values other than the NX bit or to set NX mask values to states other than “0” or “H”, click **Advanced**.
 - a Select the relevant tab.
 - b Click a row and edit the mask value.
To view an explanation of a values symbol, click **Legend**.
 - c Click **OK** to apply the changes and return to the Virtual Machine Properties dialog box.
- 5 Click **OK** to save your changes.

Change CPU/MMU Virtualization Settings in the vSphere Client

ESXi can determine whether a virtual machine should use hardware support for virtualization. It makes this determination based on the processor type and the virtual machine. Overriding the automatic selection can provide better performance for some use cases.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and under **Advanced**, select **CPU/MMU Virtualization**.
- 3 Select an instruction set.
 - **Automatic**
 - **Use only software virtualization**
 - **Use hardware support for CPU virtualization (VT/AMD-V) only**
 - **Use hardware support for both CPU and MMU virtualization (VT/AMD-V and EPT/RVI)**
- 4 Click **OK** to save your changes.

Virtual Memory Configuration

You can add, change, or configure virtual machine memory resources or options to enhance virtual machine performance. You can set most of the memory parameters during virtual machine creation or after the guest operating system is installed. Some actions require that you power off the virtual machine before changing the settings.

The memory resource settings for a virtual machine determine how much of the host's memory is allocated to the virtual machine. The virtual hardware memory size determines how much memory is available to applications that run in the virtual machine. A virtual machine cannot benefit from more memory resources than its configured virtual hardware memory size. ESXi hosts limit the memory resource use to the maximum amount useful for the virtual machine, so that you can accept the default of Unlimited memory resources.

Change the Memory Configuration in the vSphere Client

You can reconfigure the memory allocated to a virtual machine's hardware.

Minimum memory size is 4MB for virtual machines that use BIOS firmware. Virtual machines that use EFI firmware require at least 96MB of RAM or they cannot power on.

Maximum memory size for a virtual machine depends on the host's physical memory and the virtual machine's hardware version.

If the virtual machine memory is greater than the host memory size, swapping occurs, which can have a severe effect on virtual machine performance. The memory size must be a multiple of 4MB. The maximum for best performance represents the threshold above which the host's physical memory is insufficient to run the virtual machine at full speed. This value fluctuates as conditions on the host change, for example, as virtual machines are powered on or off.

Table 9-2. Maximum Virtual Machine Memory

| Introduced in Host Version | Virtual Machine Version | Maximum Memory Size |
|----------------------------|-------------------------|---------------------|
| ESXi 5.0 | 8 | 1011GB |
| ESX/ESXi 4.x | 7 | 255GB |
| ESX/ESXi 3.x | 4 | 65,532MB |

The ESXi host version indicates when support began for the increased memory size. For example, the memory size of a version 4 virtual machine running on ESXi 5.0 is restricted to 65,532MB.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select **Memory**.
- 3 Adjust the amount of memory allocated to the virtual machine.
- 4 Click **OK** to save your changes.

Allocate Memory Resources in the vSphere Client

You can change the amount of memory resources allocated to a virtual machine by using the shares, reservations, and limits settings.

A virtual machine has three user-defined settings that affect its memory resource allocation.

| | |
|--------------------|--|
| Limit | Places a limit on the consumption of memory for a virtual machine. This value is expressed in megabytes. |
| Reservation | Specifies the guaranteed minimum allocation for a virtual machine. The reservation is expressed in megabytes. |
| Shares | Each virtual machine is granted a number of memory shares. The more shares a virtual machine has, the more often it gets a time slice of a memory when no memory idle time is present. Shares represent a relative metric for allocating memory capacity. For more information about share values, see the <i>vSphere Resource Management</i> documentation. |

Assigning a virtual machine a reservation larger than its configured memory is wasteful. The vSphere Client does not allow you to make such an assignment on the **Resources** tab. If you give a virtual machine a large reservation and then reduce its configured memory size on the **Hardware** tab, the reservation is reduced to match the new configured memory size. You must power off the virtual machine before configuring memory resources.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Resources** tab and select **Memory**.
- 3 Allocated the memory capacity for this virtual machine.

| Option | Description |
|--------------------|--|
| Shares | The values Low , Normal , High , and Custom are compared to the sum of all shares of all virtual machines on the server. You can use share allocation symbolic values to configure their conversion into numeric values. |
| Reservation | Guaranteed memory allocation for this virtual machine. |
| Limit | Upper limit for this virtual machine's memory allocation. |
| Unlimited | No upper limit is specified. |

- 4 Click **OK** to save your changes.

Change Memory Hot-Add Settings in the vSphere Client

Memory hot add lets you add memory resources for a virtual machine while the machine is powered on.

Prerequisites

- The virtual machine has a guest operating system that supports Memory hot add functionality.
- The virtual machine is using hardware version 7 or later.
- VMware Tools is installed.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and under Advanced, select **Memory/CPU Hotplug**.
- 3 Enable or disable memory hot add.
 - **Enable memory hot add for this virtual machine.**
 - **Disable memory hot add for this virtual machine.**
- 4 Click **OK** to save your changes.

Associate Memory Allocations with a NUMA Node in the vSphere Client

You can specify that all future memory allocations on a virtual machine use pages associated with a single NUMA node (also known as manual memory affinity). When the virtual machine uses local memory, the performance improves on that virtual machine.

The following conditions apply to memory optimization with NUMA:

- The NUMA option is available on the Advanced Memory Resources page only if the host uses NUMA memory architecture.

- Affinity settings are meaningful only when used to modify the performance of a specific set of virtual machines on one host. This option is not available when the virtual machine resides on a DRS cluster. All affinity values are cleared when you move the virtual machine to a new host.
- You can specify nodes to use for future memory allocations only if you have also specified CPU affinity. If you make manual changes only to the memory affinity settings, automatic NUMA rebalancing does not work properly.
- Checking all the boxes is the same as applying no affinity.

For information about NUMA and advanced memory resources, including usage examples, see the *Resource Management* documentation.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Select the **Resources** tab, and select **Memory**.
- 3 In the **NUMA Memory Affinity** panel, set the NUMA node affinity for the virtual machine.
 - **No affinity**
 - **Use memory from nodes**
- 4 Click **OK** to save your changes.

Change the Swap File Location in the vSphere Client

When a virtual machine is powered on, the system creates a VMkernel swap file to serve as a backing store for the virtual machine's RAM contents. You can accept the default swap file location or save the file to a different location. By default, the swap file is stored in the same location as the virtual machine's configuration file.

For more information about host swap file settings, see the *vCenter Server and Host Management* documentation. For more information about cluster settings, see the *Resource Management* documentation.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Option** tab and under Advanced, select **Swapfile Location**.
- 3 Select an option.

| Option | Description |
|---|--|
| Default | Stores the virtual machine swap file at the default location defined by the host or cluster swap file settings. |
| Always store with the virtual machine | Stores the virtual machine swap file in the same folder as the virtual machine configuration file. |
| Store in the host's swapfile datastore | Stores the virtual machine swap file in the swap file datastore defined by the host or cluster swap file settings. |

- 4 Click **OK** to save your changes.

Network Virtual Machine Configuration

ESXi networking features provide communication between virtual machines on the same host, between virtual machines on different hosts, and between other virtual and physical machines. The networking features also allow management of ESXi hosts and provide communication between VMkernel services (NFS, iSCSI, or vSphere vMotion) and the physical network. When you configure networking for a virtual machine, you select or change an adapter type, a network connection, and whether to connect the network when the virtual machine powers on.

Network Adapter Types

When you configure a virtual machine, you can add network adapters (NICs) and specify the adapter type.

The type of network adapters that are available depend on the following factors:

- The virtual machine version, which depends on what host created it or most recently updated it.
- Whether the virtual machine has been updated to the latest version for the current host.
- The guest operating system.

The following NIC types are supported:

| | |
|----------------------------|--|
| E1000 | Emulated version of the Intel 82545EM Gigabit Ethernet NIC, with drivers available in most newer guest operating systems, including Windows XP and later and Linux versions 2.4.19 and later. |
| Flexible | Identifies itself as a Vlan adapter when a virtual machine boots, but initializes itself and functions as either a Vlan or a VMXNET adapter, depending on which driver initializes it. With VMware Tools installed, the VMXNET driver changes the Vlan adapter to the higher performance VMXNET adapter. |
| Vlan | Emulated version of the AMD 79C970 PCnet32 LANCE NIC, an older 10 Mbps NIC with drivers available in most 32bit guest operating systems except Windows Vista and later. A virtual machine configured with this network adapter can use its network immediately. |
| VMXNET | Optimized for performance in a virtual machine and has no physical counterpart. Because operating system vendors do not provide built-in drivers for this card, you must install VMware Tools to have a driver for the VMXNET network adapter available. |
| VMXNET 2 (Enhanced) | Based on the VMXNET adapter but provides high-performance features commonly used on modern networks, such as jumbo frames and hardware offloads. VMXNET 2 (Enhanced) is available only for some guest operating systems on ESX/ESXi 3.5 and later. |
| VMXNET 3 | Next generation of a paravirtualized NIC designed for performance. VMXNET 3 offers all the features available in VMXNET 2 and adds several new features, such as multiqueue support (also known as Receive Side Scaling in Windows), IPv6 offloads, and MSI/MSI-X interrupt delivery. VMXNET 3 is not related to VMXNET or VMXNET 2. |

For network adapter compatibility considerations, see the *VMware Compatibility Guide*.

Network Adapters and Legacy Virtual Machines

Legacy virtual machines are virtual machines that are supported by the product in use, but are not current for that product. The default network adapter types for all legacy virtual machines depend on the adapters available and compatible to the guest operating system and the version of virtual hardware on which the virtual machine was created.

If you do not upgrade a virtual machine to correspond with an upgrade to a newer version of an ESXi host, your adapter settings remain unchanged. If you upgrade your virtual machine to take advantage of newer virtual hardware, your default adapter settings will likely change to be compatible with the guest operating system and upgraded host hardware.

To verify the network adapters that are available to your supported guest operating system for a particular version of vSphere ESXi, see the VMware Compatibility Guide.

Change the Virtual Network Adapter (NIC) Configuration in the vSphere Client

You can change the power-on connection setting, the MAC address, and the network connection for the virtual network adapter configuration for a virtual machine.

Prerequisites

Required Privileges:

- **Virtual machine.Configuration.Modify device settings** for editing the MAC address and network.
- **Virtual machine.Interaction.Device connection** for changing **Connect** and **Connect at power on**.
- **Network.Assign network**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select the appropriate NIC in the Hardware list.
- 3 (Optional) To connect the virtual NIC when the virtual machine is powered on, select **Connect at power on**.
- 4 (Optional) Click the blue information icon under DirectPath I/O to view details regarding the virtual NIC's DirectPath I/O status and capability.
- 5 Select an option for MAC address configuration.

| Option | Description |
|------------------|--|
| Automatic | vSphere assigns a MAC address automatically. |
| Manual | Type the MAC address to use. |

- 6 Configure the **Network Connection** for the virtual NIC.

| Option | Description |
|--------------------------|---|
| Standard settings | The virtual NIC connects to a standard or distributed port group. Select the port group for the virtual NIC to connect to from the Network label drop-down menu. |
| Advanced settings | The virtual NIC connects to a specific port on a vSphere distributed switch. This option appears only when a vSphere distributed switch is available. <ol style="list-style-type: none"> a Click Switch to advanced settings. b Select a vSphere distributed switch for the virtual NIC to use from the VDS drop-down menu. c Type the Port ID of the distributed port for virtual NIC to connect to. |

- 7 Click **OK** to save your changes.

Add a Network Adapter to a Virtual Machine in the vSphere Client

When you add a Network adapter (NIC) to a virtual machine, you select the adapter type, the network connection, and whether the device should connect when the virtual machine is powered on.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and click **Add**.
- 3 Select **Ethernet Adapter**, and click **Next**.
- 4 Select an adapter type from the drop-down menu.
- 5 In the Network connection panel, select either a named network with a specified label or a legacy network.
- 6 To connect the virtual NIC when the virtual machine is powered on, select **Connect at power on**.
- 7 Click **Next**.
- 8 Review your selections and click **Finish**.
- 9 Click **OK** to save your changes.

Parallel and Serial Port Configuration

Parallel and serial ports are interfaces for connecting peripherals to the virtual machine. The virtual serial port can connect to a physical serial port or to a file on the host computer. You can also use it to establish a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. You can add parallel and serial ports and change the serial port configuration.

Using Serial Ports with vSphere Virtual Machines

You can set up virtual serial ports connections for vSphere virtual machines in several ways. The connection method that you select depends on the task that you need to accomplish.

You can set up virtual serial ports to send data in the following ways.

| | |
|---|---|
| Physical serial port on the host | Sets the virtual machine to use a physical serial port on the host computer. This method lets you use an external modem or a hand-held device in a virtual machine. |
| Output to file | Sends output from the virtual serial port to a file on the host computer. This method lets you capture the data that a program running in the virtual machine sends to the virtual serial port. |
| Connect to a named pipe | Sets a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. With this method, two virtual machines or a virtual machine and a process on the host can communicate as if they were physical machines connected by a serial cable. For example, use this option for remote debugging on a virtual machine. |
| Connect over the network | Enables a serial connection to and from a virtual machine's serial port over the network. The Virtual Serial Port Concentrator (vSPC) aggregates traffic from multiple serial ports onto one management console. vSPC behavior is similar to physical serial port concentrators. Using a vSPC also allows network |

connections to a virtual machine's serial ports to migrate seamlessly when you use vMotion to migrate the virtual machine. For requirements and steps to configure the Avocent ACS v6000 virtual serial port concentrator, see <http://kb.vmware.com/kb/1022303>.

Server and Client Connections for Named Pipe and Network Serial Ports

You can select a client or server connection for serial ports. Your selection determines whether the system waits for a connection or initiates it. Typically, to control a virtual machine over a serial port, you select a server connection. This selection lets you control the connections, which is useful if you connect to the virtual machine only occasionally. To use a serial port for logging, select a client connection. This selection lets the virtual machine connect to the logging server when the virtual machine starts and to disconnect when it stops.

Physical Serial Port Conditions

When you use a physical serial port for serial port passthrough from an ESXi host to a virtual machine, the following conditions apply.

| Supported | Not Supported |
|---|---|
| Serial ports that are integrated into the motherboard | Migration with vMotion |
| | Serial ports present on add-on expansion cards might be supported by PCI DirectPath I/O. See “Add a PCI Device in the vSphere Web Client,” on page 150 or “Add a PCI Device in the vSphere Client,” on page 212. |
| | Serial ports connected through USB are not supported for serial port passthrough. They might be supported by USB passthrough from an ESXi host to a virtual machine. See “USB Configuration from an ESXi Host to a Virtual Machine,” on page 152. |

Adding a Firewall Rule Set for Serial Port Network Connections

If you add or configure a serial port that is backed by a remote network connection, ESXi firewall settings can prevent transmissions.

Before you connect network-backed virtual serial ports, you must add one of the following firewall rule sets to prevent the firewall from blocking communication:

- **VM serial port connected to vSPC.** Use to connect the serial port output through a network with the **Use virtual serial port concentrator** option enabled to allow only outgoing communication from the host.
- **VM serial port connected over network.** Use to connect the serial port output through a network without the virtual serial port concentrator.

IMPORTANT Do not change the allowed IP list for either rule set. Updates to the IP list can affect other network services that might be blocked by the firewall.

For details about allowing access to an ESXi service through the firewall, see the *vSphere Security* documentation.

Change the Serial Port Configuration in the vSphere Client

A virtual machine can use up to four virtual serial ports. You can connect the virtual serial port to a physical serial port or to a file on the host computer. You can also set up a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer by using a host-side-named pipe. In addition, you can use a port or vSPC URI to connect a serial port over the network.

Virtual machines can be in a powered-on state during configuration.

Prerequisites

- Check that you know the correct media types for the port to access, vSPC connections, and any conditions that might apply. See [“Using Serial Ports with vSphere Virtual Machines,”](#) on page 125.
- To connect a serial port over a network, add a Firewall rule set. See [“Adding a Firewall Rule Set for Serial Port Network Connections,”](#) on page 126.
- Required privilege: **Virtual machine.Configuration.Device connection**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select a serial port in the Hardware list.
- 3 (Optional) Change the **Device status** settings.

| Option | Description |
|----------------------------|--|
| Connected | Connects or disconnects the device while the virtual machine is running. |
| Connect at power on | Connects the device whenever you power on the virtual machine. You can change this setting when the virtual machine is either powered on or powered off. |

- 4 Select a connection type.

| Option | Action |
|---------------------------------|---|
| Use physical serial port | Select this option to have the virtual machine use a physical serial port on the host computer. Select the serial port from the drop-down menu. |
| Use output file | Select this option to send output from the virtual serial port to a file on the host computer. Browse to select an output file to connect the serial port to. |
| Use named pipe | Select this option to set a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. <ol style="list-style-type: none"> a Type a name for the pipe in the Pipe Name field. b Select the Near end and Far end of the pipe from the drop-down menus. |
| Connect over the network | Select Use network to connect through a remote network. <ol style="list-style-type: none"> a Select the network backing. <ul style="list-style-type: none"> ■ Select Server to have the virtual machine monitor incoming connections from other hosts. ■ Select Client to have the virtual machine initiate a connection to another host. b Enter a Port URI. <p>The URI is the remote end of the serial port to which the virtual machine's serial port should connect.</p> c If vSPC is used as an intermediate step to access all virtual machines through a single IP address, select Use Virtual Serial Port Concentrator and enter the vSPC URI location. |

- 5 (Optional) Select **Yield on poll**.

Select this option only for guest operating systems that use serial ports in polled mode. This option prevents the guest from consuming excessive CPUs.
- 6 Click **OK** to save your changes.

Example: Establishing Serial Port Network Connections to a Client or Server Without Authentication Parameters

If you do not use vSPC and you configure your virtual machine with a serial port connected as a server with a `telnet://:12345` URI, you can connect to your virtual machine's serial port from your Linux or Windows operating system.

```
telnet yourESXiServerIPAddress 12345
```

Similarly, if you run the Telnet Server on your Linux system on port 23 (`telnet://yourLinuxBox:23`), you configure the virtual machine as a client URI.

```
telnet://yourLinuxBox:23
```

The virtual machine initiates the connection to your Linux system on port 23.

Add a Serial Port to a Virtual Machine in the vSphere Client

A virtual machine can use up to four virtual serial ports. You can connect the virtual serial port to a physical serial port or to a file on the host computer. You can also use a host-side-named pipe to set up a direct connection between two virtual machines or a connection between a virtual machine and an application on the host computer. In addition, you can use a port or vSPC URI to connect a serial port over the network.

Prerequisites

- Verify that the virtual machine is powered off.
- Familiarize yourself with the media types for the port to access, vSPC connections, and any conditions that might apply. See [“Using Serial Ports with vSphere Virtual Machines,”](#) on page 125.
- To connect a serial port over a network, add a Firewall rule set. See [“Adding a Firewall Rule Set for Serial Port Network Connections,”](#) on page 126.
- Required privilege: **Virtual Machine .Configuration.Add or Remove Device**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select **Add**.
- 3 Select **Serial Port** and click **Next**.
- 4 On the Serial Port Type page, select the type of media for the port to access.

| Option | Description |
|---|---|
| Use physical serial port on the host | Click Next and select the port from the drop-down menu. |
| Output to file | Click Next and browse to the location of the file on the host to store the output of the virtual serial port. |
| Connect to named pipe | <ol style="list-style-type: none"> a Click Next and type a name for the pipe in the Pipe Name field. b Select the Near end and Far end of the pipe from the drop-down menus. |
| Connect via network | <ol style="list-style-type: none"> a Click Next and click Server or Client and type the Port URI. The URI is the remote end of the serial port to which the virtual machine's serial port should connect. b If vSPC is used as an intermediate step to access all virtual machines through a single IP address, select Use Virtual Serial Port Concentrator (vSPC) and type the vSPC URI location. |

- 5 (Optional) Deselect **Connect at power on** if you do not want the parallel port device to be connected when the virtual machine powers on.

- 6 (Optional) Select **Yield on poll**.

Select this option only for guest operating systems that use serial ports in polled mode. This option prevents the guest from consuming excessive CPUs.

- 7 Review the information on the Ready to Complete page and click **Finish**.

Example: Establishing Serial Port Network Connections to a Client or Server Without Authentication Parameters

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```
telnet yourESXiServerIPAddress 12345
```

Similarly, if you run the Telnet Server on your Linux system on port 23 (`telnet://yourLinuxBox:23`), you configure the virtual machine as a client URI.

