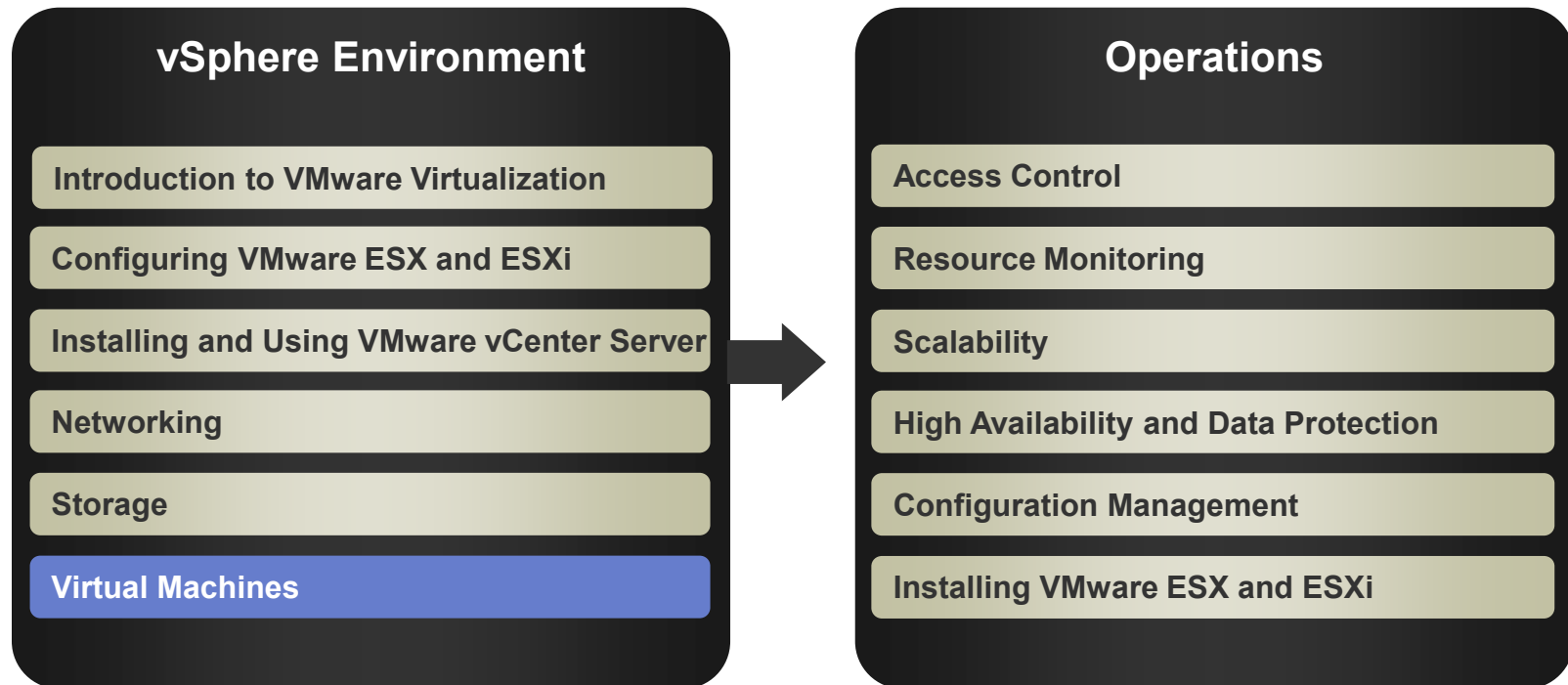




# Virtual Machines

## Module 7

## You Are Here



## Importance

- There are a number of ways to create a virtual machine. Choosing the correct method can help you save time and make the deployment process manageable and scalable.

## Module Lessons

- Lesson 1: Virtual Machine Concepts**
- Lesson 2: Creating a Virtual Machine**
- Lesson 3: Creating Templates and Clones**
- Lesson 4: VMware vCenter Converter**
- Lesson 5: vCenter Guided Consolidation**
- Lesson 6: Modifying Virtual Machines**
- Lesson 7: Managing Virtual Machines**



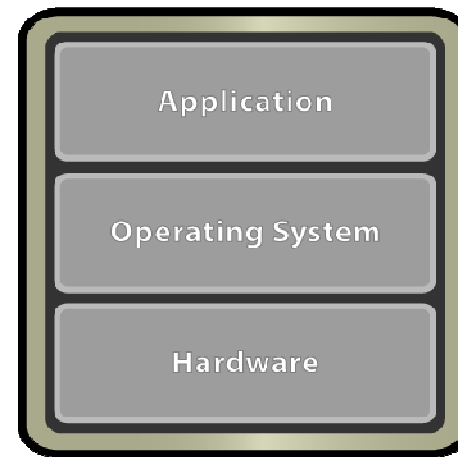
# Lesson 1: Virtual Machine Concepts

## Lesson Objectives

- Describe a virtual machine
- List the virtual machine hardware
- Display a virtual machine's files

## What Is a Virtual Machine?

- > It is a set of virtual hardware on which a supported guest operating system and its applications run.
- > It is a set of discrete files.
- > A virtual machine's configuration file describes the virtual machine's configuration, including its virtual hardware.
  - Avoid using special characters and spaces in the virtual machine's name.



**Virtual Machine**

**MyVM.vmx**

```
guestOS = "winnetstandard"  
displayName = "MyVM"  
(etc.)
```

## What Files Make Up a Virtual Machine?

File name	Description
<VM_name>.vmx	<b>Virtual machine configuration file</b>
<VM_name>.vmdk	<b>File describing virtual disk characteristics</b>
<VM_name>-flat.vmdk	<b>Preallocated virtual disk file that contains the data</b>
<VM_name>.nvram	<b>Virtual machine BIOS</b>
vmware.log	<b>Virtual machine log file</b>
vmware-#.log (where # is number starting with 1)	<b>Files containing old virtual machine log entries</b>
<VM_name>.vswp	<b>Virtual machine swap file</b>
<VM_name>.vmsd	<b>File that describes virtual machine's snapshots</b>
<b>Additional files can exist if snapshots are taken or raw disk mappings are added (to be discussed later).</b>	



## Displaying a Virtual Machine's Files

**Click the Storage link in the Configuration tab.**  
**Right-click a datastore to browse its files.**

View: Datstores Devices

**Datstores**

Identification	Status	Device	Capacity
SharedVMs	✓ Normal	DGC Fibre Channel...	99.75 GB
Storage1	✓ Normal	Local VMware Disk...	67.00 GB
NFS_Library (e)			1,008.38 G
iSCSILUN			1.75 GB
Private04			4.75 GB

Context menu for Storage1:

- Browse Datastore...
- Alarm
- Rename
- Delete
- Refresh
- Properties...
- Copy to Clipboard Ctrl+C

**Datstore Browser - [Storage1]**

Folders | Search | **[Storage1] VM-for-StudentA**

Name	Size	Type	Path
VM-for-StudentA.vmdk	3,145,728.00 KB	Virtual Disk	[Storage1] VM-for-StudentA
VM-for-StudentA.vmx	2.56 KB	Virtual Machine	[Storage1] VM-for-StudentA
VM-for-StudentA.vmx	0.26 KB	File	[Storage1] VM-for-StudentA
VM-for-StudentA.vmsd	0.00 KB	File	[Storage1] VM-for-StudentA
VM-for-StudentA.nvram	8.48 KB	Non-volatile me...	[Storage1] VM-for-StudentA
vmware-1.log	40.04 KB	Virtual Machine ...	[Storage1] VM-for-StudentA
vmware.log	54.79 KB	Virtual Machine ...	[Storage1] VM-for-StudentA
VM-for-StudentA-a45fdc09.vswp	262,144.00 KB	File	[Storage1] VM-for-StudentA