```
telnet://yourLinuxBox:23
```

The virtual machine initiates the connection to your Linux system on port 23.

Change the Parallel Port Configuration in the vSphere Client

You can change the output file and schedule the parallel port to connect or disconnect when the virtual machine powers on.

You can use a parallel port on the virtual machine to send output to a file. You cannot use a physical parallel port on ESXi hosts.

Virtual machines can be powered on during the configuration

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select the parallel port to change.
- 3 Select **Output to file** and click **Browse** to navigate to the file location.
- 4 (Optional) Deselect **Connect at power on** if you do not want the parallel port device to be connected when the virtual machine powers on.
- 5 Click **OK** to save your changes.

Add a Parallel Port to a Virtual Machine in the vSphere Client

You can use the Add Hardware wizard to add and configure a parallel port to send output to a file on the host computer.

Prerequisites

- Verify that the virtual machine is powered off.
- Required privilege: **Virtual machine.Configuration.Add or remove device**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and click **Add**.
- 3 Select **Parallel Port** and click **Next**.
- 4 Select **Output to file** and browse to the location of the file.

- 5 (Optional) Select or deselect the **Connected** check box to connect or disconnect the device.
- 6 Click **Next**.
- 7 Review the information on the Ready to Complete page, and click **Finish**.

Configure Fibre Channel NPIV Settings in the vSphere Client

N-port ID virtualization (NPIV) provides the ability to share a single physical Fibre Channel HBA port among multiple virtual ports, each with unique identifiers. This capability lets you control virtual machine access to LUNs on a per-virtual machine basis.

Each virtual port is identified by a pair of world wide names (WWNs): a world wide port name (WWPN) and a world wide node name (WWNN). These WWNs are assigned by vCenter Server.

For detailed information on how to configure NPIV for a virtual machine, see *vSphere Storage*.

NPIV support is subject to the following limitations:

- NPIV must be enabled on the SAN switch. Contact the switch vendor for information about enabling NPIV on their devices.
- NPIV is supported only for virtual machines with RDM disks. Virtual machines with regular virtual disks continue to use the WWNs of the host's physical HBAs.
- The physical HBAs on the ESXi host must have access to a LUN using its WWNs in order for any virtual machines on that host to have access to that LUN using their NPIV WWNs. Ensure that access is provided to both the host and the virtual machines.
- The physical HBAs on the ESXi host must support NPIV. If the physical HBAs do not support NPIV, the virtual machines running on that host will fall back to using the WWNs of the host's physical HBAs for LUN access.
- Each virtual machine can have up to 4 virtual ports. NPIV-enabled virtual machines are assigned exactly 4 NPIV-related WWNs, which are used to communicate with physical HBAs through virtual ports. Therefore, virtual machines can utilize up to 4 physical HBAs for NPIV purposes.

You can view or edit the virtual machines WWNs on the **Options** tab.

Prerequisites

- To edit the virtual machine's WWNs, power off the virtual machine.
- Verify that the virtual machine has a datastore containing a LUN that is available to the host.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and under **Advanced** select **Fibre Channel NPIV**.
- 3 (Optional) Select the **Temporarily Disable NPIV for this virtual machine** check box.
- 4 Assigned WWNs appear in the WWN Assignments panel.
 - To leave WWNs unchanged, select **Leave unchanged**.
 - To have vCenter Server or the ESXi host generate new WWNs, select **Generate New WWNs**.
 - To remove the current WWN assignments, select **Remove WWN assignment**.
- 5 Click **OK** to save your changes.
- 6 Provide the WWN assignments to your SAN administrator.

The administrator needs the assignments to configure virtual machine access to the LUN.

Virtual Disk Configuration

You can add virtual disks and add more space to existing disks, even when the virtual machine is running. You can set most of the virtual disk parameters during virtual machine creation or after you install the guest operating system.

You can store virtual machine data in a new virtual disk, an existing virtual disk, or a mapped SAN LUN. A virtual disk, which appears as a single hard disk to the guest operating system, is composed of one or more files on the host file system. You can copy or move virtual disks on the same hosts or between hosts.

For virtual machines running on an ESXi host, you can store the virtual machine data directly on a SAN LUN instead of storing it in a virtual disk file. This ability is useful if you are running applications in your virtual machines that must detect the physical characteristics of the storage device. Additionally, mapping a SAN LUN allows you to use existing SAN commands to manage storage for the disk.

When you map a LUN to a VMFS volume, vCenter Server creates a raw device mapping (RDM) file that points to the raw LUN. Encapsulating disk information in a file allows vCenter Server to lock the LUN so that only one virtual machine can write to it. This file has a `.vmdk` extension, but the file contains only disk information that describes the mapping to the LUN on the ESXi system. The actual data is stored on the LUN. You cannot deploy a virtual machine from a template and store its data on a LUN. You can store only its data in a virtual disk file.

About Virtual Disk Provisioning Policies

When you perform certain virtual machine management operations, such as creating a virtual disk, cloning a virtual machine to a template, or migrating a virtual machine, you can specify a provisioning policy for the virtual disk file.

NFS datastores with Hardware Acceleration and VMFS datastores support the following disk provisioning policies. On NFS datastores that do not support Hardware Acceleration, only thin format is available.

You can use Storage vMotion to transform virtual disks from one format to another.

Thick Provision 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.

Using the thick provision lazy zeroed format does not zero out or eliminate the possibility of recovering deleted files or restoring old data that might be present on this allocated space. You cannot convert a thick provision lazy zeroed disk to a thin disk.

Thick Provision Eager Zeroed

A type of 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 thick provision lazy zeroed format, the data remaining on the physical device is zeroed out when the virtual disk is created. It might take much longer to create disks in this format than to create other types of disks.

Thin Provision

Use this format to save storage space. For the thin disk, you provision as much datastore space as the disk would require based on the value that you enter for the disk size. However, the thin disk starts small and at first, uses only as much datastore space as the disk needs for its initial operations.

NOTE If a virtual disk supports clustering solutions such as Fault Tolerance, do not make the disk thin.

If the thin disk needs more space later, it can grow to its maximum capacity and occupy the entire datastore space provisioned to it. You can manually convert the thin disk into a thick disk. If disk space is exhausted and the thinly provisioned disk cannot grow, the virtual machine becomes unusable.

Change the Virtual Disk Configuration in the vSphere Client

You can change the virtual device node, the size of the disk, and the persistence mode for virtual disk configuration for a virtual machine.

NOTE The Manage Paths feature for RDM disks is not available for virtual machines on legacy hosts running versions of ESX Server earlier than 3.0.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select the hard disk to modify.
The name of the disk file and the disk type (thick or thin) appear in the upper-right pane.
- 3 Select a **Virtual Device Node** type from the drop-down menu.
- 4 To change the size of the disk, enter a new value in the **Provisioned Size** text box.
- 5 (Optional) To change the way disks are affected by snapshots, click **Independent** and select an option.

| Option | Description |
|------------------------------------|--|
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 6 Click **OK** to save your changes.

Add a Hard Disk to a Virtual Machine in the vSphere Client

When you add a hard disk to a virtual machine, you can create a new virtual disk, add an existing virtual disk, or add a mapped SAN LUN.

In most cases, you can accept the default device node. For a hard disk, a nondefault device node is useful to control the boot order or to have different SCSI controller types. For example, you might want to boot from an LSI Logic controller and use a Buslogic controller with bus sharing turned on to share a data disk with another virtual machine.

NOTE You cannot use migration with vMotion to migrate virtual machines that use raw disks for clustering purposes.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and click **Add**.
- 3 Select **Hard Disk** and click **Next**.

- 4 Select the type of disk to use.

| Option | Action |
|-------------------------------------|---|
| Create a new virtual disk | <ul style="list-style-type: none"> a Type the disk capacity. b Select a disk format. <ul style="list-style-type: none"> ■ Thick Provision Lazy Zeroed creates a virtual disk in a default thick format. ■ Thick Provision Eager Zeroed creates a type of thick virtual disk that supports clustering features such as Fault Tolerance. ■ Thin Provision creates a disk in thin format. Use this format to save storage space. c Select a location to store the disk. Store with the virtual machine or Specify a datastore. d If you selected Specify a datastore, browse for the datastore location, and click Next. |
| Use an Existing Virtual Disk | Browse for the disk file path and click Next . |
| Raw Device Mappings | Gives your virtual machine direct access to SAN. <ul style="list-style-type: none"> a Select the LUN to use for the raw disk, and click Next. b Select the datastore and click Next. c Select the compatibility mode. <ul style="list-style-type: none"> ■ Physical allows the guest operating system to access the hardware directly. ■ Virtual allows the virtual machine to use VMware snapshots and other advanced functions. d Click Next. |

- 5 Accept the default or select a different virtual device node.

In most cases, you can accept the default device node. For a hard disk, a nondefault device node is useful to control the boot order or to have different SCSI controller types. For example, you might want to boot from an LSI Logic controller and share a data disk with another virtual machine using a BusLogic controller with bus sharing turned on.

- 6 (Optional) To change the way disks are affected by snapshots, click **Independent** and select an option.

| Option | Description |
|------------------------------------|--|
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 7 Click **Next**.
- 8 Review the information and click **Finish**.
- 9 Click **OK** to save your changes.

Use Disk Shares to Prioritize Virtual Machines in the vSphere Client

You can change the disk resources for a virtual machine. If multiple virtual machines access the same VMFS datastore and the same logical unit number (LUN), use disk shares to prioritize the disk accesses from the virtual machines. Disk shares distinguish high-priority from low-priority virtual machines.

You can allocate the host disk's I/O bandwidth to the virtual hard disks of a virtual machine. Disk I/O is a host-centric resource so you cannot pool it across a cluster.

Shares is a value that represents the relative metric for controlling disk bandwidth to all virtual machines. The values are compared to the sum of all shares of all virtual machines on the server.

Disk shares are relevant only within a given ESXi host. The shares assigned to virtual machines on one host have no effect on virtual machines on other hosts.

You can select an IOP limit, which sets an upper bound for storage resources that are allocated to a virtual machine. IOPs are the number of I/O operations per second.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Resources** tab and select **Disk**.
- 3 In the Resource Allocation panel, select the virtual hard disk to change.
- 4 Click the **Shares** column and change the value to allocate a number of shares of its disk bandwidth to the virtual machine.
 - Low (500)
 - Normal (1000)
 - High (2000)
 - Custom

When you select a shares symbolic value, the numeric value appears in the **Shares Value** column. You can select **Custom** to enter a user-defined shares value.
- 5 Click the **Limit - IOPS** column and enter the upper limit of storage resources to allocate to the virtual machine.
- 6 Click **OK** to save your changes.

Converting Virtual Disks from Thin to Thick

You can determine whether your virtual disk is in the thin provision format and, if required, convert it to the thick provision format.

For more information on thin provisioning and available disk formats, see the *vSphere Storage* documentation.

Determine the Disk Format of a Virtual Machine in the vSphere Client

You can determine whether your virtual disk is in thick or thin format.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select the appropriate hard disk in the Hardware list.

The Disk Provisioning section on the right shows the type of your virtual disk.
- 3 Click **OK**.

What to do next

If your virtual disk is in the thin format, you can inflate it to its full size.

Convert a Virtual Disk from Thin to Thick

If you created a virtual disk in the thin provision format, you can convert it to the thick provision format.

The thin provisioned disk starts small and at first, uses just as much storage space as it needs for its initial operations. After having been converted, the virtual disk grows to its full capacity and occupies the entire datastore space provisioned to it during the disk's creation.

Procedure

- 1 Select the virtual machine in the inventory.
- 2 Click the **Summary** tab and, under **Resources**, double-click the datastore for the virtual machine to open the Datastore Browser dialog box.
- 3 Click the virtual machine folder to find the virtual disk file you want to convert. The file has the `.vmdk` extension.
- 4 Right-click the virtual disk file and select **Inflate**.

The virtual disk in the thick provision format occupies the entire datastore space originally provisioned to it.

Understanding Virtual Machine Storage Profiles

Virtual machine storage profiles list the storage capabilities that virtual machine home files and virtual disks require to run the applications within the virtual machine.

You can create a list of virtual machine storage profiles to define different levels of storage requirements.

The virtual machine home files (`.vmx`, `.vmsd`, `.nvram`, `.log`, and so on) and the virtual disks (`.vmdk`) can have separate virtual machine storage profiles as shown in the following table.

Table 9-3. Example Virtual Machine Storage Profiles for a Virtual Machine

| Example Virtual Machine Files | Example for a VM Storage Profile | Example for a Datastore Compliant with the VM Storage Profile |
|---|----------------------------------|---|
| <code>windows_2008r2_test.vmx</code> | Storage Profile 2 | datastore02 |
| <code>windows_2008r2_test.vmx</code> | | |
| <code>windows_2008r2_test.log</code> | | |
| <code>windows_2008r2_test.nvram</code> | | |
| <code>windows_2008r2_test.vmem</code> | | |
| <code>windows_2008r2_test.vmsd</code> | Storage Profile 3 | datastore05 |
| <code>windows_2008r2_test.vmdk</code> | | |
| <code>windows_2008r2_test_1.vmdk</code> | Storage Profile 5 | datastore10 |

When you create, clone, or migrate a virtual machine, you can select to associate it with a virtual machine storage profile. When you select a virtual machine storage profile, the client shows you the datastores that are compatible with the capabilities of the profile. You can then select a datastore or a datastore cluster.

If you select a datastore that does not match the virtual machine storage profile, the client shows that the virtual machine is using non-compliant storage.

Apply Virtual Machine Storage Profile in the vSphere Client

You can associate a virtual machine storage profile with a virtual machine to define the storage capabilities that are required by the applications running on the virtual machine.

You can associate a virtual machine storage profile with a powered-off and powered-on virtual machine.

Procedure

- 1 Open the **Profiles** tab of a virtual machine.

| Option | Description |
|---|--|
| Edit the settings of a virtual machine | <ol style="list-style-type: none"> a Right-click a virtual machine from the inventory and select Edit Settings. b In the Virtual Machine Properties window, select the Profiles tab. |
| Use the virtual machine context menu | Right-click a virtual machine from the inventory and select VM Storage Profile > Manage Profiles . |

- 2 Associate the virtual machine home files with a virtual machine storage profile from the **Home VM Storage Profile** drop-down menu.

NOTE The virtual machine home files include the file types `.vmx`, `.vmsd`, `.nvram`, and so on.

- 3 (Optional) Click **Propagate to disks** to associate all virtual disks with the same virtual machine storage profile.
- 4 Under VM storage profiles for virtual disks, associate each virtual disk with a different virtual machine storage profile from the **VM Storage Profile** drop-down menu.
- 5 Click **OK**.

The virtual machine storage profile name appears in the VM Storage Profiles pane of the **Summary** tab for the virtual machine.

NOTE If you add a new virtual disk and associate it with a virtual machine storage profile at the same time, the VMware vSphere Profile-Driven Storage Service might take some time to associate the virtual machine storage profile with the new virtual disk.

SCSI Controller Configuration

To access virtual disks and SCSI devices, a virtual machine uses virtual SCSI controllers. These virtual controllers appear to a virtual machine as different types of controllers, including BusLogic Parallel, LSI Logic Parallel, LSI Logic SAS, and VMware Paravirtual SCSI. You can add a SCSI controller, change the SCSI controller type, and select bus sharing for a virtual machine.

Each virtual machine can have a maximum of four SCSI controllers. The default SCSI controller is numbered as 0. When you create a virtual machine, the default hard disk is assigned to the default SCSI controller 0 at bus node (0:0).

When you add SCSI controllers, they are numbered sequentially 1, 2, and 3. If you add a hard disk or SCSI device to a virtual machine after virtual machine creation, it is assigned to the first available virtual device node on the default SCSI Controller, for example (0:1).

If you add a SCSI controller, you can reassign an existing or new hard disk, or a SCSI device, to that controller. For example, you can assign the device to (1:z), where 1 is SCSI Controller 1 and z is a virtual device node from 0 to 15.

By default, the SCSI controller is assigned to virtual device node (z:7), so that device node is unavailable for hard disks or SCSI devices.

Add SCSI Controllers

You can add SCSI controllers to an existing virtual machine by adding hard disks on unused SCSI Bus numbers.

Adding a new hard disk on an unused SCSI bus number automatically creates a new SCSI controller.

Prerequisites

Sufficient privileges to edit the virtual machine.

Procedure

- 1 Right-click on a virtual machine and select **Edit Settings**.
- 2 Select the **Hardware** tab.
- 3 Click **Add**.
- 4 Select **Hard Disk** and click **Next**.
- 5 Proceed through the wizard, selecting options that suit your needs.
- 6 In the **Advanced Options** page > **Virtual Device Node** section, select an unused SCSI Bus number.
For example, bus and device numbers 0:0 - 0:15 are used by the initial SCSI controller. The second SCSI controller uses bus and device numbers 1:0 - 1:15.
- 7 On the **Ready to Complete** page, click **Finish**.

The new hard disk and new SCSI controller are simultaneously created.

Change the SCSI Bus Sharing Configuration in the vSphere Client

You can set the type of SCSI bus sharing for a virtual machine and indicate whether the SCSI bus is shared. Depending on the type of sharing, virtual machines can access the same virtual disk simultaneously on the same server or on any server.

You can change the SCSI controller configuration for a virtual machine on an ESXi host only.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select a SCSI Controller in the hardware list.
- 3 Select the type of sharing in the **SCSI Bus Sharing** list.

| Option | Description |
|-----------------|---|
| None | Virtual disks cannot be shared by other virtual machines. |
| Virtual | Virtual disks can be shared by virtual machines on the same server. |
| Physical | Virtual disks can be shared by virtual machines on any server. |

- 4 Click **OK** to save your changes.

Change the SCSI Controller Type in the vSphere Client

You configure virtual SCSI controllers on your virtual machines to attach virtual disks and RDMs to.

The choice of SCSI controller does not affect whether your virtual disk is an IDE or SCSI disk. The IDE adapter is always ATAPI. The default for your guest operating system is already selected. Older guest operating systems default to the BusLogic adapter.

If you create an LSI Logic virtual machine and add a virtual disk that uses BusLogic adapters, the virtual machine boots from the BusLogic adapters disk. LSI Logic SAS is available only for virtual machines with hardware version 7 or later. Disks with snapshots might not experience performance gains when used on LSI Logic SAS, VMware Paravirtual, and LSI Logic Parallel adapters.



CAUTION Changing the SCSI controller type might result in a virtual machine boot failure.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab, select a SCSI controller, and click **Change Type**.
- 3 Select a SCSI controller type and click **OK**.
- 4 Click **OK** to save your changes.

About VMware Paravirtual SCSI Controllers

VMware Paravirtual SCSI controllers are high performance storage controllers that can result in greater throughput and lower CPU use. These controllers are best suited for high performance storage environments.

VMware Paravirtual SCSI controllers are available for virtual machines with ESXi 4.x and later compatibility. Disks on such controllers might not experience optimal performance gains if they have snapshots or if memory on the ESXi host is over committed. This behavior does not mitigate the overall performance gain of using VMware Paravirtual SCSI controllers as compared to other SCSI controller options.

If you have virtual machines with VMware Paravirtual SCSI controllers, those virtual machines cannot be part of an MSCS cluster.

For platform support for VMware Paravirtual SCSI controllers, see the *VMware Compatibility Guide*.

Add a Paravirtual SCSI Controller

You can add a VMware Paravirtual SCSI (PVSCSI) high performance storage controller to provide greater throughput and lower CPU utilization.

PVSCSI controllers are best suited for environments, especially SAN environments, running I/O-intensive applications.

Prerequisites

- Verify that the virtual machine has a guest operating system with VMware Tools installed.
- Verify that the virtual machine has hardware version 7 or later.
- Ensure that you are familiar with PVSCSI limitations. See [“About VMware Paravirtual SCSI Controllers,”](#) on page 143.
- To access boot disk devices attached to a PVSCSI controller, verify that the virtual machine has a Windows 2003 or Windows 2008 guest operating system.

- In some operating systems, before you change the controller type you need to create a virtual machine with an LSI Logic controller, install VMware Tools, then change to paravirtual mode.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and click **Add**.
- 3 Select **SCSI Device** and click **Next**.
- 4 Select a SCSI device in the Connection panel.
- 5 Select an unused Virtual Device Node and click **Next**.

For device node SCSI (0:2), 0 is the controller number and 2 is the number of the device that is attached to the controller. If you select a node on which devices already exist (for example, SCSI 0:3) you will add a SCSI device to the existing controller. To add a new controller, you must select an unused device node on an unused SCSI controller (for example 1:0).

- 6 Review your selections and click **Finish**.
New SCSI Controller (adding) and **New SCSI Device (adding)** appear in the Hardware list.
- 7 Click **OK** to save your changes and exit the dialog box.
- 8 Reopen the Virtual Machine Properties Editor.
- 9 Select the new SCSI controller and click **Change Type**.
- 10 Select **VMware Paravirtual** and click **OK**.
- 11 Click **OK** to save your changes.

Other Virtual Machine Device Configuration

In addition to configuring virtual machine CPU and Memory and adding a hard disk and virtual NICs, you can also add and configure virtual hardware, such as DVD/CD-ROM drives, floppy drives, and SCSI devices. Not all devices are available to add and configure. For example, you cannot add a video card, but you can configure available video cards and PCI devices.

Change the CD/DVD Drive Configuration

You can configure DVD or CD devices to connect to client devices, host devices, or Datastore ISO files.

Configure a Client Device Type for the DVD/CD-ROM Drive in the vSphere Client

You can connect the DVD/CD-ROM device to a physical DVD or CD-ROM device on the system running the vSphere Client.

Procedure

- 1 Select the virtual machine in the vSphere Client inventory.
- 2 Click the **CD/DVD Connections** icon on the virtual machine toolbar.
- 3 Select a drive or ISO image from the **CD/DVD drive** drop-down menu.

Passthrough IDE (raw) mode access is set by default, which lets you write or burn a remote CD.

Configure a Host Device Type for the DVD/CD-ROM Drive in the vSphere Client

You can connect the DVD/CD-ROM device to a physical DVD or CD-ROM device that resides on the host.

You cannot use vMotion to migrate virtual machines that have CD drives that are backed by the physical CD drive on the host. You must disconnect these devices before you migrate the virtual machine.

When you add a CD/DVD-ROM drive that is backed by a USB CD/DVD drive on the host, you must add the drive as a SCSI device. Hot adding or removing SCSI devices from an ESXi host is not supported.

Prerequisites

Ensure that the host is powered off before you add USB CD/DVD-ROM devices.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select the DVD/CD-ROM drive.
- 3 Select or deselect the **Connected** check box to connect or disconnect the device.
- 4 If you do not want the CD-ROM drive connected when the virtual machine starts, deselect **Connect at power on**.
- 5 Select **Host Device** under **Device Type** and select a device from the drop-down menu.
- 6 (Optional) In the drop-down menu under **Virtual Device Node**, select the node the drive uses in the virtual machine.
- 7 Click **OK** to save your changes.

Configure a Datastore ISO File for the DVD/CD-ROM Drive in the vSphere Client

You can connect the DVD/CD-ROM device to an ISO file that is stored on a datastore accessible to the host.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select the DVD/CD-ROM drive.
- 3 Select or deselect the **Connected** check box to connect or disconnect the device.
- 4 If you do not want the CD-ROM drive connected when the virtual machine starts, deselect **Connect at power on**.
- 5 Select **Datastore ISO File** under **Device Type** and click **Browse** to navigate to the file.
- 6 In the drop-down menu under **Virtual Device Node**, select the node the drive uses in the virtual machine.
- 7 Click **OK** to save your changes.

Add a DVD or CD-ROM Drive to a Virtual Machine in the vSphere Client

You can use a physical drive on a client or host or you can use an ISO image to add a DVD/CD-ROM drive to a virtual machine.

If you are adding a CD/DVD-ROM drive that is backed by USB CD/DVD drive on the host, you must add the drive as a SCSI device. Hot adding or removing SCSI devices from an ESXi host is not supported.

You cannot use vMotion to migrate virtual machines that have CD drives that are backed by the physical CD drive on the host. You must disconnect these devices before you migrate the virtual machine.

Prerequisites

Ensure that the host is powered off before you add USB DVD/CD-ROM devices.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Select the **Hardware** tab and click **Add**.

- 3 Select **DVD/CD-ROM Drive**, and click **Next**.
- 4 Select one option.

| Option | Description |
|---------------------------|--|
| Use physical drive | <ol style="list-style-type: none"> a Select Client or Host as the location. b Select the drive you want to use from the drop-down menu. c Select a Pass through (recommended) or ATAPI emulation connection type. |
| Use ISO Image | Enter the path and filename for the image file, or click Browse to navigate to the file. |

- 5 If you do not want the CD-ROM drive connected when the virtual machine starts, deselect **Connect at power on**.
- 6 Click **Next**.
- 7 Select the virtual device node the drive uses in the virtual machine and click **Next**.
- 8 Review the information on the **Ready to Complete** window, and click **Finish** or click **Back** to change the settings.
- 9 Click **OK** to save your changes.

Change the Floppy Drive Configuration in the vSphere Client

You can configure a virtual floppy drive device to connect to a client device or to an existing or new floppy image.

ESXi does not support floppy drives that are backed by a physical floppy drive on the host.

NOTE You cannot use vMotion to migrate virtual machines that have floppy drives backed by a physical floppy drive on ESX 3.5, 4.0, and 4.x hosts that vCenter Server 5.0 manages. You must disconnect these devices before you migrate the virtual machine.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select the Floppy drive.
- 3 Under Device Status, select **Connect at power on** to connect this virtual machine to the floppy drive when the virtual machine is powered on.