## Displaying Files Using the Storage Views Tab

**Click the Storage Views tab.**

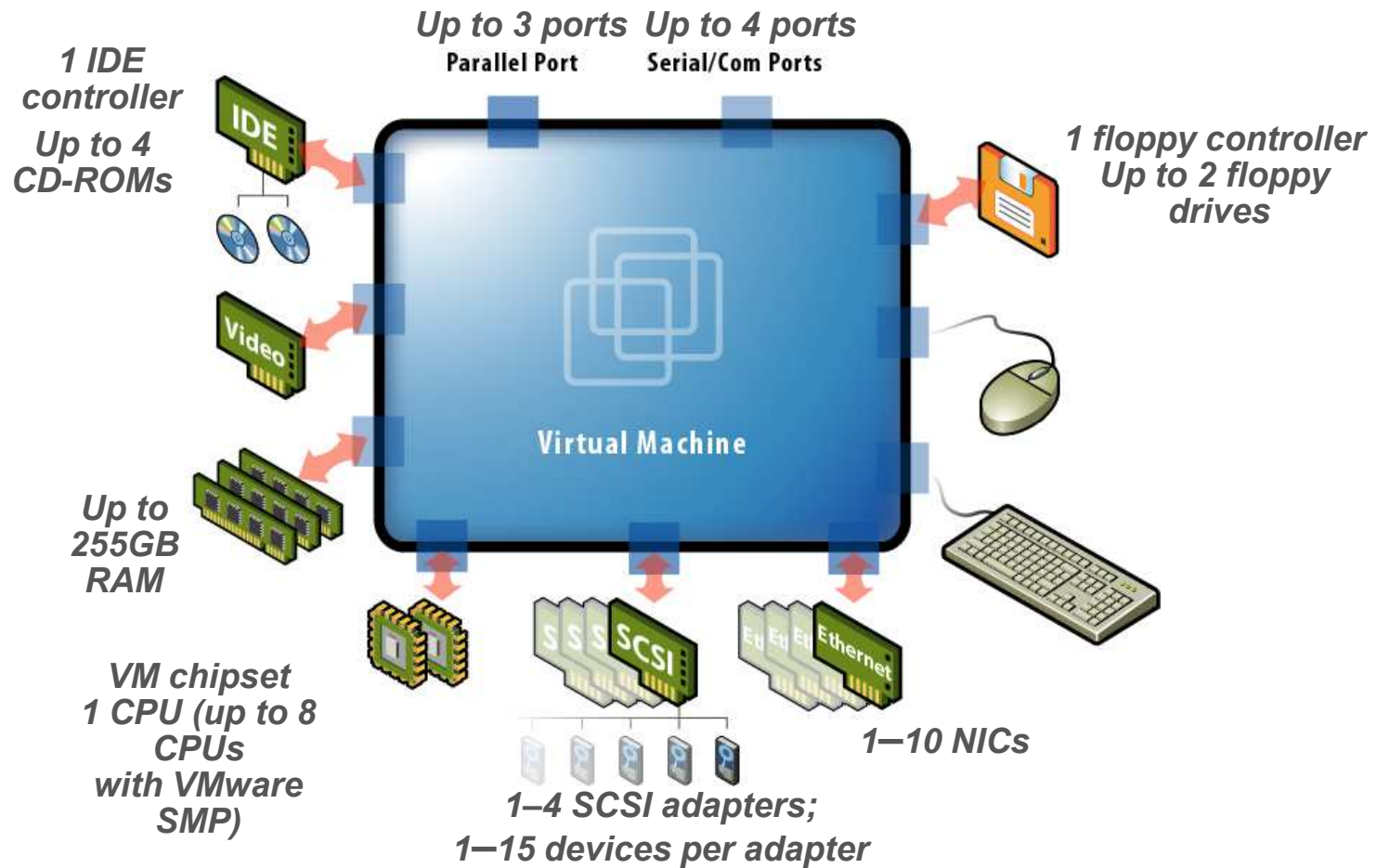
**Select Show All Virtual Machine Files from the menu.**

View: **Reports** **Maps** Last Update Time:

Show all Virtual Machine Files ▾ Name, Path or File type contains

Name	Path	File type	Datastore	Size
vmware-1.log	[Storage1] VM-for-StudentA/vmware-1.log	Log	Storage1	40.04
VM-for-StudentA.vmdk	[Storage1] VM-for-StudentA/VM-for-StudentA.vmdk	Disk Descriptor	Storage1	507.0
VM-for-StudentA.vmsd	[Storage1] VM-for-StudentA/VM-for-StudentA.vmsd	Snapshot List	Storage1	0.00 B
VM-for-StudentA.vmx	[Storage1] VM-for-StudentA/VM-for-StudentA.vmx	Extended Configuration	Storage1	270.0
vmware.log	[Storage1] VM-for-StudentA/vmware.log	Log	Storage1	54.79
VM-for-StudentA-flat.vmdk	[Storage1] VM-for-StudentA/VM-for-StudentA-flat.vmdk	Disk Extent	Storage1	3.00 G
VM-for-StudentA-a45fdc09...	[Storage1] VM-for-StudentA/VM-for-StudentA-a45fdc09...	Swap	Storage1	256.0
VM-for-StudentA.nvram	[Storage1] VM-for-StudentA/VM-for-StudentA.nvram	NVRAM	Storage1	8.48 K
VM-for-StudentA.vmx	[Storage1] VM-for-StudentA/VM-for-StudentA.vmx	Configuration	Storage1	2.56 K

# Virtual Machine Hardware



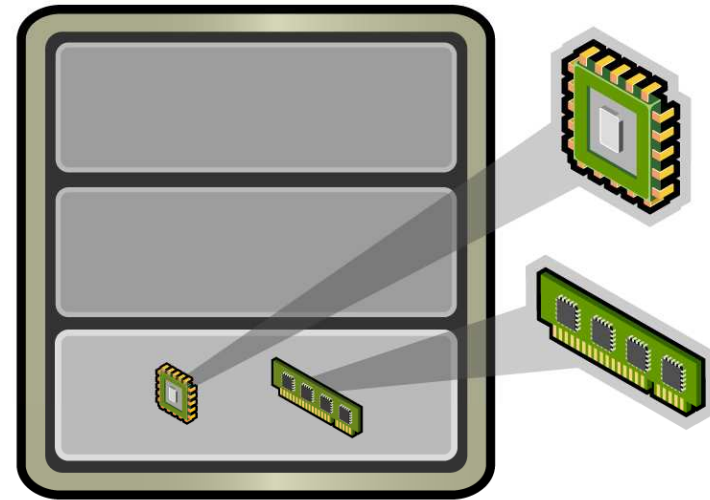
## CPU and Memory

### Up to eight virtual CPUs (VCPUs)

- > Virtual SMP license required
- > Also depends on number of licensed CPUs on a host and the number of processors supported by a guest operating system

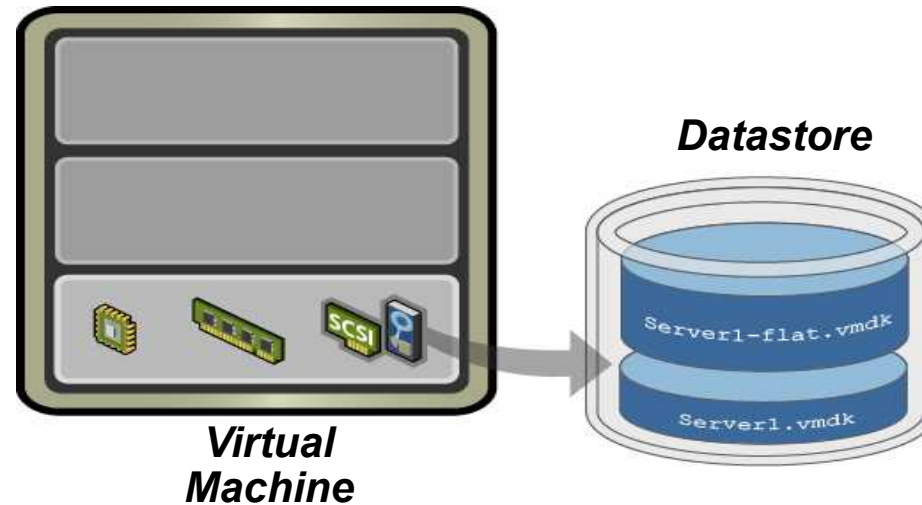
### Maximum memory size (up to 255GB)