- 4 Select the device type to use for this virtual device.

| Option | Description |
|---|--|
| Client Device | Select this option to connect the floppy device to a physical floppy device or a .flp floppy image on the system running the vSphere Client. To connect the device, click the Floppy Connections button in the toolbar when you power on the virtual machine. |
| Use existing floppy image in datastore | <ol style="list-style-type: none"> a Select this option to connect the virtual device to an existing floppy image on a datastore accessible to the host. b Click Browse and select the floppy image. |
| Create new floppy image in datastore | <ol style="list-style-type: none"> a Select this option to create a floppy image on a datastore accessible to the host. b Click Browse and browse to the location for the floppy image. c Enter a name for the floppy image and click OK. |

- 5 Click **OK** to save your changes.

Add a Floppy Drive to a Virtual Machine in the vSphere Client

Use a physical floppy drive or a floppy image to add a floppy drive to a virtual machine.

ESXi does not support floppy drives that are backed by a physical floppy drive on the host.

NOTE You cannot use vMotion to migrate virtual machines that have floppy drives backed by a physical floppy drive on ESX 3.5, 4.0, and 4.x hosts that vCenter Server 5.0 manages. You must disconnect these devices before you migrate the virtual machine.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Select the **Hardware** tab and click **Add**.
- 3 Select **Floppy Drive**, and click **Next**.
- 4 Select the device type to use for this virtual device.

| Option | Description |
|------------------------------------|--|
| Use a physical floppy drive | Select this option to connect the floppy device to a physical floppy device or a .flp floppy image on the system running the vSphere Client. To connect the device, click the Floppy Connections button in the toolbar when you power on the virtual machine. |
| Use a floppy image | <ol style="list-style-type: none"> a Select this option to connect the virtual device to an existing floppy image on a datastore accessible to the host. b Click Browse and select the floppy image. |
| Create a blank floppy image | <ol style="list-style-type: none"> a Select this option to create a floppy image on a datastore accessible to the host. b Click Browse and browse to the location for the floppy image. c Enter a name for the floppy image and click OK. |

- 5 To have the floppy drive connected to the virtual machine when you power it on, select **Connect at power on**.
- 6 Click **Next**.
- 7 Review the information on the Ready to Complete page, and click **Finish**.
- 8 Click **OK** to save your changes.

Add a SCSI Device to a Virtual Machine in the vSphere Client

You can add a SCSI device to a virtual machine through the Add Hardware wizard.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select **Add**.
- 3 Select **SCSI Device** and click **Next**.
- 4 Under **Connection**, use the drop-down menu to select a physical device.
- 5 Under **Virtual Device Node**, select the virtual device node where you want this device to appear in the virtual machine.
- 6 Review the information in the Ready to Complete page, and click **Finish**.
- 7 Click **OK** to save your changes.

Change the SCSI Device Configuration in the vSphere Client

You can change the physical device and the virtual device node of the SCSI device connection.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select a SCSI device in the Hardware list.
- 3 Under **Connection**, select the physical device you want to use.
Under Virtual device node, select the virtual device node where you want this device to appear in the virtual machine.
- 4 Click **OK** to save your changes.

Add a PCI Device in the vSphere Client

vSphere DirectPath I/O allows a guest operating system on a virtual machine to directly access physical PCI and PCIe devices connected to a host. Each virtual machine can be connected to up to six PCI devices.

PCI devices connected to a host can be marked as available for passthrough from the Hardware Advanced Settings in the **Configuration** tab for the host.

Snapshots are not supported with PCI vSphere Direct Path I/O devices.

Prerequisites

- To use DirectPath I/O, verify that the host has Intel[®] Virtualization Technology for Directed I/O (VT-d) or AMD I/O Virtualization Technology (IOMMU) enabled in the BIOS.
- Verify that the PCI devices are connected to the host and marked as available for passthrough.
- Verify that the virtual machine is using hardware version 7 or later.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 On the **Hardware** tab, click **Add**.
- 3 In the Add Hardware wizard, select **PCI Device** and click **Next**.
- 4 Select the passthrough device to connect to the virtual machine from the drop-down list and click **Next**.
- 5 Click **Finish**.

Configure the Virtual Machine Communication Interface in the vSphere Client

The Virtual Machine Communication Interface (VMCI) provides a high-speed communication channel between a virtual machine and the ESXi host that it runs on. You can also enable VMCI for communication between virtual machines that run on the same host.

Prerequisites

Verify that the virtual machine is using hardware version 7 or later.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 On the **Hardware** Tab, select **Show All Devices** and click **VMCI device**.
- 3 Select the **Enable VMCI Between VMs** check box.

- 4 Click **OK** to save your changes.

Virtual machine communication is no longer restricted to the host it runs on. Other virtual machines that run on the same host can now communicate with the unrestricted virtual machine.

Configure Video Cards in the vSphere Client

You can change the number of displays for a virtual machine, allocate memory for the displays, and enable 3D support.

The default setting for total video RAM is adequate for minimal desktop resolution. For more complex situations, you can change the default memory.

Some 3D applications require a minimum video memory of 64MB. Keep this in mind when you assign video memory.

Prerequisites

Verify that the virtual machine is powered off.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select **Video card**.
- 3 Select the display settings type and configure the available settings.

| Option | Description |
|-----------------------------------|--|
| Auto-detect video settings | Applies common video settings to the guest operating system. |
| Specify custom settings | Lets you select the number of displays and the total video memory. |

- 4 Select the number of displays from the drop-down menu.

The vSphere Client supports setting a number of displays and extending the screen across them. True multimonitor support is not available with the vSphere Client.

- 5 Enter the video memory required for the displays.
- 6 (Optional) Click **Video Memory Calculator** to calculate the required video memory based on the maximum number of displays, resolution, and color depth that the guest operating system must support and click **OK**.
- 7 (Optional) Click **Enable 3D support**.

This check box is active only for guest operating systems on which VMware supports 3D.

- 8 Click **OK** to save your changes.

Sufficient memory allocation is set for the virtual machine's video display.

Configuring vServices

A vService dependency allows a vApp or a virtual machine to request that a vService be available on a specified platform.

A vService specifies a particular service on which vApps and virtual machines can depend.

The vService configuration tab monitors and manages vService dependencies. This tab displays all the dependencies that a virtual machine or vApp has and each of their states. Each dependency shows the dependency name, description, requirement, bound status, and provider name.

Add a vService Dependency

You can add a vService dependency to a virtual machine or vApp. This dependency allows a virtual machine or vApp to request that a specific vService be available.

Procedure

- 1 Display the virtual machine or vApp in the inventory.
- 2 Power off the virtual machine or vApp.
- 3 Right-click the virtual machine or vApp and select **Edit Settings**.
- 4 Click the **vServices** tab.
- 5 Click **Add**.
- 6 In the Add Dependency wizard, select the provider for this dependency and click **Next**.
- 7 Enter the name and description for this dependency.
- 8 (Optional) If this dependency is required, select the check box and click **Next**.
Required dependencies must be bound before powering on.
- 9 (Optional) If this dependency should be bound to the provider immediately, select the **Bind to provider immediately** check box, and click **Next** after the validation is complete.
If you choose to bind this dependency now, the validation result displays. If the validation fails, you cannot complete adding the dependency. Deselect the check box to proceed.
- 10 Review the options and click **Finish** to create the dependency.

Edit a vService Dependency

You can edit a vService dependency name, description, and requirement.

Procedure

- 1 From the **vServices** tab in the Edit Settings dialog box, click **Edit**.
- 2 In the Dependency Properties dialog box, edit the dependency name and description.
- 3 Select or deselect the check box to change the required status of the dependency.
The required check box is disabled if the virtual machine or vApp is running.
- 4 Select a provider for the dependency.
When you select a provider, the description is entered containing the provider description. The validation box displays the results of the validation. If validation fails, the **OK** button is disabled until another provider or no provider is selected.
- 5 Click **OK**.

Remove a vService Dependency

You can remove a vService dependency from a virtual machine or vApp.

Procedure

- 1 From the **vServices** tab in the Edit Settings dialog box, click **Edit**.
- 2 Select the dependency and click **Remove**.

The dependency is removed from the list.

USB Configuration from an ESXi Host to a Virtual Machine

You can add multiple USB devices to a virtual machine when the physical devices are connected to an ESXi host. USB passthrough technology supports adding USB devices, such as security dongles and mass storage devices to virtual machines that reside on the host to which the devices are connected.

How USB Device Passthrough Technology Works

When you attach a USB device to a physical host, the device is available only to virtual machines that reside on that host. The device cannot connect to virtual machines that reside on another host in the datacenter.

A USB device is available to only one virtual machine at a time. When a device is connected to a powered-on virtual machine, it is not available to connect to other virtual machines that run on the host. When you remove the active connection of a USB device from a virtual machine, it becomes available to connect to other virtual machines that run on the host.

Connecting a USB passthrough device to a virtual machine that runs on the ESXi host to which the device is physically attached requires an arbitrator, a controller, and a physical USB device or device hub.

USB Arbitrator

Manages connection requests and routes USB device traffic. The arbitrator is installed and enabled by default on ESXi hosts. It scans the host for USB devices and manages device connection among virtual machines that reside on the host. It routes device traffic to the correct virtual machine instance for delivery to the guest operating system. The arbitrator monitors the USB device and prevents other virtual machines from using it until you release it from the virtual machine it is connected to.

USB Controller

The USB hardware chip that provides USB function to the USB ports that it manages. The virtual USB Controller is the software virtualization of the USB host controller function in the virtual machine.

USB controller hardware and modules that support USB 2.0 and USB 1.1 devices must exist on the host. Two virtual USB controllers are available to each virtual machine. A controller must be present before you can add USB devices to the virtual computer.

The USB arbitrator can monitor a maximum of 15 USB controllers. Devices connected to controllers numbered 16 or greater are not available to the virtual machine.

USB Devices

You can add up to 20 USB devices to a virtual machine. This is the maximum number of devices supported for simultaneous connection to one virtual machine. The maximum number of USB devices supported on a single ESXi host for simultaneous connection to one or more virtual machines is also 20. For a list of supported USB devices, see the VMware knowledge base article at <http://kb.vmware.com/kb/1021345>.

USB Autoconnect Feature

When you add a USB device connection from an ESXi host to a virtual machine, the autoconnect feature is enabled for the device connection. It is not disabled until you remove the device connection from the virtual machine.

With autoconnect enabled, the device connection re-establishes in the following cases:

- The virtual machine is cycling through power operations, such as Power Off/Power On, Reset, Pause/Resume.

- The device is unplugged from the host then plugged back in to the same USB port.
- The device is power cycled but has not changed its physical connection path.
- The device is mutating identity during usage.

The USB passthrough autoconnect feature identifies the device by using the USB path of the device on the host. It uses the physical topology and port location, rather than the device identity. This feature can seem confusing if you expect the autoconnect feature to match the connection target by device ID.

If the same device is plugged back in to the host through a different USB port, it cannot re-establish connection with the virtual machine. If you unplug the device from the host and plug in a different device to the same USB path, the new device appears and is connected to the virtual machine by the autoconnect feature that the previous device connection enabled.

Autoconnect is useful in cases where devices mutate during usage. For example, for iPhones and other such devices, the device VID:PID changes during software or firmware upgrades. The upgrade process disconnects and reconnects the devices to the USB port.

The USB port is speed-specific. The autoconnect feature assumes that devices do not transition from USB 1.1 (low-full speed) to USB 2.0 (high speed) or the reverse. You cannot interchange USB 2.0 high-speed devices with USB 1.1 devices. For example, you might connect a USB 2.0 high-speed device to a port and connect that device to the virtual machine. If you unplug the device from the host and plug a USB 1.1 device into the same port, the device does not connect to the virtual machine.

For a list of supported USB devices for passthrough from an ESXi host to a virtual machine, see the VMware knowledge base article at <http://kb.vmware.com/kb/1021345>.

vSphere Features Available with USB Passthrough

Migrations with vMotion and DRS are supported with USB device passthrough from an ESXi host to a virtual machine.

Table 9-4. vSphere Features Available for USB Passthrough from an ESXi Host to a Virtual Machine

| Feature | Supported with USB Device Passthrough |
|--|---------------------------------------|
| vSphere Distributed Power Management (DPM) | No |
| vSphere Distributed Resource Scheduler (DRS) | Yes |
| vSphere Fault Tolerance | No |
| vSphere vMotion | Yes |

For details about migration with vMotion, see “[Configuring USB Devices for vMotion](#),” on page 154.

If a host with connected USB devices resides in a DRS cluster with DPM enabled, you must disable DPM for that host. Otherwise DPM might turn off the host with the device, which disconnects the device from the virtual machine.

Configuring USB Devices for vMotion

With USB passthrough from a host to a virtual machine, you can migrate a virtual machine to another ESXi host in the same datacenter and maintain the USB passthrough device connections to the original host.

If a virtual machine has USB devices attached that pass through to an ESXi host, you can migrate that virtual machine with the devices attached.

For a successful migration, review the following conditions:

- You must configure all USB passthrough devices connected to a virtual machine for vMotion. If one or more devices is not configured for vMotion, the migration cannot proceed. For troubleshooting details, see the *vSphere Troubleshooting* documentation.

- When you migrate a virtual machine with attached USB devices away from the host to which the devices are connected, the devices remain connected to the virtual machine. However, if you suspend or power off the virtual machine, the USB devices are disconnected and cannot reconnect when the virtual machine is resumed. The device connections can be restored only if you move the virtual machine back to the host to which the devices are attached.
- If you resume a suspended virtual machine that has a Linux guest operating system, the resume process might mount the USB devices at a different location on the file system.
- If a host with attached USB devices resides in a DRS cluster with distributed power management (DPM) enabled, disable DPM for that host. Otherwise DPM might turn off the host with the attached device. This action disconnects the device from the virtual machine because the virtual machine migrated to another host.
- Remote USB devices require that the hosts be able to communicate over the management network following migration with vMotion, so 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.

Avoiding Data Loss with USB Devices

When a virtual machine connects to a physical USB device on an ESXi host, virtual machine functions can affect USB device behavior and connections.

- Before you hot add memory, CPU, or PCI devices, you must remove any USB devices. Hot adding these resources disconnects USB devices, which might result in data loss.
- Before you suspend a virtual machine, make sure that a data transfer is not in progress. During the suspend or resume process, USB devices behave as if they have been disconnected, then reconnected. For information about suspend and resume behavior after migration with vMotion, see [“Configuring USB Devices for vMotion,”](#) on page 154.
- Before you change the state of the arbitrator, make sure that USB devices residing on the host are not attached to a virtual machine. If USB devices become unavailable to a virtual machine, a host administrator might have disabled the arbitrator. When an administrator stops or disconnects the arbitrator for troubleshooting or other purposes, USB devices attached to that host become unavailable to the virtual machine. If a data transfer is taking place at this time, you might lose the data. To reestablish the arbitrator, you must reboot the host.

Connecting USB Devices to an ESXi Host

You can connect and chain multiple USB hubs and devices to an ESXi host. Careful planning and knowledge of hub behavior and limitations can help ensure that your devices work optimally.

USB physical bus topology defines how USB devices connect to the host. Support for USB device passthrough to a virtual machine is available if the physical bus topology of the device on the host does not exceed tier seven. The first tier is the USB host controller and root hub. The last tier is the target USB device. You can cascade up to five tiers of external or internal hubs between the root hub and the target USB device. An internal USB hub attached to the root hub or built into a compound device counts as one tier.

The quality of the physical cables, hubs, devices, and power conditions can affect USB device performance. To ensure the best results, keep the host USB bus topology as simple as possible for the target USB device, and use caution when you deploy new hubs and cables into the topology. The following conditions can affect USB behavior:

- Communication delay between the host and virtual machine increases as the number of cascading hubs increases.
- Connecting or chaining multiple external USB hubs increases device enumeration and response time, which can make the power support to the connected USB devices uncertain.

- Chaining hubs together also increases the chance of port and hub error, which can cause the device to lose connection to a virtual machine.
- Certain hubs can cause USB device connections to be unreliable, so use care when you add a new hub to an existing setup. Connecting certain USB devices directly to the host rather than to a hub or extension cable might resolve their connection or performance issues.

NOTE To prevent additional problems, be aware of the physical constraints of long-term deployment in a machine room environment. Small devices are easily damaged by being stepped on or knocked loose.

In some cases, you must hard reset the device and hub to restore the device to a working state.

For a list of supported USB devices for passthrough from an ESXi host to a virtual machine, see the VMware knowledge base article at <http://kb.vmware.com/kb/1021345>.

USB Compound Devices

For compound devices, the virtualization process filters out the USB hub so that it is not visible to the virtual machine. The remaining USB devices in the compound appear to the virtual machine as separate devices. You can add each device to the same virtual machine or to different virtual machines if they run on the same host.

For example, the Aladdin HASP HL Drive USB dongle package contains three devices (0529:0001 HASP dongle, 13fe:1a00 Hub, 13fe:1d00 Kingston Drive). The virtualization process filters out the USB hub. The remaining Aladdin HASP HL Drive USB dongle devices (one Aladdin HASP dongle and one Kingston Drive) appear to the virtual machine as individual devices. You must add each device separately to make it accessible to the virtual machine.

Connect USB Devices to an ESXi Host

You can connect multiple USB devices to ESXi hosts so that virtual machines that run on the hosts can access the devices. The number of devices that you can connect depends on several factors, such as how the devices and hubs chain together and the device type.

Each ESXi host has several USB ports. The number of ports on each host depends on the physical setup of the host. When you calculate the depth of hub chaining, remember that on a typical server the front ports connect to an internal hub.

The USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

The host treats USB CD/DVD-ROM devices as SCSI devices. Hot adding and removing these devices is not supported.

Prerequisites

- If a host has attached USB devices and resides in a DRS cluster with DPM enabled, disable DPM for that host. See the *vSphere Resource Management* documentation for instructions about overriding the default DPM setting for an individual host.
- Verify that you know the virtual machine requirements for USB devices. See “[Connecting USB Devices to an ESXi Host](#),” on page 155.
- Verify that the ESXi host is powered off before you add USB CD/DVD-ROM devices.

Procedure

- ◆ To add a USB device to an ESXi host, connect the device to an available port or hub.

The USB device appears in the virtual machine Add Hardware wizard device list.

What to do next

You can now add the device to the virtual machine.

Add a USB Controller to a Virtual Machine in the vSphere Client

USB controllers are available to add to virtual machines to support USB passthrough from an ESXi host or client computer to the virtual machine.

You can add two USB controllers to a virtual machine. The xHCI controller, available for Linux guest operating systems only, supports USB 3.0 superspeed, 2.0, and 1.1 devices. The EHCI+UHCI controller supports USB 2.0 and 1.1 devices.

The conditions for adding a controller vary, depending on the device version, the type of passthrough (host or client computer), and the guest operating system.

Table 9-5. USB Controller Support

| Controller type | Supported USB Device Version | Supported for Passthrough from ESXi Host to VM | Supported for Passthrough from Client Computer to VM |
|-----------------|------------------------------|--|--|
| EHCI+UHCI | 2.0 and 1.1 | Yes | Yes |
| xHCI | 3.0, 2.0, and 1.1 | Yes (USB 2.0 and 1.1 devices only) | Yes (Linux guests only) |

NOTE Drivers are not available for the xHCI controller on Windows guest operating systems.

For Mac OS X systems, the EHCI+UHCI controller is enabled by default and is required for USB mouse and keyboard access.

For virtual machines with Linux guests, you can add one or both controllers, but 3.0 superspeed devices are not supported for passthrough from an ESXi host to a virtual machine. You cannot add two controllers of the same type.

For USB passthrough from an ESXi host to a virtual machine, the USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

Prerequisites

- ESXi hosts must have USB controller hardware and modules that support USB 2.0 and 1.1 devices present.
- Client computers must have USB controller hardware and modules that support USB 3.0, 2.0, and 1.1 devices present.
- To use the xHCI controller on a Linux guest, ensure that the Linux kernel version is 2.6.35 or later.
- Verify that the virtual machine is powered on.
- Required Privilege (ESXi host passthrough): **Virtual Machine.Configuration.Add or Remove Device**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and click **Add**.
- 3 Select the type of **USB Controller** to add and click **Next**.
- 4 Review the device information and click **Next**.
- 5 Click **Finish**.

New USB Controller (adding) appears in the hardware list as **Present**.

- 6 Click **OK** to save your changes.

When you reopen the Properties Editor, the xHCI controller appears on the **Hardware** tab as USB xHCI controller. The EHCI+UHCI controller appears as **USB controller**.

What to do next

Add one or more USB devices to the virtual machine.

Add USB Devices from an ESXi Host to a Virtual Machine in the vSphere Client

You can add one or more USB passthrough devices from an ESXi host to a virtual machine if the physical device is connected to the host on which the virtual machine runs.

If a USB device is connected to another virtual machine, you cannot add it until that machine releases it.

NOTE If you have the Apple Frontpanel Controller device in your environment, you can safely add it to a virtual machine. However, this device has no documented function and no known use. ESXi hosts do not use it and do not provide Xserver functionality for USB passthrough

Prerequisites

- Verify that the virtual machine is using hardware version 7 or later.
- Verify that a USB controller is present. See [“Add a USB Controller to a Virtual Machine in the vSphere Client,”](#) on page 219.
- To use vMotion to migrate a virtual machine with multiple USB devices, you must enable all attached USB devices for vMotion. You cannot migrate individual USB devices. For vMotion limitations, see [“Configuring USB Devices for vMotion,”](#) on page 154.
- When you add a CD/DVD-ROM drive that is backed by a USB CD/DVD drive on the host, you must add the drive as a SCSI device. Hot adding and removing SCSI devices is not supported.
- Verify that you know the virtual machine requirements for USB devices. See [“USB Configuration from an ESXi Host to a Virtual Machine,”](#) on page 152.
- Required privileges: **Virtual Machine.Configuration.HostUSBDevice**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and click **Add**.
- 3 Select **USB Device** and click **Next**.
- 4 (Optional) Select **Support vMotion while device is connected**.
- 5 If you do not plan to migrate a virtual machine with USB devices attached, deselect the **Support vMotion** option.

This reduces migration complexity, which results in better performance and stability.

- 6 Select a device to add.
You can add multiple USB devices, but only one device at a time.
- 7 Click **Finish**.
New USB Device (adding) appears in the hardware list as **Present**.
- 8 Click **OK** to save your changes.

When you reopen the Properties editor, the USB device appears on the **Hardware** tab of the Properties Editor. The device type and ID appear in the right pane.

Remove USB Devices That Are Connected Through an ESXi Host

When you remove USB devices from a virtual machine, devices that use passthrough technology from a host to the virtual machine revert to the host. The devices become available to other virtual machines that run on that host.

Prerequisites

- Verify that the devices are not in use.
- To minimize the risk of data loss, follow the instructions to safely unmount or eject hardware for your operating system. Safely removing hardware allows accumulated data to be transmitted to a file. Windows operating systems typically include a Remove Hardware icon located in the System Tray. Linux operating systems use the **umount** command.

NOTE You might need to use the `sync` command instead of or in addition to the `umount` command, for example, after you issue a `dd` command on Linux or other UNIX operating systems.

Procedure

- 1 Unmount or eject the USB device from the guest operating system.
- 2 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 3 To remove the device, move your cursor over the device and click the **Remove** icon.
- 4 Click **OK** to save your changes.

Remove a USB Controller from a Virtual Machine in the vSphere Client

You can remove a USB controller from a virtual machine if you do not want to connect to USB devices.

Prerequisites

- Verify that all USB devices are disconnected from the virtual machine.
- Required Privilege: **Virtual Machine.Configuration.Add or Remove Device**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select **USB controller**.
- 3 Click **Remove**.
- 4 Click **OK** to save your changes.

The controller is no longer connected to the virtual machine, but remains available to add at a later time.

Remove USB Devices from an ESXi Host

You can remove USB devices from the host if you must shut down the host for maintenance or if you do not want those devices to be available to virtual machines that run on the host. When you detach a USB device from the host, the device disconnects from the virtual machine.



CAUTION If data transfer is taking place when you remove USB devices from a host, you can lose data.

Prerequisites

Verify that the USB devices are not in use.

Procedure

- ◆ Follow the device manufacturers instructions to safely remove the device.

When you remove the device from the host, it is no longer available to the virtual machines that run on the host.