- > Amount the guest operating system will be told it has



*Virtual Machine*

## Virtual Disk

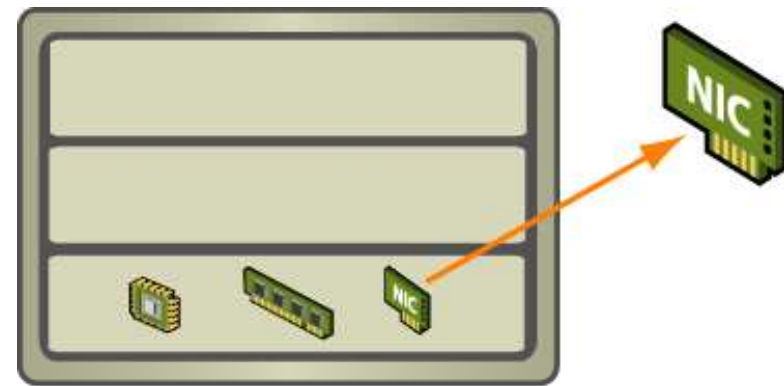


Parameter	Sample value
Virtual disk size	4GB
Datastore	MyVMFS
Virtual disk node	0:0
Virtual storage adapter	LSILogic (or BusLogic)
Virtual disk files	<VM_name>.vmdk and <VM_name>-flat.vmdk
Advanced setting: Mode	Independent – Persistent or nonpersistent

## Virtual NIC

The following network adapters might be available for your virtual machine:

- vance – Also called PCNet32, supported by most 32-bit guest operating systems
- vmxnet – Provides significantly better performance than vance
- Flexible – Can function as either a vance or vmxnet adapter
- e1000 – High-performance adapter available only for some guest operating systems
- Enhanced vmxnet – vmxnet adapter with enhanced performance
- vmxnet3 – Builds on the Enhanced vmxnet adapter



Virtual Machine



## Other Devices

### CD-ROM drive

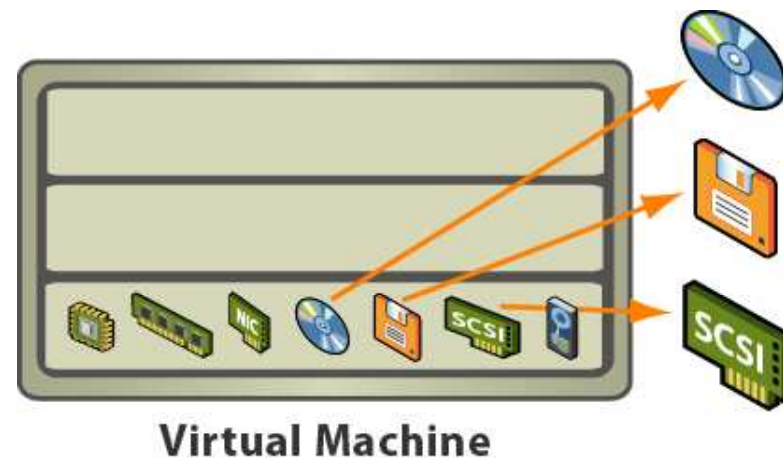
- Connect to CD-ROM or ISO image.

### Floppy drive

- Connect to floppy or floppy image.

### Generic SCSI devices (such as tape libraries)

- Can be connected to additional SCSI adapters



## Virtual Machine Console

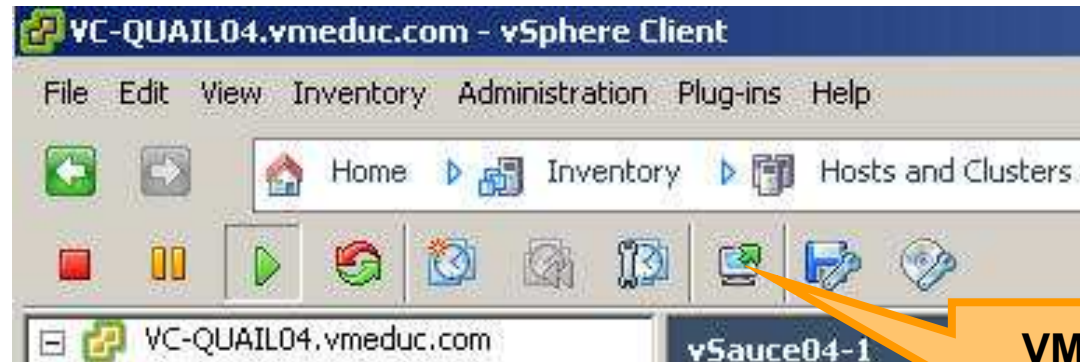
**Send power changes to virtual machine.**