USB Configuration from a Client Computer to a Virtual Machine in the vSphere Client

You can add multiple USB devices to a virtual machine when the physical devices connect to a client computer on which the vSphere Client is running. The vSphere Client must be logged in to an instance of vCenter Server that manages the ESXi host where the virtual machines reside. USB passthrough technology supports adding multiple USB devices, such as security dongles, mass storage devices, and smartcard readers to virtual machines.

How USB Device Passthrough Technology Works

The USB controller is the USB hardware chip that provides USB function to the USB ports that it manages. USB controller hardware and modules that support USB 3.0, 2.0, and USB 1.1 devices must exist in the virtual machine. Two USB controllers are available for each virtual machine. The controllers support multiple USB 3.0, 2.0, and 1.1 devices. The controller must be present before you can add USB devices to the virtual machine.

You can add up to 20 USB devices to a virtual machine. This is the maximum number of devices supported for simultaneous connection to one virtual machine.

You can add multiple devices to a virtual machine, but only one at a time. The virtual machine retains its connection to the device while in S1 standby. USB device connections are preserved when you migrate virtual machines to another host in the datacenter.

A USB device is available to only one powered-on virtual machine at a time. When a virtual machine connects to a device, that device is no longer available to other virtual machines or to the client computer. When you disconnect the device from the virtual machine or shut the virtual machine down, the device returns to the client computer and becomes available to other virtual machines that the client computer manages.

For example, when you connect a USB mass storage device to a virtual machine, it is removed from the client computer and does not appear as a drive with a removable device. When you disconnect the device from the virtual machine, it reconnects to the client computer's operating system and is listed as a removable device.

USB 3.0 Device Limitations

USB 3.0 devices have the following requirements and limitations:

- The virtual machine that you connect the USB 3.0 device to must be configured with an xHCI controller and have a Linux guest operating system with a 2.6.35 or later kernel.

- You can connect only one USB 3.0 device operating at superspeed to a virtual machine at a time.
- USB 3.0 devices are available only for passthrough from a client computer to a virtual machine. They are not available for passthrough from an ESXi host to a virtual machine.

Avoiding Data Loss

Before you connect a device to a virtual machine, make sure the device is not in use on the client computer.

If the vSphere Client disconnects from the vCenter Server or host, or if you restart or shut down the client computer, the device connection breaks. It is best to have a dedicated client computer for USB device use or to reserve USB devices connected to a client computer for short-term use, such as updating software or adding patches to virtual machines. To maintain USB device connections to a virtual machine for an extended time, use USB passthrough from an ESXi host to the virtual machine.

vSphere Features Available with USB Passthrough from a Client Computer

Migration with vMotion, DRS, and DPM are supported with USB device passthrough from a client computer to a virtual machine.

Table 9-6. Features Available for USB Passthrough from a Remote Computer to a Virtual Machine

| Feature | Supported with USB Device Passthrough |
|--|---------------------------------------|
| vSphere Distributed Power Management (DPM) | Yes |
| vSphere Distributed Resource Scheduler (DRS) | Yes |
| vSphere HA | No |
| vSphere Fault Tolerance | No |
| vSphere vMotion | Yes |

Connecting USB Devices to a Client Computer

You can connect and chain any multiple low, full, and high- or super-speed USB hubs and devices to a client computer. Careful planning and knowledge of hub behavior and limitations can help ensure that your devices work optimally.

USB physical bus topology defines how USB devices connect to the client computer. Support for USB device passthrough to a virtual machine is available if the physical bus topology of the device on the client computer does not exceed tier seven. The first tier is the USB host controller and root hub. The last tier is the target USB device. You can cascade up to five tiers of external or internal hubs between the root hub and the target USB device. An internal USB hub attached to the root hub or built into a compound device counts as one tier.

The quality of the physical cables, hubs, devices, and power conditions can affect USB device performance. To ensure the best results, keep the client computer USB bus topology as simple as possible for the target USB device, and use caution when you deploy new hubs and cables into the topology. The following conditions can affect USB behavior:

- Connecting or chaining multiple external USB hubs increases device enumeration and response time, which can make the power support to the connected USB devices uncertain.
- Chaining hubs together increases the chance of port and hub error, which can cause the device to lose connection to a virtual machine.
- Certain hubs can cause USB device connections to be unreliable, so use care when you add a new hub to an existing setup. Connecting certain USB devices directly to the client computer rather than to a hub or extension cable might resolve their connection or performance issues. In some cases, you must remove and reattach the device and hub to restore the device to a working state.

USB Compound Devices

For compound devices, the virtualization process filters out the USB hub so that it is not visible to the virtual machine. The remaining USB devices in the compound appear to the virtual machine as separate devices. You can add each device to the same virtual machine or to different virtual machines if they run on the same host.

For example, the Aladdin HASP HL Drive USB dongle package contains three devices (0529:0001 HASP dongle, 13fe:1a00 Hub, 13fe:1d00 Kingston Drive). The virtualization process filters out the USB hub. The remaining Aladdin HASP HL Drive USB dongle devices (one Aladdin HASP dongle and one Kingston Drive) appear to the virtual machine as individual devices. You must add each device separately to make it accessible to the virtual machine.

Connect USB Devices to a Client Computer

You can connect multiple USB devices to a client computer so that virtual machines can access the devices. The number of devices that you can add depends on several factors, such as how the devices and hubs chain together and the device type.

The number of ports on each client computer depends on the physical setup of the client. When you calculate the depth of hub chaining, remember that on a typical server the front ports connect to an internal hub.

The USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

Prerequisites

Verify that you know the requirements for configuring USB devices from a remote computer to a virtual machine.

Procedure

- ◆ To add a USB device to a client computer, connect the device to an available port or hub.

The USB device appears in the virtual machine toolbar menu.

What to do next

You can now add the USB device to the virtual machine.

Add a USB Controller to a Virtual Machine in the vSphere Client

USB controllers are available to add to virtual machines to support USB passthrough from an ESXi host or client computer to the virtual machine.

You can add two USB controllers to a virtual machine. The xHCI controller, available for Linux guest operating systems only, supports USB 3.0 superspeed, 2.0, and 1.1 devices. The EHCI+UHCI controller supports USB 2.0 and 1.1 devices.

The conditions for adding a controller vary, depending on the device version, the type of passthrough (host or client computer), and the guest operating system.

Table 9-7. USB Controller Support

| Controller type | Supported USB Device Version | Supported for Passthrough from ESXi Host to VM | Supported for Passthrough from Client Computer to VM |
|-----------------|------------------------------|--|--|
| EHCI+UHCI | 2.0 and 1.1 | Yes | Yes |
| xHCI | 3.0, 2.0, and 1.1 | Yes (USB 2.0 and 1.1 devices only) | Yes (Linux guests only) |

NOTE Drivers are not available for the xHCI controller on Windows guest operating systems.

For Mac OS X systems, the EHCI+UHCI controller is enabled by default and is required for USB mouse and keyboard access.

For virtual machines with Linux guests, you can add one or both controllers, but 3.0 superspeed devices are not supported for passthrough from an ESXi host to a virtual machine. You cannot add two controllers of the same type.

For USB passthrough from an ESXi host to a virtual machine, the USB arbitrator can monitor a maximum of 15 USB controllers. If your system includes controllers that exceed the 15 controller limit and you connect USB devices to them, the devices are not available to the virtual machine.

Prerequisites

- ESXi hosts must have USB controller hardware and modules that support USB 2.0 and 1.1 devices present.
- Client computers must have USB controller hardware and modules that support USB 3.0, 2.0, and 1.1 devices present.
- To use the xHCI controller on a Linux guest, ensure that the Linux kernel version is 2.6.35 or later.
- Verify that the virtual machine is powered on.
- Required Privilege (ESXi host passthrough): **Virtual Machine.Configuration.Add or Remove Device**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and click **Add**.
- 3 Select the type of **USB Controller** to add and click **Next**.
- 4 Review the device information and click **Next**.
- 5 Click **Finish**.

New USB Controller (adding) appears in the hardware list as **Present**.

- 6 Click **OK** to save your changes.

When you reopen the Properties Editor, the xHCI controller appears on the **Hardware** tab as USB xHCI controller. The EHCI+UHCI controller appears as **USB controller**.

What to do next

Add one or more USB devices to the virtual machine.

Add USB Devices From a Client Computer to a Virtual Machine in the vSphere Client

You can add one or more USB passthrough devices from a client computer to a virtual machine in the vSphere Client. The devices must be connected to a client computer that connects to the ESXi host on which the virtual machines reside.

The devices maintain their virtual machine connections in S1 standby, if the vSphere Client is running and connected. After you add the USB device to the virtual machine, an information message appears on the client computer stating that the device is disconnected. The device remains disconnected from the client computer until the virtual machine releases it.

FT is not supported with USB passthrough from a client computer to a virtual machine.

Prerequisites

- Verify that a USB controller is installed.
- Verify that the vSphere Client is connected to the ESXi host on which the virtual machines are running.
- Required Privilege: **Virtual Machine.Interaction.Add or Remove Device**

Procedure

- 1 Select the virtual machine in the vSphere Client inventory.
- 2 Click the USB icon on the virtual machine toolbar.
- 3 Select an available device from the **Connect to USB Devices** drop-down menu.

The status of the device appears as Connecting.

The device appears in the **USB Connections** drop-down menu and is ready to use. The device remains connected until you power off the virtual machine or disconnect the vSphere Client from the ESXi host.

Remove USB Devices That Are Connected Through a Client Computer in the vSphere Client

You can remove USB devices from a virtual machine if the devices are no longer needed. When you disconnect a USB device from a virtual machine, the device is released from the virtual machine and is given back to the client computer, which starts using it.

Prerequisites

To minimize the risk of data loss, follow the instructions to safely unmount or eject hardware for your operating system. Safely removing hardware allows accumulated data to be transmitted to a file. Windows operating systems typically include a "Remove Hardware" icon located in the System Tray. Linux operating systems use the **umount** command.

NOTE You might need to use the `sync` command instead of or in addition to the `umount` command, for example after you run a `dd` command on Linux or other UNIX operating systems.

Procedure

- 1 Unmount or eject the USB device from the guest operating system.
- 2 Select the virtual machine in the vSphere Client inventory.
- 3 Click **USB Connections** on the virtual machine toolbar.

- 4 Select the device to remove from the drop-down menu.

For example, select **USB Device 1 > Disconnect from***device name*.

The menu shows the device status as Disconnecting.

The device reconnects to the client computer and is available to add to another virtual machine. In some cases, Windows Explorer detects the device and opens a dialog box on the client computer. You can close this dialog box.

Remove a USB Controller from a Virtual Machine in the vSphere Client

You can remove a USB controller from a virtual machine if you do not want to connect to USB devices.

Prerequisites

- Verify that all USB devices are disconnected from the virtual machine.
- Required Privilege: **Virtual Machine.Configuration.Add or Remove Device**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Hardware** tab and select **USB controller**.
- 3 Click **Remove**.
- 4 Click **OK** to save your changes.

The controller is no longer connected to the virtual machine, but remains available to add at a later time.

Remove USB Devices from a Client Computer

You can remove USB devices from a client computer if you do not want those devices to be available to virtual machines.

When you detach a USB device from the remote client, the device disconnects from the virtual machine. Ensure that data transfer is not taking place before you remove the device.

Prerequisites

Verify that the devices are not in use.

Procedure

- ◆ To minimize the risk of data loss, follow the instructions to safely unmount or eject hardware for your operating system. Safely removing hardware allows accumulated data to be transmitted to a file. Windows operating systems typically include a Remove Hardware icon located in the System Tray. Linux operating systems use the **umount** command.

You might need to use the `sync` command instead of or in addition to the `umount` command, for example after you issue a `dd` command on Linux or other UNIX operating systems.

When you remove the device from the client computer, it is no longer available to virtual machines.

Add a Shared Smart Card Reader to Virtual Machines in the vSphere Client

You can configure multiple virtual machines to use a virtual shared smart card reader for smart card authentication. The smart card reader must be connected to a client computer on which the vSphere Client runs. All smart card readers are treated as USB devices.

A license is required for the shared smart card feature. See the *vCenter Server and Host Management* documentation.

When you log out of Windows XP guest operating systems, to log back in, you must remove the smart card from the smart card reader and re-add it. You can also disconnect the shared smart card reader and reconnect it.

If the vSphere Client disconnects from the vCenter Server or host, or if the client computer is restarted or shut down, the smart card connection breaks. For this reason, it is best to have a dedicated client computer for smart card use.

To connect a USB smart card reader that is not shared, see [“USB Configuration from a Client Computer to a Virtual Machine in the vSphere Client,”](#) on page 222.

Prerequisites

- Verify that the smart card reader is connected to the client computer.
- Verify that the virtual machine is powered on.
- Verify that a USB controller is present.

Procedure

- 1 Select the virtual machine in the vSphere Client inventory.
- 2 Click the USB icon on the virtual machine toolbar.
- 3 Select the shared smart card reader from the **Connect to USB Devices** drop-down menu.
The smart card device appears in the menu as a USB device and as a virtual shared device.
- 4 Select **Shared***the model name of your smart card reader* followed by a number.
The device status appears as Connecting, then the device connects.

You can now use smart card authentication to log in to virtual machines in the vSphere Client inventory.

Manage Power Management Settings for a Virtual Machine

You can set the power options so that a virtual machine is suspended or remains powered on when the guest operating system is placed on standby.

Power Management options are not available on every guest operating system. **Wake on LAN** supports only Windows guest operating systems and is not available on Vlance NICs, or when a Flexible NIC is operating in Vlance mode (that is, the current VMware Tools are not installed on the guest operating system).

Wake on LAN can resume virtual machines that are in an S1 sleep state only. It cannot resume suspended, hibernated, or powered off virtual machines.

The following NICs support **Wake on LAN**:

- Flexible (VMware Tools required).
- vmxnet
- Enhanced vmxnet

- vmxnet 3

Prerequisites

You must power off the virtual machine.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and select **Power Management**.
- 3 In the **Guest Power Management** panel, select a power option.
 - **Suspend the virtual machine**
 - **Put the guest operating system in standby mode and leave the virtual machine powered on**
- 4 (Optional) Select **Wake on LAN for virtual machine traffic on** and select the virtual NICs to trigger this action.

Unsupported NICs might be listed, but are unavailable to connect.
- 5 Click **OK** to save your changes.

Configure the Virtual Machine Power States

Changing virtual machine power states is useful when you do maintenance on the host. You can use the system default settings for the toolbar power controls or you can configure the controls to interact with the guest operating system. For example, you can configure the stop button on the toolbar to power off the virtual machine or shut down the guest operating system.

You can modify many virtual machine configurations while the virtual machine is running, but you might need to change the virtual machine power state for some configurations.

[Table 9-8](#) lists available power buttons and describes their behavior.

Table 9-8. Virtual Machine Power Button Settings

| Power Button | Description |
|---|---|
|  | Shuts down the guest operating system or powers off the virtual machine. A power off operation displays a confirmation dialog box indicating that the guest operating system might not shut down properly. Use this power off option only when necessary. |
|  | Suspends the virtual machine without running a script when VMware Tools is not installed. When VMware Tools is installed and available, a suspend action runs a script, and suspends the virtual machine. |
|  | Powers on a virtual machine when a virtual machine is stopped, or resumes the virtual machine and runs a script when it is suspended and VMware Tools is installed and available. Resumes the virtual machine and does not run a script when VMware Tools is not installed. |
|  | Resets the virtual machine when VMware Tools is not installed. Restarts the guest operating system when VMware Tools is installed and available. A reset operation displays a confirmation dialog box indicating that the guest operating system is not shut down properly. |

Prerequisites

- Verify that the vSphere Client is logged in to a vCenter Server.
- Verify that you have access to at least one virtual machine in the inventory.
- Verify that you have privileges to perform the intended power operation on the virtual machine.

- To set optional power functions, you must install VMWare Tools in the virtual machine.
- Power off the virtual machine before editing the VMware Tools options.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and select **VMware Tools**.
- 3 In the right panel, select the **Power Controls** for the virtual machine.
- 4 Select an option for the **Power Off** button.

| Option | Description |
|------------------------|---|
| Shut Down Guest | Uses VMware Tools to initiate an orderly system shut down of the virtual machine. This type of powering off is known as a "soft" power operation. Soft power operations are possible only if the tools are installed in the guest operating system. |
| Power Off | Immediately stops the virtual machine. This type of powering off is known as a "hard" power operation. |
| System Default | Follows system settings. The current value of the system settings is shown in parentheses. |

- 5 Select an option for the **Suspend** button.

| Option | Description |
|-----------------------|---|
| Suspend | Pauses all virtual machine activity. |
| System Default | Follows system settings. The current value of the system setting is shown in parentheses. |

- 6 Select an option for the **Reset** button.

| Option | Description |
|-----------------------|---|
| Restart Guest | Uses VMware Tools to initiate an orderly reboot. (This type of reset is known as a "soft" power operation. Soft power operations are possible only if the tools are installed in the guest operating system.) |
| Reset | Shuts down and restarts the guest operating system without powering off the virtual machine. (This type of reset is known as a "hard" power operation.) |
| System Default | Follows system settings; the current value of the system setting is shown in parentheses. |

- 7 Click **OK** to save your changes.

What to do next

Configure VMware Tools scripts to run before or after power operations.

Delay the Boot Sequence in the vSphere Client

The time between when you power on the virtual machine and when it exits the BIOS or EFI and launches the guest operating system software can be short. You can change the boot delay or force the virtual machine to enter the BIOS or EFI setup screen after power on.

Delaying the boot operation is useful for changing BIOS or EFI settings such as the boot order. For example, you can change the BIOS or EFI settings to force a virtual machine to boot from a CD-ROM.

Prerequisites

Required Privilege: **Virtual machine.Configuration.Settings**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and under Advanced select **Boot Options**.
- 3 In the **Power on Boot Delay** panel, select the time in milliseconds to delay the boot operation.
- 4 (Optional) Select whether to force entry into the BIOS or EFI setup screen the next time the virtual machine boots.
- 5 (Optional) Select whether to try to reboot after a boot failure.
- 6 Click **OK** to save your changes.

Enable Logging in the vSphere Client

You can enable logging to collect log files to help troubleshoot issues with your virtual machine.

Required privilege: **Virtual machine.Configuration.Settings**

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Edit Settings**.
- 2 Click the **Options** tab and select **AdvancedGeneral**.
- 3 In the **Settings** pane, select **Enable logging**.
- 4 Click **OK**.

Disable Acceleration in the vSphere Client

You can temporarily disable acceleration to allow a virtual machine to successfully run or install software.

In rare instances, you might find that when you install or run software in a virtual machine, the virtual machine appears to stop responding. Generally, the problem occurs early in the program's execution. Often, you can get past the problem by temporarily disabling acceleration in the virtual machine.

This setting slows down virtual machine performance, so only use it for getting past the problem with running the program. After the program stops encountering problems, deselect **Disable acceleration**. Then you might be able to run the program with acceleration.

You can enable and disable acceleration when the virtual machine is running.

Procedure

- 1 Click the **Options** tab.
- 2 Select **Advanced > General** in the **Settings** list.
- 3 To disable acceleration, select the **Disable acceleration** check box.

Configure Debugging and Statistics in the vSphere Client

You can run a virtual machine so that it collects debugging information and statistics that are helpful to VMware technical support in resolving issues.

Procedure

- 1 Click the **Options** tab and click **Advanced > General**.

- 2 To enable debugging mode, select an option from the **Debugging and Statistics** section.

| Option | Description |
|-------------------------------------|---|
| Run normally | Collects debugging information. |
| Record debugging information | Collects debugging and performance information. Use this option to aid troubleshooting when the guest operating system crashes or is not behaving properly. |

Managing Multi-Tiered Applications with vSphere vApp in the vSphere Web Client

10

You can use VMware vSphere as a platform for running applications, in addition to using it as a platform for running virtual machines. The applications can be packaged to run directly on top of VMware vSphere. The format of how the applications are packaged and managed is called vSphere vApp.

A vApp is a container, like a resource pool and can contain one or more virtual machines. A vApp also shares some functionality with virtual machines. A vApp can power on and power off, and can also be cloned.

Each vApp has a specific summary page with the current status of the service and relevant summary information, as well as operations on the service.

The distribution format for vApp is OVF.

NOTE The vApp metadata resides in the vCenter Server's database, so a vApp can be distributed across multiple ESXi hosts. This information can be lost if the vCenter Server database is cleared or if a standalone ESXi host that contains a vApp is removed from vCenter Server. You should back up vApps to an OVF package to avoid losing any metadata.

vApp metadata for virtual machines within vApps do not follow the snapshots semantics for virtual machine configuration. So, vApp properties that are deleted, modified, or defined after a snapshot is taken remain intact (deleted, modified, or defined) after the virtual machine reverts to that snapshot or any prior snapshots.

You can use VMware Studio to automate the creation of ready-to-deploy vApps with pre-populated application software and operating systems. VMware Studio adds a network agent to the guest so that vApps bootstrap with minimal effort. Configuration parameters specified for vApps appear as OVF properties in the vCenter Server deployment wizard. For information about VMware Studio and for download, see the VMware Studio developer page on the VMware web site.

This chapter includes the following topics:

- [“Create a vApp in the vSphere Web Client,”](#) on page 234
- [“Create an Object Inside a vApp in the vSphere Web Client,”](#) on page 235
- [“Add an Object to a vApp in the vSphere Web Client,”](#) on page 236
- [“Edit vApp Settings in the vSphere Web Client,”](#) on page 236
- [“Clone a vApp in the vSphere Web Client,”](#) on page 239
- [“Power on a vApp in the vSphere Web Client,”](#) on page 241
- [“Power Off a vApp in the vSphere Web Client,”](#) on page 241
- [“Suspend a vApp in the vSphere Web Client,”](#) on page 242
- [“Resume a vApp in the vSphere Web Client,”](#) on page 242
- [“Edit vApp Annotation in the vSphere Web Client,”](#) on page 242

- [“Add a Network Protocol Profile in the vSphere Web Client,”](#) on page 242
- [“vApp Options,”](#) on page 244

Create a vApp in the vSphere Web Client

After you create a datacenter and add a clustered host enabled with DRS or a standalone host to your vCenter Server system, you can create a vApp.

You can create a vApp under the following conditions.

- A standalone host is selected in the inventory that is running ESX 3.0 or greater.
- A cluster enabled with DRS is selected in the inventory.

You can create vApps on folders, standalone hosts, resource pools, clusters enabled with DRS, and within other vApps.

Select the Create a vApp Object in the vSphere Web Client

You can create vApps on folders, standalone hosts, resource pools, clusters enabled with DRS, and within other vApps.

Procedure

- 1 Navigate to a DRS-enabled cluster.
- 2 Select the Create New vApp icon ()
- 3 In the Create vApp wizard, select **Create a new vApp**.
- 4 Click **Next**.

Select vApp Name and Location in the vSphere Web Client

The name that you enter is the vApp display name that appears in the inventory.

Procedure

- 1 In the **vApp Name** text box, type a name for the vApp.
- 2 Select the datacenter or folder in which to deploy the vApp.
- 3 Click **Next**.

Allocate vApp Resources in the vSphere Web Client

You can allocate CPU and memory resources for the new vApp using shares, reservations, and limits.

Procedure

- 1 Allocate CPU resources for this vApp.

| Option | Description |
|--------------------|---|
| Shares | CPU shares for this vApp with respect to the parent’s total. Sibling vApps share resources according to their relative share values bounded by the reservation and limit. Select Low , Normal , or High , which specify share values respectively in a 1:2:4 ratio. Select Custom to give each vApp a specific number of shares, which express a proportional weight. |
| Reservation | Guaranteed CPU allocation for this vApp. |

| Option | Description |
|-------------------------|--|
| Reservation Type | Select the Expandable check box to make the reservation expandable. When the vApp is powered on, if the combined reservations of its virtual machines are larger than the reservation of the vApp, the vApp can use resources from its parent or ancestors. |
| Limit | Upper limit for this vApp's CPU allocation. Select Unlimited to specify no upper limit. |

- 2 Allocate memory resources for this vApp.

| Option | Description |
|-------------------------|--|
| Shares | Memory shares for this vApp with respect to the parent's total. Sibling vApps share resources according to their relative share values bounded by the reservation and limit. Select Low , Normal , or High , which specify share values respectively in a 1:2:4 ratio. Select Custom to give each vApp a specific number of shares, which express a proportional weight. |
| Reservation | Guaranteed memory allocation for this vApp. |
| Reservation Type | Select the Expandable check box to make the reservation expandable. When the vApp is powered on, if the combined reservations of its virtual machines are larger than the reservation of the vApp, the vApp can use resources from its parent or ancestors. |
| Limit | Upper limit for this vApp's memory allocation. Select Unlimited to specify no upper limit. |

- 3 Click **Next**.

Complete the vApp Creation in the vSphere Web Client

Before you deploy the vApp, you can review the vApp settings.

Procedure

- 1 Review the vApp settings and make any necessary changes by clicking **Back** to return to the relevant page.
- 2 Click **Finish**.

Create an Object Inside a vApp in the vSphere Web Client

Within a vApp, you can create a new virtual machine, resource pool, or another vApp.

Procedure

- 1 Navigate to the vApp in which you want to create the object machine.
- 2 Select the menu option to create a specific object.

| Menu Option | Description |
|---|--|
| Click the Create Virtual Machine () icon. | Creates a new virtual machine inside the vApp. Complete the Create New Virtual Machine wizard. |
| Click the Create Resource Pool () icon. | Adds a resource pool inside the vApp. Complete the Create Resource Pool dialog box. |
| Click the All Actions icon () and select Inventory > New vApp . | Creates a new vApp inside the currently selected vApp. Complete the New vApp wizard. |

The new object appears as part of the vApp in the inventory.

Add an Object to a vApp in the vSphere Web Client

You can add an object, such as a virtual machine or another vApp, to an existing vApp.

An existing virtual machine or another vApp that is not already contained inside the vApp can be moved into the currently selected vApp.

Procedure

- 1 Display the object in the inventory.
- 2 Click and drag the object to the target object.
If the move is not permitted, red x icon appears, and the object is not moved.
- 3 Release the mouse button.

Edit vApp Settings in the vSphere Web Client

You can edit and configure several vApp settings, including startup order, resources, and custom properties.

Procedure

- ◆ Navigate to a vApp and click **Edit vApp Settings**.
Expand the areas of the vApp configuration that you want to edit.

Configure vApp Resources in the vSphere Web Client

You can configure the CPU and memory resource allocation for the vApp.

Reservations on vApps and all their child resource pools, child vApps, and child virtual machines count against the parent resources only when they are powered on.

Prerequisites

Required privilege: **vApp resource configuration** on the vApp.

Procedure

- 1 Navigate to a vApp in the inventory and click **Edit vApp Settings**.
- 2 Allocate CPU resources for this vApp.

| Option | Description |
|-------------------------|---|
| Shares | CPU shares for this vApp with respect to the parent's total. Sibling vApps share resources according to their relative share values bounded by the reservation and limit. Select Low , Normal , or High , which specify share values respectively in a 1:2:4 ratio. Select Custom to give each vApp a specific number of shares, which express a proportional weight. |
| Reservation | Guaranteed CPU allocation for this vApp. |
| Reservation Type | Select the Expandable check box to make the reservation expandable. When the vApp is powered on, if the combined reservations of its virtual machines are larger than the reservation of the vApp, the vApp can use resources from its parent or ancestors. |
| Limit | Upper limit for this vApp's CPU allocation. Select Unlimited to specify no upper limit. |

- Allocate memory resources for this vApp.

| Option | Description |
|-------------------------|--|
| Shares | Memory shares for this vApp with respect to the parent's total. Sibling vApps share resources according to their relative share values bounded by the reservation and limit. Select Low , Normal , or High , which specify share values respectively in a 1:2:4 ratio. Select Custom to give each vApp a specific number of shares, which express a proportional weight. |
| Reservation | Guaranteed memory allocation for this vApp. |
| Reservation Type | Select the Expandable check box to make the reservation expandable. When the vApp is powered on, if the combined reservations of its virtual machines are larger than the reservation of the vApp, the vApp can use resources from its parent or ancestors. |
| Limit | Upper limit for this vApp's memory allocation. Select Unlimited to specify no upper limit. |

- Click **OK**.

Configure vApp Properties in the vSphere Web Client

You can edit any vApp property that is defined in the Application Properties Configuration.

Prerequisites

Required privilege: **vApp.vApp application configuration** on the vApp.

Procedure

- Navigate to a vApp in the inventory and click **Edit vApp Settings**.
- Click the **Application Properties** triangle to expand the vApp properties.
- Edit the vApp properties.
- Click **OK**.

Configure vApp IP Allocation Policy in the vSphere Web Client

You can edit how IP addresses are allocated for the vApp.

Prerequisites

Required privilege: **vApp.vApp instance configuration**

Procedure

- Navigate to a vApp in the inventory and click **Edit vApp Settings**.
- Click the **IP Allocation** triangle to expand the IP allocation options.
- Select an IP allocation option.

| Option | Description |
|------------------|--|
| Fixed | IP addresses are manually configured. No automatic allocation is performed. |
| Transient | IP addresses are automatically allocated using IP pools from a specified range when the vApp is powered on. The IP addresses are released when the appliance is powered off. |
| DHCP | A DHCP server is used to allocate the IP addresses. The addresses assigned by the DHCP server are visible in the OVF environments of virtual machines started in the vApp. |

- 4 Click OK.

Configure vApp Startup and Shutdown Options in the vSphere Web Client

You can change the order in which virtual machines and nested vApps within a vApp start up and shut down. You can also specify delays and actions performed at startup and shutdown.

Prerequisites

Required privilege: **vApp.vApp application configuration** on the vApp.

Procedure

- 1 Navigate to a vApp in the inventory and click **Edit vApp Settings**.
- 2 Click the **Start Order** triangle to expand the start order options.
- 3 Select a virtual machine and click the up or down arrow to move the virtual machine in the startup order.
Virtual machines and vApps in the same group will start concurrently with each other. The reverse order will be used for shutdown.
- 4 For each virtual machine, select the startup action for the virtual machine.
- 5 (Optional) Set the delay for the startup action.
 - Enter a time delay in seconds for the startup action.
 - Select **VMware Tools are ready** to perform the startup action when VMware Tools has started.
- 6 For each virtual machine, select the shutdown action for the virtual machine.
- 7 (Optional) Enter a time delay in seconds for the shutdown action.
- 8 Click OK.

Configure vApp Product Properties in the vSphere Web Client

You can configure product and vendor information for a vApp.

Prerequisites

Required privilege: **vApp.vApp application configuration** on the vApp.

Procedure

- 1 Navigate to a vApp in the inventory and click **Edit vApp Settings**.
- 2 Click the **Product** triangle to expand the product options.
- 3 Set and configure the settings that appear on the summary page of the virtual machine.

| vApp Setting | Description |
|---------------------|---|
| Product Name | Product Name. |
| Version | vApp version. |
| Full Version | Full version of the vApp. |
| Product URL | If you enter a product URL, a user can click the product name on the virtual machine summary page and go to the product's web page. |

| vApp Setting | Description |
|------------------------|---|
| Vendor URL | If you enter a vendor URL, a user can click the vendor name on the virtual machine summary page and go to the vendor's web page. |
| Application URL | If you use properties to specify the virtual machine IP address, you can enter a dynamic application URL that points to a web page exposed by running the virtual machine. If you enter a valid application URL, the state of the virtual machine changes to the Available link when the virtual machine begins running. |

If you configure the virtual machine to use the property called *webservice_ip* and the virtual machine has a web server, you can enter **http://\${webservice_ip}/** as the **Application URL**.

- 4 (Optional) Click **View** to test the **Product URL** and **Vendor URL**.
- 5 Click **OK**.

View vApp License Agreement in the vSphere Web Client

You can view the license agreement for the vApp that you are editing.

NOTE This option is available only if the vApp was imported and contains a license agreement.

Prerequisites

Required privilege: **vApp.vApp application configuration** on the vApp.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **View License Agreement** in the Options list.
- 3 Click **OK**.

View Unrecognized OVF Sections in the vSphere Web Client

View OVF sections that are not recognized by vCenter Server.

These additional OVF sections originate from the OVF deployment process that created this vApp. Most of the OVF sections that vCenter Server did not recognize during deployment are accessible here for reference.

Procedure

- 1 Navigate to a vApp in the inventory and click **Edit vApp Settings**.
- 2 Click **Unrecognized OVF Sections** in the Options list.
- 3 Click **OK**.

Clone a vApp in the vSphere Web Client

Cloning a vApp is similar to cloning a virtual machine

Prerequisites

To clone a vApp, the vSphere Web Client must be connected to the vCenter Server system.

A host must be selected in the inventory that is running ESX 3.0 or greater, or a cluster enabled with DRS.

Select the Clone a vApp Object in the vSphere Web Client

When you clone a vApp, you create a copy of an existing vApp.

Prerequisites

Procedure

- 1 Navigate to a DRS-enabled cluster and click the **Create a new vApp** icon ().
- 2 In the Create vApp wizard, select **Clone an existing vApp**.
- 3 Click **Next**.

Select the Source vApp in the vSphere Web Client

Select an existing vApp to clone.

Procedure

- 1 Expand the inventory and select an existing vApp to clone.
- 2 Click **Next**.

Select the Destination in the vSphere Web Client

A vApp must be run within a cluster, host, resource pool, or another vApp.

Procedure

- 1 Expand the inventory and select a valid host, vApp, or resource pool in which to run the vApp.
- 2 Click **Next**.

Select vApp Name and Location in the vSphere Web Client

The name that you enter is the vApp display name that appears in the inventory.

Procedure

- 1 In the **vApp Name** text box, type a name for the vApp.
- 2 Select the datacenter or folder in which to deploy the vApp.
- 3 Click **Next**.

Select Storage in the vSphere Web Client

Select the target datastore to use for the cloned vApp.

Procedure

- 1 Select virtual disk format.
- 2 Select target datastore.
- 3 Click **Next**.

Map Network for Cloned vApp in the vSphere Web Client

Select the network for the cloned vApp.

Procedure

- 1 Select the network for the cloned vApp.
- 2 Click **Next**.

Complete the vApp Creation in the vSphere Web Client

Before you deploy the vApp, you can review the vApp settings.

Procedure

- 1 Review the vApp settings and make any necessary changes by clicking **Back** to return to the relevant page.
- 2 Click **Finish**.

Power on a vApp in the vSphere Web Client

Each virtual machine within the vApp is powered on according to the startup order configuration.

When powering on a vApp within a DRS cluster in manual mode, no DRS recommendations are generated for virtual machine placements. The power-on operation performs as if DRS is run in a semiautomatic or automatic mode for the initial placements of the virtual machines. This does not affect vMotion recommendations. Recommendations for individual powering on and powering off of virtual machines are also generated for vApps that are running.

Prerequisites

Required privilege: **vApp.Power On** on the vApp.

Procedure

- 1 Navigate to the vApp you want to power on.
- 2 Click the **Power On** icon (.

If a delay is set in the startup settings, the vApp waits for the set length of time before powering up that virtual machine.

In the **Summary** tab, the **Status** portlet indicates when the vApp has started and is available.

Power Off a vApp in the vSphere Web Client

Each virtual machine within the vApp is powered off in reverse order to how they are configured for startup.

Prerequisites

Required privilege: **vApp.Power Off** on the vApp.

Procedure

- 1 Navigate to the vApp you want to power off.
- 2 Click the **Power Off** icon (.

If a delay is set in the shutdown settings, the vApp waits for the set length of time before powering down that virtual machine.

Suspend a vApp in the vSphere Web Client

A suspended vApp pauses all its running virtual machines until you resume the vApp.

The virtual machines within a vApp are suspended based on their stop order. All virtual machines are suspended regardless of stop action.

Prerequisites

Required privilege: **vApp.Suspend** on the vApp.

Procedure

- 1 Navigate to the vApp you want to suspend.
- 2 Click the **Suspend** icon ().

Resume a vApp in the vSphere Web Client

You can continue the activity of the virtual machines within a vApp that is in a suspended state.

The suspended virtual machines within the vApp are resumed in reverse order to the order in which they were suspended.

Procedure

- 1 Navigate to the vApp you want to resume.
- 2 Click the **Power On** icon (.

Edit vApp Annotation in the vSphere Web Client

You can add or edit notes for a particular vApp.

Procedure

- 1 Select the vApp in the inventory.
- 2 Select **All Actions > Edit Notes**.
- 3 Type your comments in the Edit Notes window.
- 4 Click **OK**.

Your comments appear in the Summary tab for the vApp.

Add a Network Protocol Profile in the vSphere Web Client

Network protocol profiles provide a network identity to vApps. A network protocol profile is a network configuration that is assigned to a network used by a vApp. The vApp can then leverage vCenter Server to automatically provide an IP configuration to its virtual machines.

Procedure

- 1 Navigate to a datacenter and click the **Manage** tab.
- 2 Click the Add icon () to add a new network protocol profile.

Select Name and Network in the vSphere Web Client

Name the network protocol profile and select the network that should use it.

Procedure

- 1 Type the name of the network protocol profile.
- 2 Select the networks that use this network protocol profile.
A network can be associated with one network protocol profile at a time.
- 3 Click **Next**.

Configure IPv4 in the vSphere Web Client

Set up the IPv4 configuration for the network protocol profile.

Network protocol profile ranges are configured with IPv4 and IPv6. vCenter Server uses these ranges to dynamically allocate IP addresses to virtual machines when a vApp is set up to use transient IP allocation.

Procedure

- 1 Enter the **IP Subnet** and **Gateway** in their respective fields.
- 2 Select **DHCP Present** to indicate that the DHCP server is available on this network.
- 3 Enter the DNS server information.
Specify the servers by IP addresses separated by a comma, semicolon, or space.
- 4 Select the **Enable IP Pool** check box to specify an IP pool range.
- 5 If you enable IP Pools, enter a comma-separated list of host address ranges in the **IP pool range** field.
A range consists of an IP address, a pound sign (#), and a number indicating the length of the range.
The gateway and the ranges must be within the subnet, but must exclude the gateway address.
For example, **10.20.60.4#10**, **10.20.61.0#2** indicates that the IPv4 addresses can range from 10.20.60.4 to 10.20.60.13 and 10.20.61.0 to 10.20.61.1.
- 6 Click **Next**.

Configure IPv6 in the vSphere Web Client

Set up the IPv6 configuration for the network protocol profile.

Network protocol profile ranges are configured with IPv4 and IPv6. vCenter Server uses these ranges to dynamically allocate IP addresses to virtual machines when a vApp is set up to use transient IP allocation.

Procedure

- 1 Enter the **IP Subnet** and **Gateway** in their respective fields.
- 2 Select **DHCP Present** to indicate that the DHCP server is available on this network.
- 3 Enter the DNS server information.
Specify the servers by IP addresses separated by a comma, semicolon, or space.
- 4 Select the **Enable IP Pool** check box to specify an IP pool range.

- 5 If you enable IP Pools, enter a comma-separated list of host address ranges in the **IP pool range** field.
A range consists of an IP address, a pound sign (#), and a number indicating the length of the range.
The gateway and the ranges must be within the subnet, but must exclude the gateway address.
For example, **10.20.60.4#10**, **10.20.61.0#2** indicates that the IPv4 addresses can range from 10.20.60.4 to 10.20.60.13 and 10.20.61.0 to 10.20.61.1.
- 6 Click **Next**.

Specify Network Configuration Settings in the vSphere Web Client

Enter the remaining network configuration settings for the network protocol profile.

Procedure

- 1 Enter the DNS domain.
- 2 Enter the host prefix.
- 3 Enter the DNS search path.
The search paths are specified as a list of DNS domains separated by commas, semi-colons, or spaces.
- 4 Enter the server name and port number for the proxy server.
The server name can optionally include a colon and a port number.
For example, `web-proxy:3912` is a valid proxy server.
- 5 Click **Next**.

Complete the Network Protocol Profile Creation in the vSphere Web Client

Procedure

- ◆ Review the settings and click **Finish** to complete adding the network protocol profile.

vApp Options

When vApp options are enabled for a virtual machine, you can configure OVF properties, use the OVF environment, and specify IP allocation and product information for the virtual machine.

Change the vApp options on the **vApp Options** tab of the Virtual Machine Properties Editor.

Enable vApp Options in the vSphere Web Client

You can enable the vApp functionality for a virtual machine. This allows options specific for vApp to be set and configured for the virtual machine.

Enabling these options allow the virtual machine to receive an OVF Environment XML descriptor at boot time. The OVF environment can contain values for custom properties including network configuration and IP addresses.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the vApp Options tab.
- 3 Select **Enable vApp options** to activate vApps functionality and to show the vApps options.

- 4 Click **OK**.

Access Custom vApp Properties in the vSphere Web Client

You can access vApp properties through the Virtual Machine Properties dialog box.

A vApp might have a number of user configurable properties that control how the vApp behaves at runtime. For each user configurable property, you can enter a value, which will be part of the OVF environment available to the vApp once it is started.

Prerequisites

Ensure that vApp options are enabled for the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the vApp Options tab.
The user configurable vApp properties, if any, are displayed.
- 3 Edit properties to your satisfaction and click **OK**.

Edit IP Allocation Policy in the vSphere Web Client

You can edit the IP allocation policy through the Virtual Machine Properties dialog box.

Prerequisites

vApp options must be enabled in order to access these options.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the vApp Options tab.
The user configurable vApp properties, if any, are displayed.
- 3 Select **IP allocation scheme**.
- 4 Select a network configuration scheme.

The IP allocation schemes determine the IP allocation policy options that are enabled.

| Option | Description |
|------------------------|---|
| OVF environment | Determined by the OVF environment. |
| DHCP | The IP addresses are allocated using DHCP when the virtual machine is powered on. |

- 5 Choose the IP protocol that this vApp supports: IPv4, IPv6, or both.
- 6 Click **OK**.

View Unrecognized OVF Sections in the vSphere Web Client

View additional OVF sections which are not recognized by vCenter Server.

These additional OVF sections originate from the OVF deployment process that created this vApp. Most of the OVF descriptors are distributed in various vApp settings, but these unrecognized sections are visible here for reference.

Prerequisites

vApp options must be enabled in order to access these options.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the vApp Options tab.
The user configurable vApp properties, if any, are displayed.
- 3 Click **Unrecognized OVF sections**.
- 4 Click **OK** when finished.

Edit vApp Product Information

Advanced options, such as product and vendor information, custom properties, and IP allocation can be edited from this page.

Prerequisites

vApp options must be enabled in order to access these options.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the vApp Options tab.
The user configurable vApp properties, if any, are displayed.
- 3 Click **Properties** and edit the product information. Examples of product properties are:
 - **Product Name**—the product name.
 - **Version**—the version of the vApp.
 - **Full version**—the full version of the vApp.
 - **Product URL**—the product's URL. If a product URL is entered, a user can click the product name on the virtual machine summary page and go to the product's Web page.
 - **Vendor URL**—the vendor's URL. If a vendor URL is entered, a user can click the vendor name on the virtual machine summary page and go to the vendor's Web page.

- **Application URL**—the application URL. If properties are used for specifying the virtual machine IP address, a dynamic application URL can be entered that points to a Web page exposed by running the virtual machine. If you enter a valid application URL, the state of the virtual machine changes to a clickable **Available** link once the virtual machine is running.

If the virtual machine is configured to use the property called *webservers_ip* and the virtual machine has a Web server, you can enter `http://${webservers_ip}/` as the **Application URL**.

- 4 Click **OK** when complete.

Create Custom Properties in the vSphere Web Client

You can create custom properties that are part of the virtual machine's OVF environment.

After you create a custom property, it is available in the **vApp Options > Properties** screen.

Prerequisites

vApp options must be enabled in order to access these options.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the vApp Options tab.

The user configurable vApp properties, if any, are displayed.
- 3 Click **Properties**.
- 4 Click **New**.
- 5 Enter values for each field.
- 6 Specify whether you want the property to be user-configurable.
- 7 Click **OK**.

Edit OVF Settings in the vSphere Web Client

You can edit and configure settings that affect the OVF environment in the Virtual Machine Properties dialog box.

The following settings can be configured:

- **OVF Environment**—Click **View** to display the OVF environment settings. The settings are not available when the virtual machine is powered off.
- **OVF Transport ISO Image**—Select this option to transport the OVF environment to the virtual machine using a custom made ISO image mounted in the CD-ROM drive.
- **OVF Transport VMware Tools**—Select this option to transport the OVF environment to the virtual machine using *guestInfo* in VMware Tools.
- **Installation Reboot**—Select **Enable** if the virtual machine needs to reboot after import to complete the installation.

If this option is enabled, you can select the amount of time to wait until the virtual machine powers off.

Prerequisites

vApp options must be enabled in order to access these options.

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Click the vApp Options tab.

The user configurable vApp properties, if any, are displayed.
- 3 Select **OVF Settings**.
- 4 Specify the settings to your satisfaction and click **OK**.

Managing Multi-Tiered Applications with vSphere vApp in the vSphere Client

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You can use VMware vSphere as a platform for running applications, in addition to using it as a platform for running virtual machines. The applications can be packaged to run directly on top of VMware vSphere. The format of how the applications are packaged and managed is called vSphere vApp.

A vApp is a container, like a resource pool and can contain one or more virtual machines. A vApp also shares some functionality with virtual machines. A vApp can power on and power off, and can also be cloned.

In the vSphere Client, a vApp is represented in both the Host and Clusters view and the VM and Template view. Each view has a specific summary page with the current status of the service and relevant summary information, as well as operations on the service.

The distribution format for vApp is OVF.

NOTE The vApp metadata resides in the vCenter Server's database, so a vApp can be distributed across multiple ESXi hosts. This information can be lost if the vCenter Server database is cleared or if a standalone ESXi host that contains a vApp is removed from vCenter Server. You should back up vApps to an OVF package to avoid losing any metadata.

vApp metadata for virtual machines within vApps do not follow the snapshots semantics for virtual machine configuration. So, vApp properties that are deleted, modified, or defined after a snapshot is taken remain intact (deleted, modified, or defined) after the virtual machine reverts to that snapshot or any prior snapshots.

You can use VMware Studio to automate the creation of ready-to-deploy vApps with pre-populated application software and operating systems. VMware Studio adds a network agent to the guest so that vApps bootstrap with minimal effort. Configuration parameters specified for vApps appear as OVF properties in the vCenter Server deployment wizard. For information about VMware Studio and for download, see the VMware Studio developer page on the VMware web site.

This chapter includes the following topics:

- [“Create a vApp in the vSphere Client,”](#) on page 250
- [“Populate the vApp,”](#) on page 251
- [“Edit vApp Settings in the vSphere Client,”](#) on page 252
- [“Configuring IP Pools,”](#) on page 256
- [“Clone a vApp,”](#) on page 258
- [“Power On a vApp in the vSphere Client,”](#) on page 259
- [“Power Off a vApp in the vSphere Client,”](#) on page 259
- [“Suspend a vApp in the vSphere Client,”](#) on page 259
- [“Resume a vApp in the vSphere Client,”](#) on page 259

- [“Edit vApp Annotation in the vSphere Client,”](#) on page 260

Create a vApp in the vSphere Client

After you create a datacenter and add a clustered host enabled with DRS or a standalone host to your vCenter Server system, you can create a vApp.

You can create a vApp under the following conditions.

- A standalone host is selected in the inventory that is running ESX 3.0 or greater.
- A cluster enabled with DRS is selected in the inventory.

You can create vApps on folders, standalone hosts, resource pools, clusters enabled with DRS, and within other vApps.

Start the New vApp Wizard

The New vApp wizard allows you to create a vApp.

Procedure

- ◆ Select **File > New > vApp** to open the New vApp wizard.

Name the vApp

The name that you enter is the vApp display name that appears in the inventory.

The vApp name can be up to 80 characters long. This name must be unique within the folder.

Procedure

- 1 On the Name and Folder page, enter a name for the vApp.
- 2 Select a folder location in the inventory for the vApp.

If you are creating a vApp from within another vApp, the vApp Inventory Location selection is unavailable.

- 3 Click **Next**.

Select the vApp Destination

The destination is the standalone host, cluster, resource pool, or another vApp on which the vApp will run.

NOTE This step, selecting a vApp destination, does not appear if you create a vApp from a standalone host, cluster, resource pool, or another vApp within the inventory.

Procedure

- 1 On the Destination page, select a standalone host, cluster, or resource pool where this vApp will run and click **Next**.

If you selected a cluster enabled with DRS and the cluster is in DRS manual mode, select the host as the destination for the vApp.

The message in the Compatibility panel indicates whether the validation for this destination succeeded or whether a specific requirement was not met.

- 2 Click **Next**.

Allocate vApp Resources

Determine how CPU and memory should be allocated for the vApp.

Procedure

- 1 In the Resource Allocation page, allocate CPU and memory resources for this vApp.
- 2 Click **Next**.

Complete the vApp Creation

The Ready to Complete page lets you review the vApp configuration.

Procedure

- 1 Review the new vApp settings on the Ready to Complete page.
- 2 (Optional) Click **Back** to edit or change any settings.
- 3 Click **Finish** to create the vApp.

Populate the vApp

Virtual machines and other vApps can be added to and removed from a vApp.

After you create a vApp, you can populate it with virtual machines or other vApps.

Create an Object Inside the vApp in the vSphere Client

Within a vApp, you can create a new virtual machine, resource pool, or another vApp.

Procedure

- 1 In the inventory, select the vApp in which you want to create the object machine.
- 2 Select the menu option to create a specific object.

| Menu Option | Description |
|---|---|
| Inventory > vApp > New Virtual Machine | Creates a new virtual machine inside the vApp. Complete the Create New Virtual Machine wizard. See “Creating a Virtual Machine in the vSphere Client,” on page 59 for instructions on creating a new virtual machine. |
| Inventory > vApp > New Resource Pool | Adds a resource pool inside the vApp. Complete the Create Resource Pool window. |
| Inventory > vApp > New vApp | Creates a new vApp inside the currently selected vApp. Complete the New vApp wizard. See “Create a vApp in the vSphere Client,” on page 250 for instructions on creating a new vApp. |

The new object appears as part of the vApp in the inventory.

Add an Object to a vApp in the vSphere Client

You can add an object, such as a virtual machine or another vApp, to an existing vApp.

An existing virtual machine or another vApp that is not already contained inside the vApp can be moved into the currently selected vApp.

Procedure