**Access virtual machine's guest operating system.**

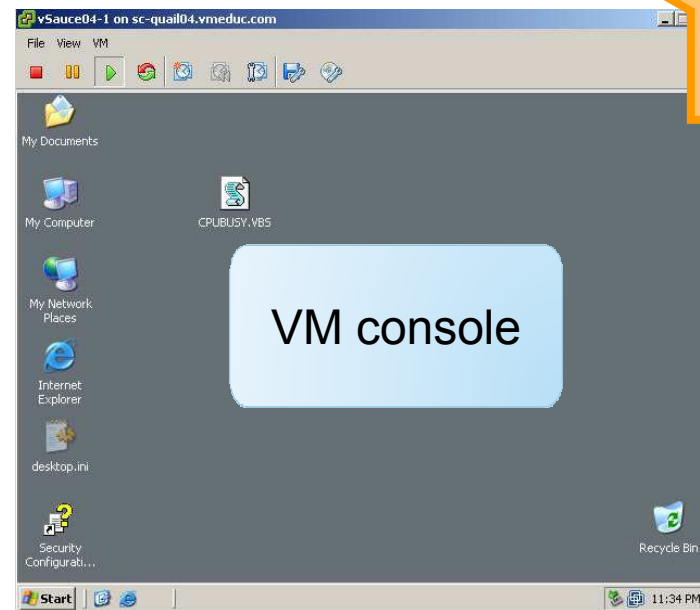
**Send Ctrl+Alt+Del to guest operating system.**

- Press Ctrl+Alt+Ins in virtual machine console.