- 1 Display the object in the inventory.

- 2 Click and drag the object to the target object.
 - If the move is permitted, a box appears around the target-object, indicating it is selected.
 - If the move is not permitted, a naught sign (zero with a slash) appears, and the object is not moved.
- 3 Release the mouse button.

Either the object moves to the new location or an error message indicates what needs to be done to permit the move.

Edit vApp Settings in the vSphere Client

You can edit and configure several vApp settings, including startup order, resources, and custom properties.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click the **Options** tab to edit or view vApp properties.

NOTE The deployer typically edits the IP allocation policy and properties. The vApp author typically edits the other, more advanced settings.

- 3 Click the **Start Order** tab to edit vApp startup and shutdown options.
- 4 Click **OK**.

Edit vApp Startup and Shutdown Options

You can change the order in which virtual machines and nested vApps within a vApp start up and shut down. You can also specify delays and actions performed at startup and shutdown.

Required privilege: **vApp.vApp application configuration**

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 In the **Start Order** tab of the Edit vApp Settings window, select a virtual machine and use the arrow keys to change the startup order.

Virtual Machines and vApps with the same start order (or within the same grouping) will start concurrently with each other.

The reverse order will be used for shutdown.
- 3 Select the startup and shutdown action for each virtual machine.
- 4 (Optional) Use the arrow keys to change the time delay for startup and shutdown for each virtual machine.
- 5 Click **OK**.

Edit vApp Resources

You can edit the CPU and memory resource allocation for the vApp.

Required privilege: **vApp.vApp application configuration**

Reservations on vApps and all their child resource pools, child vApps, and child virtual machines count against the parent resources only when they are powered on.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.

- 2 Click **Resources** in the Options list.
- 3 Edit the CPU and memory resource allocation.
- 4 Click **OK**.

Edit vApp Properties

You can edit any vApp property that is defined in Advanced Property Configuration.

Required privilege: **vApp.vApp application configuration**

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **Properties** in the **Options** list.
- 3 Edit the vApp properties.
- 4 Click **OK**.

View vApp License Agreement

You can view the license agreement for the vApp that you are editing.

NOTE This option is available only if the vApp was imported and contains a license agreement.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **View License Agreement** in the Options list.
- 3 Click **OK**.

Edit IP Allocation Policy

You can edit how IP addresses are allocated for the vApp.

Prerequisites

- For automatic (transient) IP allocation to work, you must use the vSphere Client and configure an IP pool. See [“Configuring IP Pools,”](#) on page 256.

Required privilege: **vApp.vApp instance configuration**.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **IP Allocation Policy** in the Options list.
- 3 Select an IP allocation option.

| Option | Description |
|------------------|--|
| Fixed | IP addresses are manually configured. No automatic allocation is performed. |
| Transient | IP addresses are automatically allocated using IP pools from a specified range when the vApp is powered on. The IP addresses are released when the appliance is powered off. |
| DHCP | A DHCP server is used to allocate the IP addresses. The addresses assigned by the DHCP server are visible in the OVF environments of virtual machines started in the vApp. |

- 4 Click **OK**.

View Additional OVF Sections

View OVF sections that are not recognized by vCenter Server.

These additional OVF sections originate from the OVF deployment process that created this vApp. Most of the OVF sections that vCenter Server did not recognize during deployment are accessible here for reference.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **View Additional OVF Sections** in the Options list.
- 3 Click **OK**.

Add a vService Dependency

You can add a vService dependency to a virtual machine or vApp. This dependency allows a virtual machine or vApp to request that a specific vService be available.

Procedure

- 1 Display the virtual machine or vApp in the inventory.
- 2 Power off the virtual machine or vApp.
- 3 Right-click the virtual machine or vApp and select **Edit Settings**.
- 4 Click the **vServices** tab.
- 5 Click **Add**.
- 6 In the Add Dependency wizard, select the provider for this dependency and click **Next**.
- 7 Enter the name and description for this dependency.
- 8 (Optional) If this dependency is required, select the check box and click **Next**.
Required dependencies must be bound before powering on.
- 9 (Optional) If this dependency should be bound to the provider immediately, select the **Bind to provider immediately** check box, and click **Next** after the validation is complete.
If you choose to bind this dependency now, the validation result displays. If the validation fails, you cannot complete adding the dependency. Deselect the check box to proceed.
- 10 Review the options and click **Finish** to create the dependency.

Edit a vService Dependency

You can edit a vService dependency name, description, and requirement.

Procedure

- 1 From the **vServices** tab in the Edit Settings dialog box, click **Edit**.
- 2 In the Dependency Properties dialog box, edit the dependency name and description.
- 3 Select or deselect the check box to change the required status of the dependency.
The required check box is disabled if the virtual machine or vApp is running.

- 4 Select a provider for the dependency.

When you select a provider, the description is entered containing the provider description. The validation box displays the results of the validation. If validation fails, the **OK** button is disabled until another provider or no provider is selected.

- 5 Click **OK**.

Remove a vService Dependency

You can remove a vService dependency from a virtual machine or vApp.

Procedure

- 1 From the **vServices** tab in the Edit Settings dialog box, click **Edit**.
- 2 Select the dependency and click **Remove**.

The dependency is removed from the list.

Configure Advanced vApp Properties

You can edit and configure advanced settings, such as product and vendor information, custom properties, and IP allocation.

Required privilege: **vApp.vApp application configuration**

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **Advanced** in the Options list.
- 3 Set and configure the settings that appear on the summary page of the virtual machine.

| vApp Setting | Description |
|------------------------|---|
| Product Name | Product Name. |
| Version | vApp version. |
| Full Version | Full version of the vApp. |
| Product URL | If you enter a product URL, a user can click the product name on the virtual machine summary page and go to the product's web page. |
| Vendor URL | If you enter a vendor URL, a user can click the vendor name on the virtual machine summary page and go to the vendor's web page. |
| Application URL | If you use properties to specify the virtual machine IP address, you can enter a dynamic application URL that points to a web page exposed by running the virtual machine. If you enter a valid application URL, the state of the virtual machine changes to the Available link when the virtual machine begins running. |

If you configure the virtual machine to use the property called *webservers_ip* and the virtual machine has a web server, you can enter **http://\${webservers_ip}/** as the **Application URL**.

- 4 (Optional) Click **View** to test the **Product URL** and **Vendor URL**.
- 5 Click **Properties** to edit the custom vApp properties.
- 6 Click **IP Allocation** to edit the supported IP allocation schemes of this vApp.
- 7 Click **OK**.

Define OVF Environment Properties

You can view or modify the OVF environment properties for the vApp.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **Advanced** in the Options list.
- 3 Click **Properties**.
- 4 In Advanced Property Configuration, you can perform the following actions.
 - Click **New** to add a new custom property.
 - Select the property and click **Edit** to edit a property.
 - Click **Delete** to delete a property.
- 5 Click **OK**.

Edit Advanced IP Allocation Properties

You can edit the IP allocation scheme for the vApp.

Procedure

- 1 On the Summary page of the vApp, click **Edit Settings**.
- 2 Click **Advanced** in the **Options** list.
- 3 Click **IP Allocation**.
- 4 In the Advanced IP Allocation dialog box, you can perform the following actions.
 - Select an IP allocation scheme.
 - Select the IP protocols supported by the vApp: IPv4, IPv6, or both.
- 5 Click **OK**.

Configuring IP Pools

IP pools provide a network identity to vApps. An IP pool is a network configuration that is assigned to a network used by a vApp. The vApp can then leverage vCenter Server to automatically provide an IP configuration to its virtual machines.

Specify an IP Address Range

You can set up an IP address range by specifying a host address range within a network.

IP pool ranges are configured with IPv4 and IPv6. vCenter Server uses these ranges to dynamically allocate IP addresses to virtual machines when a vApp is set up to use transient IP allocation.

Procedure

- 1 In the inventory, select the datacenter that contains the vApp.
- 2 In the IP Pools tab, right-click the IP pool that you want to edit and select **Properties**.
If no IP pools appear, click **Add** to add a new IP pool.
- 3 In the Properties dialog box, select the IPv4 or the IPv6 tab, depending on your IP protocol.
- 4 Enter the **IP Subnet** and **Gateway** in their respective fields.

- 5 (Optional) Select the **Enable IP Pool** check box.
Enable this setting to specify an IP address range.
- 6 (Optional) Enter a comma-separated list of host address ranges in the **Ranges** field.
A range consists of an IP address, a pound sign (#), and a number indicating the length of the range.
The gateway and the ranges must be within the subnet, but must exclude the gateway address.
For example, `10.20.60.4#10, 10.20.61.0#2` indicates that the IPv4 addresses can range from 10.20.60.4 to 10.20.60.13 and 10.20.61.0 to 10.20.61.1.
- 7 Click **OK**.

Select DHCP

You can specify that an IPv4 or IPv6 DHCP server is available on the network.

Procedure

- 1 In the inventory, select the datacenter that contains the vApp you are configuring.
- 2 In the **IP Pools** tab, right-click the IP pool that you want to edit and select **Properties**.
If no IP pools appear, click **Add** to add a new IP pool.
- 3 In the Properties dialog box, select the **DHCP** tab.
- 4 Select either the **IPv4 DHCP Present** or **IPv6 DHCP Present** check box to indicate that one of the DHCP servers is available on this network.
- 5 Click **OK**.

Specify DNS Settings

Enter the DNS settings for the vApp.

Procedure

- 1 In the inventory, select the datacenter that contains the vApp you are configuring.
- 2 In the IP Pools tab, right-click the IP pool that you want to edit and select **Properties**.
If no IP pools appear, click **Add** to add a new IP pool.
- 3 In the Properties dialog box, select the **DNS** tab.
- 4 Enter the DNS server information.
Specify the servers by IP addresses separated by a comma, semicolon, or space.
You can enter the following types of DNS information:
 - DNS Domain
 - Host Prefix
 - DNS Search Path
 - IPv4 DNS Servers
 - IPv6 DNS Servers
- 5 Click **OK**.

Specify a Proxy Server

Specify a HTTP proxy server for the vApp.

Procedure

- 1 In the inventory, select the datacenter that contains the vApp.
- 2 In the IP Pools tab, right-click the IP pool that you want to edit and select **Properties**.
If no IP pools appear, click **Add** to add a new IP pool.
- 3 In the Properties dialog box, select the **Proxy** tab.
- 4 Enter the server name and port number for the proxy server.
The server name can optionally include a colon and a port number.
For example, `web-proxy:3912` is a valid proxy server.
- 5 Click **OK**.

Select Network Associations

You can associate one or more networks with an IP pool.

Procedure

- 1 In the inventory, select the datacenter that contains the vApp.
- 2 In the **IP Pools** tab, right-click the IP pool that you want to edit and select **Properties**.
If no IP pools appear, click **Add** to add a new IP pool.
- 3 In the Properties dialog box, select the **Association** tab.
- 4 Select the networks that use this IP pool.
A network can be associated with one IP pool at a time.
- 5 Click **OK**.

Clone a vApp

Cloning a vApp is similar to cloning a virtual machine.

Prerequisites

To clone a vApp, the vSphere Client must be connected to the vCenter Server system.

A host must be selected in the inventory that is running ESX 3.0 or greater, or a cluster enabled with DRS.

Procedure

- 1 Select the vApp in the inventory.
- 2 Select **Inventory > vApp > Clone**.
Complete each page in Clone vApp the wizard.
- 3 Select the vApp destination and click **Next**.
- 4 Specify a Host and click **Next**.

NOTE This step is available only if you select a cluster that is in DRS manual mode.

- 5 Name the vApp and click **Next**.

- 6 Select a datastore and click **Next**.
- 7 (Optional) Select a network and click **Next**.
- 8 Complete the vApp clone.

Power On a vApp in the vSphere Client

Each virtual machine within the vApp is powered on according to the startup order configuration.

When powering on a vApp within a DRS cluster in manual mode, no DRS recommendations are generated for virtual machine placements. The power-on operation performs as if DRS is run in a semiautomatic or automatic mode for the initial placements of the virtual machines. This does not affect vMotion recommendations. Recommendations for individual powering on and powering off of virtual machines are also generated for vApps that are running.

Procedure

- ◆ In the Summary page for the service, click **Power On**.

If a delay is set in the startup settings, the vApp waits for the set length of time before powering up that virtual machine.

In the **Summary** tab, the status indicates when the vApp has started and is available. Links to the product and vendor Web sites are also found under the General section.

Power Off a vApp in the vSphere Client

Each virtual machine within the vApp is powered off in reverse order to how they are configured for startup.

Procedure

- ◆ In the Summary page for the service, click **Power Off**.

If a delay is set in the shutdown settings, the vApp waits for the set length of time before powering down that virtual machine.

Suspend a vApp in the vSphere Client

A suspended vApp pauses all its running virtual machines until you resume the vApp.

The virtual machines within a vApp are suspended based on their stop order. All virtual machines are suspended regardless of stop action.

Procedure

- 1 From the vSphere Client select the vApp you want to place in suspended state.
- 2 Right-click the vApp and select **Suspend**.

Resume a vApp in the vSphere Client

You can continue the activity of the virtual machines within a vApp that is in a suspended state.

The suspended virtual machines within the vApp are resumed in reverse order to the order in which they were suspended.

Procedure

- 1 From the vSphere Client, select the vApp.
- 2 Right-click the vApp and select **Power On**.

Edit vApp Annotation in the vSphere Client

You can add or edit notes for a particular vApp.

Procedure

- 1 Select the vApp in the inventory.
- 2 Click the **Summary** tab for the vApp.
- 3 In the Annotation section, click **Edit**.
- 4 Type your comments in the Edit Service Annotation window.
- 5 Click **OK**.

Your comments appear under Annotation.

Monitoring Solutions with the vCenter Solutions Manager

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A vSphere administrator uses the vCenter Solutions Manager in the vSphere Client to view the installed solutions, view detailed information about the solutions, and monitor the solution health status. You can also perform those tasks in the vSphere Web Client.

You can monitor and manage vSphere solutions from the vSphere Client or the vSphere Web Client. Both clients display an inventory of vSphere solutions and details about each solution.

A solution is an extension of the vCenter Server that adds new functions to a vCenter Server instance. For example, vSphere ESX Agent Manager is a standard vCenter solution provided by VMware that allows you to manage ESX host agents that add new capabilities to ESX hosts. Another standard solution that vSphere provides is vService Manager. VMware products that integrate with vCenter Server are also considered solutions. You can install a solution to add functionality from third-party technologies to the standard functions of vCenter Server. Solutions typically are delivered as OVF packages. You can install and deploy solutions from vSphere Client. Solutions can be integrated into the vCenter Solutions Manager.

If a virtual machine or vApp is running a solution, a custom icon appears next to it in the inventory view of the vSphere Client. When you power on or power off a virtual machine or vApp, you are notified that you are performing this operation on an entity that is managed by the solution manager.

Each solution registers a unique icon to identify that the virtual machine or vApp is being managed by that solution. The icons show the power states (powered on, paused, powered off).

The solutions display more than one type of icon if they manage more than one type of virtual machine or vApp.

When you attempt an operation on a virtual machine or a vApp that is managed by a solution, an informational warning message appears.

For more information, see the *Developing and Deploying vSphere Solutions, vServices, and ESX Agents* documentation.

This chapter includes the following topics:

- [“Viewing Solutions,”](#) on page 262
- [“View Solutions and vServices in the vSphere Web Client,”](#) on page 262
- [“Monitoring Agents,”](#) on page 263
- [“Monitoring vServices,”](#) on page 263

Viewing Solutions

You can deploy, monitor, and interact with solutions that are installed in a vCenter Server instance with the vCenter Solutions Manager. The Solutions Manager displays information about the health of a solution.

You can navigate to the Solutions Manager from the home page of the vSphere Client. The Solutions Manager view displays information about the solution:

- Solution name
- Solution health
- vService providers

Procedure

- 1 Click the Solutions Manager icon from vSphere Client home.
- 2 Navigate through the tabs in the Solutions Manager.
 - **Summary** tab. Lists the number of installed solutions and a brief health overview for each of the solutions.
 - **Solutions** tab. Lists each managed solution.
 - **Health** tab. Provides the health status of the vCenter services. It also shows alerts or warnings for each of the services.
- 3 In the Solutions Manager inventory, click one of the solutions.
 - **Summary** tab. Lists information about the solution, including a link to the product and vendor Web sites, a link to launch the management UI in a separate window, and a link to the virtual machine or vApp running this solution.

Selecting the vendor Web site link takes you to the Summary page of the virtual machine or vApp. A link under "Managed by" returns you to the solution.
 - **Virtual Machines** tab. Lists all the virtual machines belonging to the solution
 - **vServices Providers** tab.
 - **Management** tab or any other tabs the solution specified.

View Solutions and vServices in the vSphere Web Client

In the vSphere Web Client, you can view information about solutions and vService providers.

Procedure

- 1 Navigate to the vCenter Server system in the object navigator.
- 2 Double-click the vCenter Server object.
- 3 Click **Extensions**.
- 4 Select a solution.

The **Summary** tab displays more information about the solution.
- 5 To view vService provider information, click **Monitor**, and click **vServices**.

Monitoring Agents

The vCenter Solutions Manager displays the vSphere ESX Agent Manager agents that you use to deploy and manage related agents on ESX hosts.

An administrator uses the solutions manager to keep track of whether a solution's agents are working as expected. Outstanding issues are reflected by the solution's ESX Agent Manager status and a list of issues.

When a solution's state changes, the solutions manager updates the ESX Agent Manager's summary status and state. Administrators use this status to track whether the goal state is reached.

The agency's health status is indicated by a specific color:

- Red. The solution must intervene for the ESX Agent Manager to proceed. For example, if a virtual machine agent is powered off manually on a compute resource and the ESX Agent Manager does not attempt to power on the agent. The ESX Agent Manager reports this action to the solution. The solution alerts the administrator to power on the agent.
- Yellow. The ESX Agent Manager is actively working to reach a goal state. The goal state can be enabled, disabled, or uninstalled. For example, when a solution is registered, its status is yellow until the ESX Agent Manager deploys the solutions agents to all the specified compute resources. A solution does not need to intervene when the ESX Agent Manager reports its ESX Agent Manager health status as yellow.
- Green. A solution and all its agents reached the goal state.

Monitoring vServices

A vService is a service or function that a solution provides to virtual machines and vApps. A solution can provide one or more vServices. These vServices integrate with the platform and are able to change the environment in which the vApp or virtual machine runs.

A vService is a type of service for a virtual machine and a vApp provided by a vCenter extension. Virtual machines and vApps can have dependencies on vServices. Each dependency is associated with a vService type. The vService type must be bound to a particular vCenter extension that implements that vService type. This vService type is similar to a virtual hardware device. For example, a virtual machine can have a networking device that at deployment must be connected to a particular network.

The vService Manager allows a solution to connect to operations related to OVF templates:

- Importing OVF templates. Receive a callback when OVF templates with a vService dependency of a certain type is imported.
- Exporting OVF templates. Inserts OVF sections when a virtual machine is exported.
- OVF environment generation. Inserts OVF sections into the OVF environment at the power-on instance.

The **vService Provider** tab in the solution manager provides details for each vCenter extension. This information allows you to monitor vService providers and list the virtual machines or vApps to which they are bound.

Managing Virtual Machines

You can manage individual virtual machines or a group of virtual machines that belongs to a host or cluster. If you have vCenter Server systems in your environment that are connected with vCenter Linked Mode, you can connect to that vCenter Server system and view and manage all virtual machines that run in that system.

You can install the Client Integration Plug-in to access the virtual machine's console. From the console, you can change the guest operating system settings, use applications, browse the file system, monitor system performance, and so on. Use snapshots to capture the state of the virtual machine at the time you take the snapshot.

To migrate virtual machines using cold or hot migration, including vMotion, Storage vMotion, and cross-host Storage vMotion, see the *vCenter Server and Host Management* documentation.

This chapter includes the following topics:

- [“Edit Virtual Machine Startup and Shutdown Settings in the vSphere Web Client,”](#) on page 265
- [“Edit Virtual Machine Startup and Shutdown Settings,”](#) on page 267
- [“Install the Client Integration Plug-In in the vSphere Web Client,”](#) on page 267
- [“Open a Virtual Machine Console in the vSphere Web Client,”](#) on page 268
- [“Open a Console to a Virtual Machine,”](#) on page 269
- [“Adding and Removing Virtual Machines,”](#) on page 269
- [“Change the Template Name in the vSphere Web Client,”](#) on page 271
- [“Deleting Templates in the vSphere Web Client,”](#) on page 272
- [“Using Snapshots To Manage Virtual Machines,”](#) on page 273
- [“Managing vServices in the vSphere Web Client,”](#) on page 287

Edit Virtual Machine Startup and Shutdown Settings in the vSphere Web Client

You can configure virtual machines running on an ESXi host to start up and shut down with the host. You can also set the default timing and startup order for selected virtual machines. This ability allows the operating system to save data when the host enters maintenance mode or is being powered off for another reason.

The Virtual Machine Startup and Shutdown (automatic startup) feature is disabled for all virtual machines residing on hosts that are in a vSphere HA cluster. Automatic startup is not supported with vSphere HA.

NOTE You can also create a scheduled task to change the power settings of a virtual machine. Information about scheduling tasks is included in *vCenter Server and Host Management*.

Procedure

- 1 In the vSphere Web Client, navigate to the host where the virtual machine is located.
- 2 Select **Manage > Settings**.
- 3 Under Virtual Machines, select **VM Startup/Shutdown** and click **Edit**.
The Edit VM Startup and Shutdown dialog box opens.
- 4 Select **Allow virtual machines to start and stop automatically with the system**.
- 5 (Optional) In the Default VM Settings pane, configure the default startup and shutdown behavior for all virtual machines on the host.

| Option | Action |
|--|--|
| Startup Delay | Set the delay for starting the operating system after the virtual machine powers on. This delay allows time for VMware Tools or the booting system to run scripts. |
| Continue immediately if VMware Tools starts | Select this check box to have the operating system start immediately after VMware Tools start without waiting for the delay to pass. |
| Shutdown Delay | Set the delay between shutting down each virtual machine. The shutdown delay applies only if the virtual machine does not shut down before the delay period elapses. If the virtual machine shuts down before the delay time is reached, the next virtual machine starts shutting down. |
| Shutdown Action | Select a shutdown option from the drop-down menu. <ul style="list-style-type: none"> ■ Power Off ■ Suspend ■ Guest Shutdown |

- 6 (Optional) In the Per-VM Overrides pane, configure the startup order and behavior for individual virtual machines.

The settings that you configure for individual virtual machines override the default settings for these machines.

- a To change the startup order of virtual machines, select one from the Manual Startup category and use the up arrow to move it up to Automatic Startup or Any Order.

For virtual machines in the Automatic Startup category, you can use the up and down arrows to change their startup order. During shutdown, the virtual machines shut down in the opposite order.

- b Click **Startup Behaviour**, select **Custom** then configure the startup delay for the operating system to allow VMware Tools and other services to start first.
- c Click **VMware Tools**, and select whether the operating system startup should wait for the delay to pass when VMware Tools are already installed on the virtual machine.

The **Continue if VMware Tools is installed** option enables the operating system to start without waiting for the delay to pass. The **Do not continue if VMware Tools is installed** option enables the operating system startup to wait for the delay to pass.

- d Click **Shutdown Behavior**, select **Custom**, and configure the shutdown action and delay.

- 7 Click **OK** to close the dialog box and save your settings.

Edit Virtual Machine Startup and Shutdown Settings

You can configure virtual machines running on an ESXi host to start up and shut down with the host. You can also set the default timing and startup order for selected virtual machines. This ability allows the operating system to save data when the host enters maintenance mode or is being powered off for another reason.

The Virtual Machine Startup and Shutdown (automatic startup) feature is disabled for all virtual machines residing on hosts that are in (or moved into) a vSphere HA cluster. Automatic startup is not supported when used with vSphere HA.

NOTE You can also create a scheduled task to change the power settings of a virtual machine. Information about scheduling tasks is included in *vCenter Server and Host Management*.

Procedure

- 1 In the vSphere Client inventory, select the host where the virtual machine is located and click the **Configuration** tab.
- 2 Under Software, click **Virtual Machine Startup/Shutdown** and click **Properties**.
The Virtual Machine Startup and Shutdown dialog box opens.
- 3 Select **Allow virtual machines to start and stop automatically with the system**.
- 4 (Optional) Configure the startup and shutdown behavior.

| Option | Action |
|--|---|
| Default Startup Delay | Select the amount of time to delay starting the operating system. This delay allows time for VMware Tools or the booting system to run scripts. |
| Continue immediately if the VMware Tools starts | Select to start the operating system immediately after VMware Tools starts. |
| Default Shutdown Delay | Select the amount of time to delay shutdown for each virtual machine. The shutdown delay applies only if the virtual machine does not shut down before the delay period elapses. If the virtual machine shuts down before the delay time is reached, the next virtual machine starts shutting down. |
| Shutdown Action | Select a shutdown option from the drop-down menu. <ul style="list-style-type: none"> ■ Power Off ■ Suspend ■ Guest Shutdown |
| Move Up and Move Down | Select a virtual machine in the Manual Startup category and use the Move Up button to move it up to Automatic Startup or Any Order. When virtual machines are in the Automatic Startup category, you can use Move Up and Move Down to order them so that they start in a preferred sequence. During shutdown, the virtual machines are stopped in the opposite order. |
| Edit | Click Edit to configure user-specified autostartup and shutdown behavior for virtual machines in the Automatic Startup or Any Order category. |

- 5 Click **OK** to close the dialog box and save your settings.

Install the Client Integration Plug-In in the vSphere Web Client

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 tasks.

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.

You install the Client Integration Plug-in only once to connect virtual devices to virtual machines that you access through an instance of the vSphere Web Client. You must restart the browser after you install the plug-in.

If you install the Client Integration Plug-in from an Internet Explorer browser, you must first disable Protected Mode. 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 does not install correctly because Protected Mode is enabled for the Internet.

The Client Integration Plug-in also enables you to log in to the vSphere Web Client using Windows session credentials.

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

Procedure

- 1 Disable Internet Protected Mode for Internet Explorer browsers.
 - a Open the browser and select **Tools > Internet Options**.
 - b Click the **Security** tab and deselect **Enable Protected Mode** for the Internet and Local intranet zones.
- 2 Click the **Download the client integration plug-in** link.

| Option | Description |
|--------------------------------------|---|
| vSphere Web Client login page | <ol style="list-style-type: none"> a Open a Web browser and enter the URL for the vSphere Web Client. b At the bottom of the vSphere Web Client login page, click Download Client Integration Plug-in. |
| Guest OS Details panel | <ol style="list-style-type: none"> a Select a virtual machine in the inventory and click the Summary tab. b Click Download Client Integration Plug-in. |

- 3 If the browser blocks the installation, either by issuing certificate errors or with pop-up blocking, follow the Help instructions for your browser to resolve the problem.

What to do next

You can open the virtual machine console to configure operating system settings, run applications, monitor performance, and so on.

Open a Virtual Machine Console in the vSphere Web Client

With the vSphere Web Client, you can access a virtual machine's desktop by launching a console to the virtual machine. From the console, you can perform activities in the virtual machine such as configure operating system settings, run applications, monitor performance, and so on.

Prerequisites

- Ensure that the Client Integration Plug-in is installed in your Web browser.
- Verify that the virtual machine has a guest operating system and that VMware Tools are installed.
- Verify that the virtual machine is powered on.

Procedure

- 1 Select a datacenter, folder, cluster, resource pool, host, or vApp and click the **Related Objects** tab.
- 2 Click **Virtual Machines** and select a virtual machine from the list and click it.
- 3 Click the **Summary** tab and click **Launch console**.

The virtual machine console opens in a new tab of the Web browser.

- 4 Click anywhere inside the console window to enable your mouse, keyboard, and other input devices to work in the console.
- 5 (Optional) Press Ctrl+Alt to release the cursor from the console window and work outside the console window.
- 6 (Optional) Click **Full Screen** to display the console in full screen mode.
- 7 (Optional) Press Ctrl+Alt+Enter to exit full screen mode.
- 8 (Optional) Click **Send Ctrl-Alt-Delete** to send a Ctrl+Alt+Delete to the guest operating system.

Open a Console to a Virtual Machine

With the vSphere Client, you can access a virtual machine's desktop by launching a console to the virtual machine. From the console, you can perform activities within the virtual machine such as configure operating system settings, run applications, monitor performance, and so on.

Procedure

- 1 In the vSphere Client inventory, right-click the virtual machine and select **Open Console**.
- 2 Click anywhere inside the console window to enable your mouse, keyboard, and other input devices to work in the console.

Adding and Removing Virtual Machines

You add virtual machines to the vCenter Server inventory through their managed hosts. You can remove virtual machines from vCenter Server, from their managed host's storage, or from both.

Adding Existing Virtual Machines to vCenter Server

When you add a host to vCenter Server, it discovers all the virtual machines on that managed host and adds them to the vCenter Server inventory.

If a managed host is disconnected, the already discovered virtual machines continue to be listed in the inventory.

If a managed host is disconnected and reconnected, any changes to the virtual machines on that managed host are identified, and the vSphere Client updates the list of virtual machines. For example, if node3 is removed and node4 is added, the new list of virtual machines adds node4 and shows node3 as orphaned.

Remove Virtual Machines from vCenter Server in the vSphere Web Client

When you remove a virtual machine from the inventory, you unregister it from the host and vCenter Server, but you do not delete it from the datastore. Virtual machine files remain at the same storage location and you can re-register the virtual machine by using the datastore browser at a later time. This capability is useful if you need to unregister a virtual machine to edit the virtual machine's configuration file. The ability to remove a virtual machine and maintain its files is useful when you have reached the maximum number of virtual machines that your license or hardware allows.

Prerequisites

Verify that the virtual machine is turned off.

Procedure

- 1 Right-click the virtual machine, and select **All vCenter Actions > Remove From Inventory**.
 - 2 To confirm that you want to remove the virtual machine from the inventory, click **OK**.
- vCenter Server removes references to the virtual machine and no longer tracks its condition.

Remove Virtual Machines from vCenter Server

Removing a virtual machine from the inventory unregisters it from the host and vCenter Server, but does not delete it from the datastore. Virtual machine files remain at the same storage location and the virtual machine can be re-registered by using the datastore browser.

Prerequisites

Power off the virtual machine.

Procedure

- 1 Display the virtual machine in the inventory.
- 2 Right-click the virtual machine and select **Remove from Inventory**.
- 3 To confirm that you want to remove the virtual machine from the inventory, click **OK**.

vCenter Server removes references to the virtual machine and no longer tracks its condition.

Remove Virtual Machines from the Datastore in the vSphere Web Client

If you no longer need a virtual machine and want to free up space on the datastore, you can remove the virtual machine from vCenter Server and delete all virtual machine's files from the datastore, including the configuration file and virtual disk files.

Prerequisites

- Power off the virtual machine.
- Ensure that another virtual machine is not sharing the disk. If two virtual machines are sharing the same disk, the disk files are not deleted.

Procedure

- 1 Right-click the virtual machine and select **All vCenter Actions > Delete from Disk**.
- 2 Click **OK**.

vCenter Server deletes the virtual machine from its datastore. Disks that are shared with other virtual machines are not deleted.

Remove Virtual Machines from the Datastore

You use the **Delete from Disk** option to remove a virtual machine from vCenter Server and delete all virtual machine files, including the configuration file and virtual disk files, from the datastore.

Prerequisites

Power off the virtual machine.

Procedure

- 1 Display the virtual machine in the inventory.
- 2 Right-click the virtual machine and select **Delete from Disk**.
- 3 Click **OK** in the confirmation dialog box.

vCenter Server deletes the virtual machine from its datastore. Disks that are shared with other virtual machines are not deleted.

Return a Virtual Machine or Template to vCenter Server

If you remove a virtual machine or template from vCenter Server, but do not remove it from the managed host's datastore, you can return it to vCenter Server by using the Datastore Browser.

Procedure

- 1 Display the datastore in the inventory.
- 2 Right-click the datastore and select **Browse Datastore**.
- 3 Navigate to the virtual machine or template to add to the inventory.
- 4 Right-click the virtual machine or template and select **Add to Inventory**.
- 5 Complete the Add to Inventory wizard to add the virtual machine or template.

Register a Virtual Machine with the vSphere Web Client

If you removed a virtual machine from vCenter Server but did not remove it from the managed host's datastore, you can return it to the vCenter Server inventory by registering it with the vCenter Server.

Procedure

- 1 In the vSphere Web Client inventory, right-click the datastore on which the virtual machine configuration file is stored and select **All vCenter Actions > Register VM**.
- 2 Browse to and select the virtual machine configuration (.vmx) file and click **OK**.
- 3 Use the existing virtual machine name or type a new name, and select a datacenter or folder location for the virtual machine.
- 4 Click **Next**.
- 5 Select a host or cluster on which to run the new virtual machine.

| Option | Action |
|--|--|
| Run the virtual machine on a standalone host. | Select the host and click Next . |
| Run the virtual machine in a cluster with DRS automatic placement. | Select the cluster and click Next . |
| Run the virtual machine in a cluster without DRS automatic placement. | <ol style="list-style-type: none"> a Select the cluster and click Next. b Select a host within the cluster and click Next. |

- 6 Select a resource pool in which to run the virtual machine and click **Next**.
- 7 Review your selections and click **Finish**.

The virtual machine is added to the vCenter Server inventory.

Change the Template Name in the vSphere Web Client

If you move a template to another host or datacenter folder, you can change the template name to make it unique in that folder.

Procedure

- 1 Right-click the template and select **Rename**.
- 2 Enter a new name and click **OK**.

Deleting Templates in the vSphere Web Client

You can delete a template by removing it from the inventory or deleting the template from the disk. If you remove the template from the inventory, it remains on the disk and can be reregistered with vCenter Server to restore it to the inventory.

Remove Templates from the Inventory in the vSphere Web Client

If a template has become outdated and you no longer use it in your environment, you can remove it from the inventory. Removing a template unregisters it from the vCenter Server inventory, but it is not removed from the datastore. The template remains at the same storage location, and you can use the datastore browser to reregister the template at a later time. You can later decide to update the template rather than create one.

Procedure

- 1 Right-click the template and select **All vCenter Actions > Remove from Inventory**.
- 2 Click **Yes** to confirm removing the template from the vCenter Server database.

The template is unregistered from the vCenter Server inventory.

Delete a Template from the Disk in the vSphere Web Client

If you no longer need a template or need to free up disk space, you can remove it from the disk. Templates that you delete are permanently removed from the system.

You cannot recover a template that you delete from the disk.

Procedure

- 1 Right-click the template and select **All vCenter Actions > Delete from Disk**.
- 2 Click **Yes** to confirm removing the template from the datastore.

Reregister Templates in the vSphere Web Client

Templates can become unregistered from vCenter Server if they are removed from the inventory or if the hosts with which they are associated are removed from vCenter Server and then readded.

Procedure

- 1 Browse to or search for the datastore that contains the template.
- 2 Click the **Manage** tab and click **Files**.
- 3 Browse to locate the template and click it to display the template files.
The hard disk and configuration and other files appear in the Name column.
- 4 Click the template to display the template files.
- 5 Locate and right-click the **.vmtx** file and select **Register VM**.
The Register Virtual Machine wizard appears.
- 6 Maintain the original template name or enter a new name in the **Name** text box.
- 7 Select a location for the template and click **Next**.
- 8 Select a host or cluster on which to store the template and click **Next**.
- 9 Review your selections and click **Finish**.

- 10 To verify that the template is reregistered, check the host or cluster inventory.

| Inventory | Description |
|-----------|--|
| Host | Browse to the host. Click the Related Objects tab, and click VM Templates . |
| Cluster | Browse to the cluster. In the inventory view, select VM Templates to display the list of templates. |

The template is registered to the host. Click the **Related Objects** tab, and click VM Templates to view the template. You can view the template from the host's **Related Objects** tab by clicking **VM Templates**.

Using Snapshots To Manage Virtual Machines

Snapshots preserve the state and data of a virtual machine at the time you take the snapshot. Snapshots are useful when you must revert repeatedly to the same virtual machine state, but you do not want to create multiple virtual machines.

You can take multiple snapshots of a virtual machine to create restoration positions in a linear process. With multiple snapshots, you can save many positions to accommodate many kinds of work processes. Snapshots operate on individual virtual machines. Taking snapshots of multiple virtual machines, for example, taking snapshots for all members of a team, requires that you take a separate snapshot of each team member's virtual machine.

Snapshots are useful as a short term solution for testing software with unknown or potentially harmful effects. For example, you can use a snapshot as a restoration point during a linear or iterative process, such as installing update packages, or during a branching process, such as installing different versions of a program. Using snapshots ensures that each installation begins from an identical baseline.

With snapshots, you can preserve a baseline before diverging a virtual machine in the snapshot tree.

The Snapshot Manager in the vSphere Web Client and the vSphere Client provide several operations for creating and managing virtual machine snapshots and snapshot trees. These operations let you create snapshots, restore any snapshot in the snapshot hierarchy, delete snapshots, and more. You can create extensive snapshot trees that you can use to save the virtual machine state at any specific time and restore the virtual machine state later. Each branch in a snapshot tree can have up to 32 snapshots.

A snapshot preserves the following information:

- Virtual machine settings. The virtual machine directory, which includes disks that were added or changed after you took the snapshot.
- Power state. The virtual machine can be powered on, powered off, or suspended.
- Disk state. State of all the virtual machine's virtual disks.
- (Optional) Memory state. The contents of the virtual machine's memory.

The Snapshot Hierarchy

The Snapshot Manager presents the snapshot hierarchy as a tree with one or more branches. The relationship between snapshots is like that of a parent to a child. In the linear process, each snapshot has one parent snapshot and one child snapshot, except for the last snapshot, which has no child snapshots. Each parent snapshot can have more than one child. You can revert to the current parent snapshot or restore any parent or child snapshot in the snapshot tree and create more snapshots from that snapshot. Each time you restore a snapshot and take another snapshot, a branch, or child snapshot, is created.

Parent Snapshots

The first virtual machine snapshot that you create is the base parent snapshot. The parent snapshot is the most recently saved version of the current state of the virtual machine. Taking a snapshot creates a delta disk file for each disk attached to the virtual machine and optionally, a memory file. The delta disk

files and memory file are stored with the base `.vmdk` file. The parent snapshot is always the snapshot that appears immediately above the You are here icon in the Snapshot Manager. If you revert or restore a snapshot, that snapshot becomes the parent of the You are here current state.

NOTE The parent snapshot is not always the snapshot that you took most recently.

Child Snapshots

A snapshot that is taken of the same virtual machine after the parent snapshot. Each child constitutes delta files for each attached virtual disk, and optionally a memory file that points from the present state of the virtual disk (You are here). Each child snapshot's delta files merge with each previous child snapshot until reaching the parent disks. A child disk can later be a parent disk for future child disks.

The relationship of parent and child snapshots can change if you have multiple branches in the snapshot tree. A parent snapshot can have more than one child. Many snapshots have no children.

IMPORTANT Do not manually manipulate individual child disks or any of the snapshot configuration files because doing so can compromise the snapshot tree and result in data loss. This restriction includes disk resizing and making modifications to the base parent disk using `vmkfstools`.

Snapshot Behavior

Taking a snapshot preserves the disk state at a specific time by creating a series of delta disks for each attached virtual disk or virtual RDM and optionally preserves the memory and power state by creating a memory file. Taking a snapshot creates a snapshot object in the Snapshot Manager that represents the virtual machine state and settings.

Each snapshot creates an additional delta `.vmdk` disk file. When you take a snapshot, the snapshot mechanism prevents the guest operating system from writing to the base `.vmdk` file and instead directs all writes to the delta disk file. The delta disk represents the difference between the current state of the virtual disk and the state that existed at the time that you took the previous snapshot. If more than one snapshot exists, delta disks can represent the difference between each snapshot. Delta disk files can expand quickly and become as large as the entire virtual disk if the guest operating system writes to every block of the virtual disk.

Snapshot Files

When you take a snapshot, you capture the state of the virtual machine settings and the virtual disk. If you are taking a memory snapshot, you also capture the memory state of the virtual machine. These states are saved to files that reside with the virtual machine's base files.

Snapshot Files

A snapshot consists of files that are stored on a supported storage device. A Take Snapshot operation creates `.vmdk`, `-delta.vmdk`, `.vmsd`, and `.vmsn` files. By default, the first and all delta disks are stored with the base `.vmdk` file. The `.vmsd` and `.vmsn` files are stored in the virtual machine directory.

Delta disk files

A `.vmdk` file to which the guest operating system can write. The delta disk represents the difference between the current state of the virtual disk and the state that existed at the time that the previous snapshot was taken. When you take a snapshot, the state of the virtual disk is preserved, which prevents the guest operating system from writing to it, and a delta or child disk is created.

A delta disk has two files, including a descriptor file that is small and contains information about the virtual disk, such as geometry and child-parent relationship information, and a corresponding file that contains the raw data.

NOTE If you are looking at a datastore with the Datastore Browser in the vSphere Client, you see only one entry to represent both files.

The files that make up the delta disk are referred to as child disks or redo logs. A child disk is a sparse disk. Sparse disks use the copy-on-write mechanism, in which the virtual disk contains no data in places, until copied there by a write operation. This optimization saves storage space. A grain is the unit of measure in which the sparse disk uses the copy-on-write mechanism. Each grain is a block of sectors that contain virtual disk data. The default size is 128 sectors or 64KB.

| | |
|----------------------|--|
| Flat file | A <code>-flat.vmdk</code> file that is one of two files that comprises the base disk. The flat disk contains the raw data for the base disk. This file does not appear as a separate file in the Datastore Browser. |
| Database file | A <code>.vmsd</code> file that contains the virtual machine's snapshot information and is the primary source of information for the Snapshot Manager. This file contains line entries, which define the relationships between snapshots and between child disks for each snapshot. |
| Memory file | A <code>.vmsn</code> file that includes the active state of the virtual machine. Capturing the memory state of the virtual machine lets you revert to a turned on virtual machine state. With nonmemory snapshots, you can only revert to a turned off virtual machine state. Memory snapshots take longer to create than nonmemory snapshots. The time the ESX host takes to write the memory onto the disk is relative to the amount of memory the virtual machine is configured to use. |

A **Take Snapshot** operation creates `.vmdk`, `-delta.vmdk`, `vmsd`, and `vmsn` files.

| File | Description |
|---|--|
| <code>vmname-number.vmdk</code> and <code>vmname-number-delta.vmdk</code> | Snapshot file that represents the difference between the current state of the virtual disk and the state that existed at the time the previous snapshot was taken. The filename uses the following syntax, <code>S1vm-000001.vmdk</code> where <code>S1vm</code> is the name of the virtual machine and the six-digit number, <code>000001</code> , is based on the files that already exist in the directory. The number does not consider the number of disks that are attached to the virtual machine. |
| <code>vmname.vmsd</code> | Database of the virtual machine's snapshot information and the primary source of information for the Snapshot Manager. |
| <code>vmname.Snapshotnumber.vmsn</code> | Memory state of the virtual machine at the time you take the snapshot. The file name uses the following syntax, <code>S1vm.snapshot1.vmsn</code> , where <code>S1vm</code> is the virtual machine name, and <code>snapshot1</code> is the first snapshot. NOTE A <code>.vmsn</code> file is created each time you take a snapshot, regardless of the memory selection. A <code>.vmsn</code> file without memory is much smaller than one with memory. |

Snapshot Limitations

Snapshots can affect virtual machine performance and do not support some disk types or virtual machines configured with bus sharing. Snapshots are useful as short-term solutions for capturing point-in-time virtual machine states and are not appropriate for long-term virtual machine backups.

- VMware does not support snapshots of raw disks, RDM physical mode disks, or guest operating systems that use an iSCSI initiator in the guest.
- Virtual machines with independent disks must be powered off before you take a snapshot. Snapshots of powered-on or suspended virtual machines with independent disks are not supported.
- Snapshots are not supported with PCI vSphere Direct Path I/O devices.
- VMware does not support snapshots of virtual machines configured for bus sharing. If you require bus sharing, consider running backup software in your guest operating system as an alternative solution. If your virtual machine currently has snapshots that prevent you from configuring bus sharing, delete (consolidate) the snapshots.
- Snapshots provide a point-in-time image of the disk that backup solutions can use, but Snapshots are not meant to be a robust method of backup and recovery. If the files containing a virtual machine are lost, its snapshot files are also lost. Also, large numbers of snapshots are difficult to manage, consume large amounts of disk space, and are not protected in the case of hardware failure.
- Snapshots can negatively affect the performance of a virtual machine. Performance degradation is based on how long the snapshot or snapshot tree is in place, the depth of the tree, and how much the virtual machine and its guest operating system have changed from the time you took the snapshot. Also, you might see a delay in the amount of time it takes the virtual machine to power-on. Do not run production virtual machines from snapshots on a permanent basis.

Managing Snapshots

You can review all snapshots for the active virtual machine and act on them by using the Snapshot Manager.

After you take a snapshot, you can use the **Revert to current** snapshot command from the virtual machine's right-click menu to restore that snapshot at any time. If you have a series of snapshots, you can use the **Go to** command in the Snapshot Manager to restore any parent or child snapshot. Subsequent child snapshots that you take from the restored snapshot create a branch in the snapshot tree. You can delete a snapshot from the tree in the Snapshot Manager.

The Snapshot Manager window contains the following areas: Snapshot tree, Details region, command buttons, Navigation region, and a **You are here** icon.

| | |
|--------------------------------------|---|
| Snapshot tree | Displays all snapshots for the virtual machine. |
| You are here icon | Represents the current and active state of the virtual machine. The You are here icon is always selected and visible when you open the Snapshot Manager. You can select the You are here state to see how much space the node is using. Go to , Delete , and Delete all are disabled for the You are here state. |
| Go to, Delete, and Delete All | Snapshot options. |

| | |
|-------------------|--|
| Details | Shows the snapshot name and description, the date you created the snapshot, and the disk space. The Console shows the power state of the virtual machine when a snapshot was taken. The Name, Description, and Created text boxes are blank if you do not select a snapshot. |
| Navigation | Contains buttons for navigating out of the dialog box. <ul style="list-style-type: none"> ■ Close the Snapshot Manager. ■ The question mark icon opens the help system. |

Taking Snapshots

You can take one or more snapshots of a virtual machine to capture the settings state, disk state, and memory state at different specific times. When you take a snapshot, you can also quiesce the virtual machine files and exclude the virtual machine disks from snapshots.

When you quiesce a virtual machine, VMware Tools quiesces the file system of the virtual machine. A quiesce operation ensures that a snapshot disk represents a consistent state of the guest file systems. If the virtual machine is powered off or VMware Tools are not available, the Quiesce parameter is not available.

When you capture the virtual machine's memory state, the snapshot retains the live state of the virtual machine. The virtual machine's files do not require quiescing. If you do not capture the memory state, the snapshot does not save the live state of the virtual machine and the disks are crash-consistent unless you quiesce them.

When you take a snapshot, other activity that is occurring in the virtual machine might affect the snapshot process when you revert to that snapshot. The best time to take a snapshot from a storage perspective, is when you are not incurring a large I/O load. The best time to take a snapshot from a service perspective is when no applications in the virtual machine are communicating with other computers. The potential for problems is greatest if the virtual machine is communicating with another computer, especially in a production environment. For example, if you take a snapshot while the virtual machine is downloading a file from a server on the network, the virtual machine continues downloading the file and communicating its progress to the server. If you revert to the snapshot, communications between the virtual machine and the server are confused and the file transfer fails.

Change Disk Mode to Exclude Virtual Disks from Snapshots in the vSphere Web Client

You can set a virtual disk to independent mode to exclude the disk from any snapshots taken of its virtual machine.

Prerequisites

Power off the virtual machine and delete any existing snapshots before you change the disk mode. Deleting a snapshot involves committing the existing data on the snapshot disk to the parent disk.

Required privileges:

- **Virtual machine.State.Remove Snapshot**
- **Virtual machine.Configuration.Modify device settings**

Procedure

- 1 Right-click the virtual machine and select **Edit Settings**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.

- 2 On the **Virtual Hardware** tab, expand **Hard disk**, and select an independent disk mode option.

| Option | Description |
|------------------------------------|--|
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 3 Click **OK**.

Change Disk Mode to Exclude Virtual Disks from Snapshots in the vSphere Client

You can set a virtual disk to independent mode to exclude the disk from any snapshots taken of its virtual machine.

Prerequisites

Power off the virtual machine and delete any existing snapshots before you change the disk mode. Deleting a snapshot involves committing the existing data on the snapshot disk to the parent disk.

Required privileges:

- **Virtual machine.State.Remove Snapshot**
- **Virtual machine.Configuration.Modify device settings**

Procedure

- 1 Select **Inventory > Virtual Machine > Edit Settings**.
- 2 Click the **Hardware** tab and select the hard disk to exclude.
- 3 Under **Mode**, select **Independent**.

Snapshots do not affect the state of an independent disk.

NOTE Any disk, regardless of its type, that is created after you take a snapshot does not appear if you revert to that snapshot.

- 4 Select an independent disk mode option.

| Option | Description |
|------------------------------------|--|
| Independent - Persistent | Disks in persistent mode behave like conventional disks on your physical computer. All data written to a disk in persistent mode are written permanently to the disk. |