**Press Ctrl+Alt to release cursor from virtual machine console.**



**VM console icon**



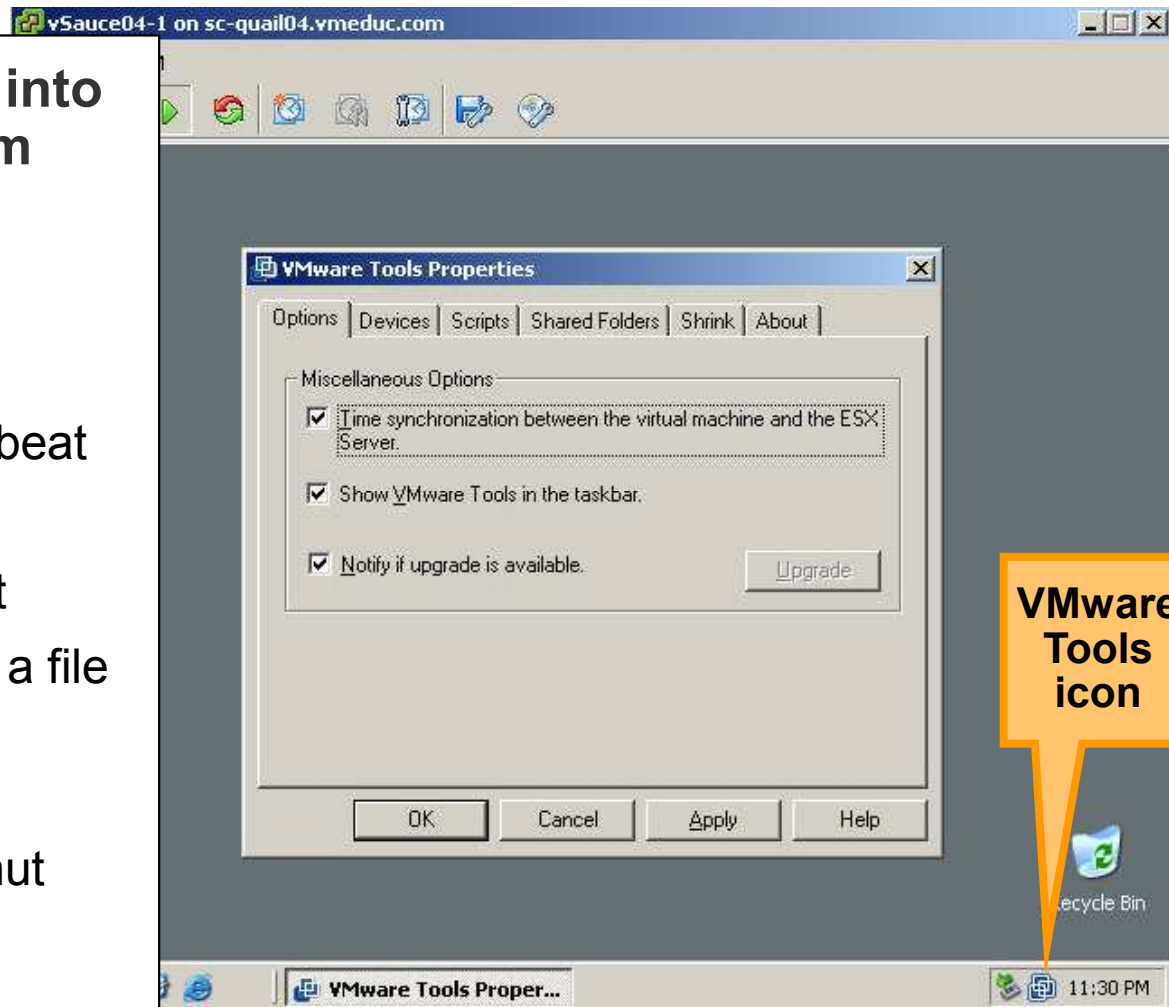


# VMware Tools

**VMware Tools installs into guest operating system like an application.**

## Features include:

- Device drivers
- Virtual machine heartbeat
- Improved mouse
- Memory management
- Support for quiescing a file system
- Time synchronization
- Ability to gracefully shut down virtual machine



## Provisioning a Virtual Machine

### Several methods for creating virtual machines:

- Use the Create New Virtual Machine wizard.
- Import a virtual appliance.
- Deploy a virtual machine from template.
- Clone a virtual machine.
- Use VMware vCenter™ Converter.
- Use VMware vCenter Guided Consolidation.

# VMware Products for Provisioning Virtual Machines

## VMware vCenter Lifecycle Manager



## VMware Lab Manager

- Allows you to create and manage a library of commonly used configurations and dynamically provision them in seconds

## Lesson Summary

- A virtual machine is a discrete set of files that is located in a datastore.
- Display a virtual machine's files using the host's Configuration tab or Storage Views tab.
- VMware Tools provides features such as enhanced device drivers, improved mouse movement, and a virtual machine heartbeat.



# Lesson 2: Creating a Virtual Machine

## Lesson Objectives

- Provision a virtual machine
  - Create the virtual machine
  - Install the guest operating system into the virtual machine
  - Install VMware Tools into the guest operating system
- Describe how to import a virtual appliance

## Creating a Virtual Machine: Launch Wizard

### Create a new virtual machine in the VMware vCenter Server inventory.

- > In the Hosts and Clusters view, select a datacenter, cluster, or host.
- > In the VMs and Templates view, select a datacenter or folder.

### Launch the Create New Virtual Machine wizard.

- > Perform a “typical” or “custom” configuration.



## Choosing the Typical Configuration

### Information needed for a typical configuration:

- Virtual machine name and inventory location
- Location in which to place the virtual machine (cluster, host, resource pool)
- Datastore on which to store virtual machine's files
- Guest operating system and version
- Disk parameters for creating a new virtual disk:
  - Disk size
  - Disk-provisioning settings:
    - **Allocate and commit space on demand (Thin Provisioning)**
    - **Support clustering features such as Fault Tolerance**