| Independent - Nonpersistent | Changes to disks in nonpersistent mode are discarded when you power off or reset the virtual machine. With nonpersistent mode, you can restart the virtual machine with a virtual disk in the same state every time. Changes to the disk are written to and read from a redo log file that is deleted when you power off or reset. |

- 5 Click **OK**.

Take a Snapshot in the vSphere Web Client

Snapshots capture the entire state of the virtual machine at the time you take the snapshot. You can take a snapshot when a virtual machine is powered on, powered off, or suspended. If you are suspending a virtual machine, wait until the suspend operation finishes before you take a snapshot.

When you create a memory snapshot, the snapshot captures the state of the virtual machine's memory and the virtual machine power settings. When you capture the virtual machine's memory state, the snapshot operation takes longer to complete. You might also see a momentary lapse in response over the network.

When you quiesce a virtual machine, VMware Tools quiesces the file system in the virtual machine. The quiesce operation pauses or alters the state of running processes on the virtual machine, especially processes that might modify information stored on the disk during a restore operation.

NOTE Do not use VMware snapshots to backup Dynamic Disks. If you take a snapshot of a Dynamic Disk (Microsoft specific file system), you will not be able to revert to the snapshot. Snapshot technology does not have visibility into dynamic disks and cannot preserve the quiesce state of the disk files.

Prerequisites

- If you are taking a memory snapshot of a virtual machine that has multiple disks in different disk modes, verify that the virtual machine is powered off. For example, if you have a special purpose configuration that requires you to use an independent disk, you must power off the virtual machine before taking a snapshot.
- To capture the memory state of the virtual machine, verify that the virtual machine is powered on.
- To quiesce the virtual machine files, verify that the virtual machine is powered on and that VMware Tools is installed.
- Required privilege: **Virtual machine.State. Create snapshot** on the virtual machine.

Procedure

- 1 Right-click the virtual machine in the inventory and select **Take Snapshot**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 Type a name for the snapshot.
- 3 (Optional) Type a description for the snapshot.
- 4 (Optional) Select the **Snapshot the virtual machine's memory** check box to capture the memory of the virtual machine.
- 5 (Optional) Select the **Quiesce guest file system (Needs VMware Tools installed)** check box to pause running processes on the guest operating system so that file system contents are in a known consistent state when you take the snapshot.

Quiesce the virtual machine files only when the virtual machine is powered on and you do not want to capture the virtual machine's memory.

- 6 Click **OK**.

Take a Snapshot in the vSphere Client

Snapshots capture the entire state of the virtual machine at the time you take the snapshot. You can take a snapshot when a virtual machine is powered on, powered off, or suspended. If you are suspending a virtual machine, wait until the suspend operation finishes before you take a snapshot.

When you create a memory snapshot, the snapshot captures the state of the virtual machine's memory and the virtual machine power settings. When you capture the virtual machine's memory state, the snapshot operation takes longer to complete. You might also see a momentary lapse in response over the network.

When you quiesce a virtual machine, VMware Tools quiesces the file system in the virtual machine. The quiesce operation pauses or alters the state of running processes on the virtual machine, especially processes that might modify information stored on the disk during a restore operation.

NOTE You cannot revert to a snapshot with dynamic disks, so quiesced snapshots are not used when you restore dynamic disks. Snapshot technology has no visibility into Dynamic Disks. Dynamic Disks are commonly known as Microsoft specific file systems.

Prerequisites

- If you are taking a memory snapshot of a virtual machine that has multiple disks in different disk modes, verify that the virtual machine is powered off. For example, if you have a special purpose configuration that requires you to use an independent disk, you must power off the virtual machine before taking a snapshot.
- To capture the memory state of the virtual machine, verify that the virtual machine is powered on.
- To quiesce the virtual machine files, verify that the virtual machine is powered on and that VMware Tools is installed.
- Required privilege: **Virtual machine.State. Create snapshot** on the virtual machine.

Procedure

- 1 Select **Inventory > Virtual Machine > Snapshot > Take Snapshot**.
- 2 Type a name for the snapshot.
- 3 Type a description for the snapshot.
Adding a date and time or a description, for example, "Snapshot before applying XYZ patch," can help you determine which snapshot to restore or delete.
- 4 (Optional) Select the **Snapshot the virtual machine's memory** check box to capture the memory of the virtual machine.
- 5 (Optional) Select the **Quiesce guest file system (Needs VMware Tools installed)** check box to pause running processes on the guest operating system so that file system contents are in a known consistent state when you take the snapshot.
- 6 Click **OK**.

After you take the snapshot, you can view its status in the **Recent Tasks** field at the bottom of the vSphere Client.

Restoring Snapshots

To return a virtual machine to its original state, or to return to another snapshot in the snapshot hierarchy, you can restore a snapshot.

When you restore a snapshot, you return the virtual machine's memory, settings, and the state of the virtual machine disks to the state they were in at the time you took the snapshot. If you want the virtual machine to be suspended, powered on, or powered off when you start it, make sure that it is in the correct state when you take the snapshot.

You can restore snapshots in the following ways:

- Revert to Current Snapshot** Restores the parent snapshot, one level up in the hierarchy from the **You are Here** position. **Revert to Current Snapshot** activates the parent snapshot of the current state of the virtual machine.
- Go To** Lets you restore any snapshot in the snapshot tree and makes that snapshot the parent snapshot of the current state of the virtual machine. Subsequent snapshots from this point create a new branch of the snapshot tree.

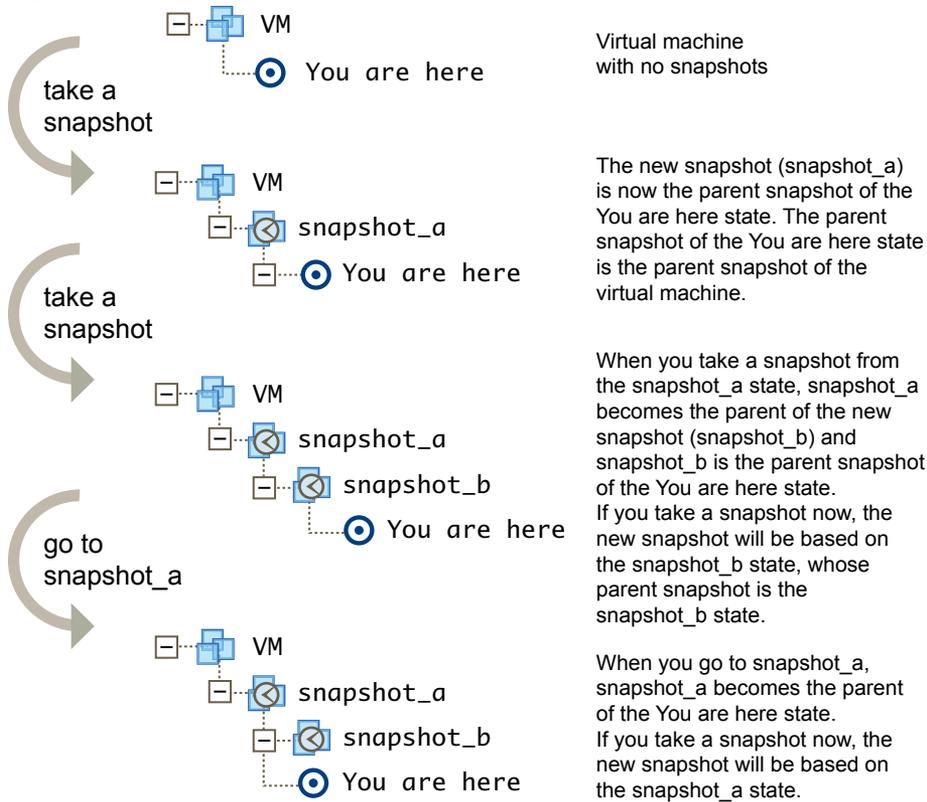
Restoring snapshots has the following effects:

- The current disk and memory states are discarded, and the virtual machine reverts to the disk and memory states of the parent snapshot.
- Existing snapshots are not removed. You can restore those snapshots at any time.
- If the snapshot includes the memory state, the virtual machine will be in the same power state as when you created the snapshot.

Table 13-1. Virtual Machine Power State After Restoring a Snapshot

| Virtual Machine State When Parent Snapshot Is Taken | Virtual Machine State After Restoration |
|---|--|
| Powered on (includes memory) | Reverts to the parent snapshot, and the virtual machine is powered on and running. |
| Powered on (does not include memory) | Reverts to the parent snapshot and the virtual machine is powered off. |
| Powered off (does not include memory) | Reverts to the parent snapshot and the virtual machine is powered off. |

Virtual machines running certain kinds of workloads can take several minutes to resume responsiveness after reverting from a snapshot.

Figure 13-1. Revert to Snapshot

When you revert a virtual machine, the virtual machine returns to the parent snapshot of the virtual machine (that is, the parent of the current You are here state).

NOTE vApp metadata for virtual machines in vApps does not follow the snapshot semantics for virtual machine configuration. vApp properties that are deleted, modified, or defined after a snapshot is taken remain intact (deleted, modified, or defined) after the virtual machine reverts to that snapshot or any previous snapshots.

Revert to a Snapshot in the vSphere Web Client

When you revert to a snapshot, you immediately restore the parent snapshot of the virtual machine.

When you revert to a snapshot, disks that you added or changed after the snapshot was taken are reverted to the snapshot point. For example, when you take a snapshot of a virtual machine, add a disk, and revert the snapshot, the added disk is removed.

Independent disks are also removed when you revert to a snapshot that was taken before the disk was added. If the latest snapshot includes an independent disk, its contents do not change when you revert to that snapshot.

Prerequisites

Required privilege: **Virtual machine.State.Revert to snapshot** on the virtual machine.

Procedure

- ◆ Right-click a virtual machine in the inventory, and select **Revert to Current Snapshot**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.

The virtual machine power and data states are returned to the states they were in at the time you took the parent snapshot. If the parent snapshot is a memory snapshot, the virtual machine is restored to an on power state.

Revert to a Snapshot in the vSphere Client

You can restore the parent snapshot of the current state of the virtual machine.

When you revert to a snapshot, disks that you added or changed after the snapshot was taken are reverted to the snapshot point. For example, when you take a snapshot of a virtual machine, add a disk, and revert the snapshot, the added disk is removed.

Prerequisites

Required privilege: **Virtual machine.State.Revert to snapshot** on the virtual machine.

Procedure

- ◆ Right-click a virtual machine in the vSphere Client inventory and select **Revert to Current Snapshot**.

The virtual machine power and data states are returned to the states they were in at the time you took the parent snapshot. If the parent snapshot is a memory snapshot, the virtual machine is restored to an on power state.

Go to a Snapshot in the vSphere Web Client

Go to a snapshot to restore the virtual machine to the state of that snapshot.

Prerequisites

Required privilege: **Virtual machine.State.Revert to snapshot** on the virtual machine

Procedure

- 1 Right-click the virtual machine and select **Manage Snapshots**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 In the Snapshot Manager, click a snapshot to select it.
- 3 Click **Go to** to restore the virtual machine to the snapshot.

The **Go to** command lets you restore the state of any snapshot.
- 4 Click **Yes** in the confirmation dialog box.
- 5 Click **Close** to exit the Snapshot Manager.

Go To a Snapshot in the vSphere Client

You can go to any snapshot in the snapshot tree to restore the virtual machine to the state of that snapshot.

NOTE Virtual machines running certain kinds of workloads might take several minutes to resume responsiveness after reverting from a snapshot.

Prerequisites

Required privilege: **Virtual machine.State.Revert to snapshot** on the virtual machine

Procedure

- 1 Right-click a virtual machine in the vSphere Client inventory and select **Snapshot Manager**.
- 2 In the Snapshot Manager, click a snapshot to select it.

- 3 Click **Go to** to restore the virtual machine to the snapshot.
- 4 Click **Yes** in the confirmation dialog box.

Subsequent child snapshots from this point create a new branch of the snapshot tree. The delta disks for snapshots that you took after you restored the current snapshot are not removed and you can restore those snapshots at any time.

Deleting Snapshots

Deleting a snapshot removes the snapshot from the Snapshot Manager. The snapshot files are consolidated and written to the parent snapshot disk and merge with the virtual machine base disk.

Deleting a snapshot leaves the current state of the virtual machine or any other snapshot untouched. Deleting a snapshot consolidates the changes between snapshots and previous disk states and writes to the parent disk all data from the delta disk that contains the information about the deleted snapshot. When you delete the base parent snapshot, all changes merge with the base virtual machine disk.

Deleting snapshots involves large amounts of disk reads and writes, which can reduce virtual machine performance until consolidation is complete. Consolidating snapshots removes redundant disks, which improves virtual machine performance and saves storage space. The time it takes to delete snapshots and consolidate the snapshot files depends on the volume of data that the guest operating system wrote to the virtual disks after you took the last snapshot. The required time is proportional to the amount of data the virtual machine is writing during consolidation if the virtual machine is powered on.

If disk consolidation fails when you delete a snapshot or delete all snapshots and you notice a degradation in virtual machine performance, you can view a list of virtual machines to determine if any files require consolidation, and if so, run a separate consolidation operation. For information about locating and viewing the consolidation state of multiple virtual machines and running a separate consolidation operation, see [“Consolidate Snapshots in the vSphere Client,”](#) on page 286

Delete

Use the **Delete** option to remove a single parent or child snapshot from the snapshot tree. **Delete** writes disk changes between the snapshot and the previous delta disk state to the parent snapshot.

You can also use the **Delete** option to remove a corrupt snapshot and its files from an abandoned branch of the snapshot tree without merging them with the parent snapshot.

Delete All

Use the **Delete All** option to delete all snapshots from the Snapshot Manager. **Delete all** consolidates and writes changes between snapshots and previous delta disk states to the base parent disk and merges them with the base virtual machine disk.

To prevent snapshot files from merging with the parent snapshot, for example in cases of failed updates or installations, first use the **Go to** command to restore to a previous snapshot. This action invalidates the snapshot delta disks and deletes the memory file. You can then use the **Delete** option to remove the snapshot and any associated files.

Delete a Snapshot in the vSphere Web Client

You can use the Snapshot Manager to delete a single snapshot or all snapshots in a snapshot tree.

Use care when you delete snapshots. You cannot restore a deleted snapshot. For example, you might want to install several browsers, a, b, and c, and capture the virtual machine state after you install each browser. The first, or base snapshot, captures the virtual machine with browser a and the second snapshot captures browser b. If you restore the base snapshot that includes browser a and take a third snapshot to capture browser c and delete the snapshot that contains browser b, you cannot return to the virtual machine state that includes browser b.

Prerequisites

- Ensure that you are familiar with the Delete and Delete all actions and how they might affect virtual machine performance. See [“Deleting Snapshots,”](#) on page 284.
- Required Privilege: **Virtual machine.State.Remove Snapshot** on the virtual machine.

Procedure

- 1 Right-click the virtual machine and select **Manage Snapshots**.
 - a To locate a virtual machine, select a datacenter, folder, cluster, resource pool, host, or vApp.
 - b Click the **Related Objects** tab and click **Virtual Machines**.
- 2 In the Snapshot Manager, click a snapshot to select it.
- 3 Select whether to delete a single snapshot or all snapshots.

| Option | Description |
|-------------------|---|
| Delete | Consolidates the snapshot data to the parent snapshot and removes the selected snapshot from the Snapshot Manager and virtual machine. |
| Delete All | Consolidates all of the immediate snapshots before the You are here current state to the base parent disk and removes all existing snapshots from the Snapshot Manager and virtual machine. |

- 4 Click **Yes** in the confirmation dialog box.
- 5 Click **Close** to exit the Snapshot Manager.

Delete a Snapshot in the vSphere Client

You can use the Snapshot Manager to delete a single snapshot or all snapshots in a snapshot tree.

Use care when you delete snapshots. You cannot restore a deleted snapshot. For example, you might want to install several browsers, a, b, and c, and capture the virtual machine state after you install each browser. The first, or base snapshot, captures the virtual machine with browser a and the second snapshot captures browser b. If you restore the base snapshot that includes browser a and take a third snapshot to capture browser c and delete the snapshot that contains browser b, you cannot return to the virtual machine state that includes browser b.

Prerequisites

- Ensure that you are familiar with the Delete and Delete all actions and how they might affect virtual machine performance. See [“Deleting Snapshots,”](#) on page 284.
- Required Privilege: **Virtual machine.State.Remove Snapshot** on the virtual machine.

Procedure

- 1 Select **Inventory > Virtual Machine > Snapshot > Snapshot Manager**.
- 2 In the Snapshot Manager, click a snapshot to select it.
- 3 Select a delete option.

| Option | Description |
|-------------------|---|
| Delete | Consolidates the snapshot data to the parent snapshot and removes the selected snapshot from the Snapshot Manager and virtual machine. |
| Delete All | Consolidates all of the immediate snapshots before the You are here current state to the base parent disk and removes all existing snapshots from the Snapshot Manager and virtual machine. |

- 4 Click **Yes**.

Consolidate Snapshots in the vSphere Web Client

The presence of redundant delta disks can adversely affect virtual machine performance. You can combine such disks without violating a data dependency. After consolidation, redundant disks are removed, which improves virtual machine performance and saves storage space.

Snapshot consolidation is useful when snapshot disks fail to compress after a **Delete** or **Delete all** operation or if the disk did not consolidate. This might happen, for example, if you delete a snapshot but its associated disk does not commit back to the base disk.

The Needs Consolidation column in the vSphere Web Client shows the virtual machines to consolidate.

Prerequisites

Required privilege: **Virtual machine.State.Remove Snapshot**

Procedure

- 1 Show the Needs Consolidation column.
 - a Select a vCenter Server instance, a host, or a cluster and click the **Manage** tab and click **Virtual Machines**.
 - b Right-click the menu bar for any virtual machine column and select **Show/Hide Columns > Needs Consolidation**.

A Yes status indicates that the snapshot files for the virtual machine should be consolidated, and that the virtual machine's **Tasks and Events** tab shows a configuration problem. A No status indicates that the files are OK.

- 2 To consolidate the files, right-click the virtual machine and select **All vCenter Actions > Consolidate**.
- 3 Check the Needs Consolidation column to verify that the task succeeded.

If the task succeeded, a No value appears in the Needs Consolidation column.
- 4 If the task failed, check the event log for failed conditions, such as running out of disk space.
- 5 Correct the error, and retry the consolidation task.

The configuration problem is resolved, and the Needs Consolidation value is No.

Consolidate Snapshots in the vSphere Client

The snapshot Consolidation command searches for hierarchies or delta disks to combine without violating data dependency. After consolidation, redundant disks are removed, which improves virtual machine performance and saves storage space.

Snapshot consolidation is useful when snapshot disks fail to compact after a **Delete** or **Delete all** operation or if the disk did not consolidate. This might happen, for example, if you delete a snapshot but its associated disk does not commit back to the base disk.

The Needs Consolidation column in the vSphere Client shows the virtual machines that need to be consolidated and the virtual machine's **Summary** tab shows a Configuration Issues consolidation message if the virtual machine needs to be consolidated. If you see errors for failed conditions, such as running out of disk space, correct them and run the consolidation task.

Prerequisites

Required privilege: **Virtual machine.State.Remove Snapshot**

Procedure

- 1 Display the Need Consolidation column in the vSphere Client.
 - a Select a vCenter Server, host, or cluster and click the **Virtual Machines** tab.
 - b Right-click the menu bar for any virtual machine column and select **Needs Consolidation** from the menu.

The Needs Consolidation column appears. A Yes status indicates that the snapshot files for the virtual machine should be consolidated and that the virtual machine's **Tasks and Events** tab shows a configuration problem. A No status indicates that the files are OK.

- 2 To consolidate the files, right-click the virtual machine and select **Snapshot > Consolidate**.
- 3 Check the Need Consolidation column to verify that the task succeeded.

If the task succeeded, the Configuration Issues message should be cleared and the Needs Consolidation value should be No.

Managing vServices in the vSphere Web Client

A vService dependency allows a vApp or a virtual machine to request that a vService be available on a specified platform.

A vService specifies a particular service on which vApps and virtual machines can depend.

The vService management page tab displays all the dependencies that a virtual machine or vApp has and each of their states.

Add a vService Dependency in the vSphere Web Client

You can add a vService dependency to a virtual machine or vApp. This dependency allows a virtual machine or vApp to request that a specific vService be available.

Prerequisites

The virtual machine must be powered off before adding a dependency.

Procedure

- 1 Display the virtual machine or vApp in the inventory.
- 2 Right-click the virtual machine or vApp and select **Edit Settings**.
- 3 Click the **Manage** tab and click **vServices**.
- 4 Click **Add**.
- 5 In the New vService Dependency wizard, select the provider for this dependency and click **Next**.
- 6 Enter the name and description for this dependency and click **Next**.
- 7 If this dependency is required, select the check box.

Required dependencies must be bound before powering on.

- 8 If this dependency should be bound to the provider immediately, select the **Bind to provider immediately** check box after the validation is complete.

If you choose to bind this dependency now, the validation result displays. If the validation fails, you cannot complete adding the dependency. Deselect the check box to proceed.

- 9 Click **Next**.
- 10 Review the options and click **Finish** to create the dependency.

The new dependency is added to the list of dependencies.

Remove a vService Dependency in the vSphere Web Client

You can remove a vService dependency from a virtual machine or vApp.

Procedure

- 1 Display the virtual machine or vApp in the inventory.
- 2 Right-click the virtual machine or vApp and select **Edit Settings**.
- 3 Click the **Manage** tab and click **vServices**.
- 4 Select the dependency and click **Remove**.

The dependency is removed from the list.

Edit a vService Dependency in the vSphere Web Client

You can edit a vService dependency name, description, and requirement.

Procedure

- 1 Display the virtual machine or vApp in the inventory.
- 2 Right-click the virtual machine or vApp and select **Edit Settings**.
- 3 Click the **Manage** tab and click **vServices**.
- 4 Click **Edit**.
- 5 In the Dependency Properties dialog box, edit the dependency name and description.
- 6 Select or deselect the check box to change the required status of the dependency.

The required check box is disabled if the virtual machine or vApp is running.

- 7 Select a provider for the dependency.

When you select a provider, the description is entered containing the provider description. The validation box displays the results of the validation. If validation fails, the **OK** button is disabled until another provider or no provider is selected.

- 8 Click **OK**.

Required Privileges for Common Tasks

14

Many tasks require permissions on more than one object in the inventory. You can review the privileges required to perform the tasks and, where applicable, the appropriate sample roles.

The following table lists common tasks that require more than one privilege. You can use the Applicable Roles on the inventory objects to grant permission to perform these tasks, or you can create your own roles with the equivalent required privileges.

Table 14-1. Required Privileges for Common Tasks

| Task | Required Privileges | Applicable Role |
|--|---|---|
| Create a virtual machine | On the destination folder or datacenter: <ul style="list-style-type: none"> ■ Virtual machine.Inventory.Create new ■ Virtual Machine.Configuration.Add New Disk (if creating a new virtual disk) ■ Virtual Machine .Configuration.Add Existing Disk (if using an existing virtual disk) ■ Virtual Machine.Configuration.Raw Device (if using a RDM or SCSI pass-through device) | Virtual Machine Administrator |
| | On the destination host, cluster, or resource pool: Resource.Assign Virtual Machine to Resource Pool | Virtual Machine Administrator |
| | On the destination datastore or folder containing a datastore: Datastore.Allocate Space | Datastore Consumer or Virtual Machine Administrator |
| | On the network that the virtual machine will be assigned to: Network.Assign Network | Network Consumer or Virtual Machine Administrator |
| Deploy a virtual machine from a template | On the destination folder or datacenter: <ul style="list-style-type: none"> ■ Virtual machine .Inventory.Create from existing ■ Virtual Machine .Configuration.Add Add New Disk | Virtual Machine Administrator |
| | On a template or folder of templates: Virtual Machine.Provisioning.Deploy Template | Virtual Machine Administrator |
| | On the destination host, cluster or resource pool: Resource.Assign Virtual.Machine to Resource Pool | Virtual Machine Administrator |
| | On the destination datastore or folder of datastores: Datastore.Allocate Spaces | Datastore Consumer or Virtual Machine Administrator |

Table 14-1. Required Privileges for Common Tasks (Continued)

| Task | Required Privileges | Applicable Role |
|---|--|--|
| | On the network that the virtual machine will be assigned to: Network.Assign Network | Network Consumer or Virtual Machine Administrator |
| Take a virtual machine snapshot | On the virtual machine or a folder of virtual machines: Virtual Machine.State.Create Snapshots | Virtual Machine Power User or Virtual Machine Administrator |
| | On the destination datastore or folder of datastores: Datastore.Allocate Space | Datastore Consumer or Virtual Machine Administrator |
| Move a virtual machine into a resource pool | On the virtual machine or folder of virtual machines: <ul style="list-style-type: none"> ■ Resource.Assign Virtual Machine to Resource Pool ■ Virtual machine.Inventory.Move | Virtual Machine Administrator |
| | On the destination resource pool: Resource.Assign Virtual Machine to Resource Pools | Virtual Machine Administrator |
| Install a guest operating system on a virtual machine | On the virtual machine or folder of virtual machines: <ul style="list-style-type: none"> ■ Virtual Machine.Interaction.Answer Question ■ Virtual Machine.Interaction.Console Interaction ■ Virtual Machine.Interaction.Device Connection ■ Virtual Machine.Interaction.Power Offs ■ Virtual Machine.Interaction.Power On ■ Virtual Machine.Interaction.Reset ■ Virtual Machine.Interaction.Configure CD Media (if installing from a CD) ■ Virtual Machine.Interaction.Configure Floppy Media (if installing from a floppy disk) ■ Virtual Machine.Interaction.Tools Install | Virtual Machine Power User or Virtual Machine Administrator |
| | On a datastore containing the installation media ISO image: Datastore.Browse Datastore (if installing from an ISO image on a datastore) | Virtual Machine Power User or Virtual Machine Administrator |
| | On the datastore to which you upload the installation media ISO image: <ul style="list-style-type: none"> ■ Datastore.Browse datastore ■ Datastore.Low level file operations | |
| Migrate a virtual machine with vMotion | On the virtual machine or folder of virtual machines: <ul style="list-style-type: none"> ■ Resource.Migrate ■ Resource.Assign Virtual Machine to Resource Pool (if destination is a different resource pool from the source) | Datacenter Administrator or Resource Pool Administrator or Virtual Machine Administrator |
| | On the destination host, cluster, or resource pool (if different from the source): Resource.Assign Virtual Machine to Resource Pool | Datacenter Administrator or Resource Pool Administrator or Virtual Machine Administrator |
| Cold migrate (relocate) a virtual machine | On the virtual machine or folder of virtual machines: <ul style="list-style-type: none"> ■ Resource.Relocate ■ Resource.Assign Virtual Machine to Resource Pool (if destination is a different resource pool from the source) | Datacenter Administrator or Resource Pool Administrator or Virtual Machine Administrator |

Table 14-1. Required Privileges for Common Tasks (Continued)

| Task | Required Privileges | Applicable Role |
|--|---|--|
| | On the destination host, cluster, or resource pool (if different from the source): Resource.Assign Virtual Machine to Resource Pool | Datacenter Administrator or Resource Pool Administrator or Virtual Machine Administrator |
| | On the destination datastore (if different from the source): Datastore.Allocate Space | Datastore Consumer or Virtual Machine Administrator |
| Migrate a Virtual Machine with Storage vMotion | On the virtual machine or folder of virtual machines: Resource.Migrate | Datacenter Administrator or Resource Pool Administrator or Virtual Machine Administrator |
| | On the destination datastore: Datastore.Allocate Space | Datastore Consumer or Virtual Machine Administrator |
| Move a host into a cluster | On the host: Host.Inventory.Add Host to Cluster | Datacenter Administrator or Virtual Machine Administrator |
| | On the destination cluster: Host.Inventory.Add Host to Cluster | Datacenter Administrator or Virtual Machine Administrator |

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