## Choosing the Custom Configuration

### Additional information needed for a custom configuration:

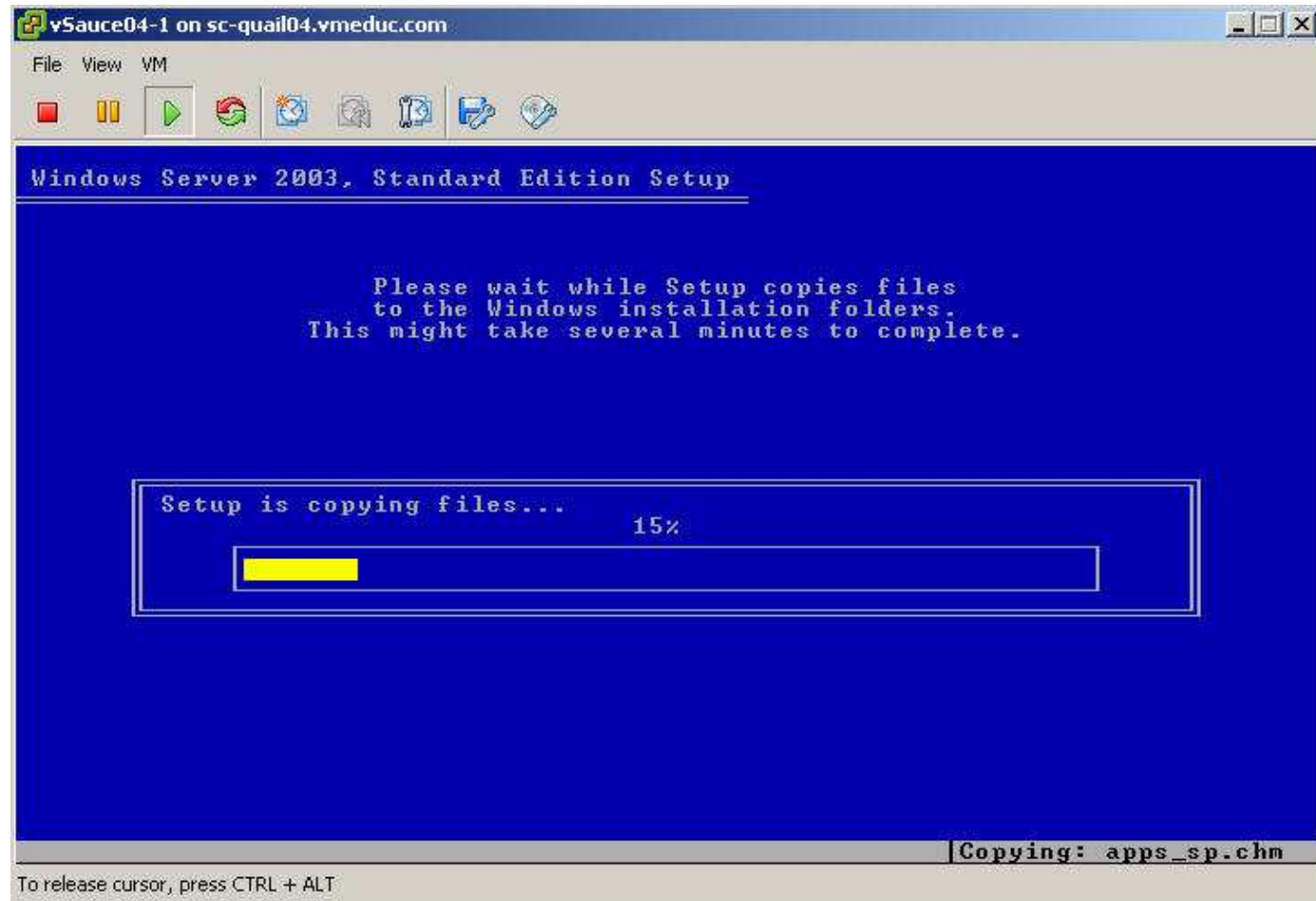
- > Virtual machine version (version 7 is the latest)
- > Number of CPUs and size of memory
- > Number of NICs, network to connect to, and network adapter type
- > SCSI controller type
- > Whether to create a new disk, use an existing disk, use an RDM, or use no disk
- > Additional disk-provisioning settings:
  - Store virtual disk with virtual machine or in a different datastore
  - Virtual device node (for example, SCSI(0:0))
  - Mode-independent (persistent and nonpersistent)

**You can also edit the virtual machine settings before completing the creation task.**

- > For example, attach an ISO image to the virtual CD-ROM device.

## Installing the Guest Operating System

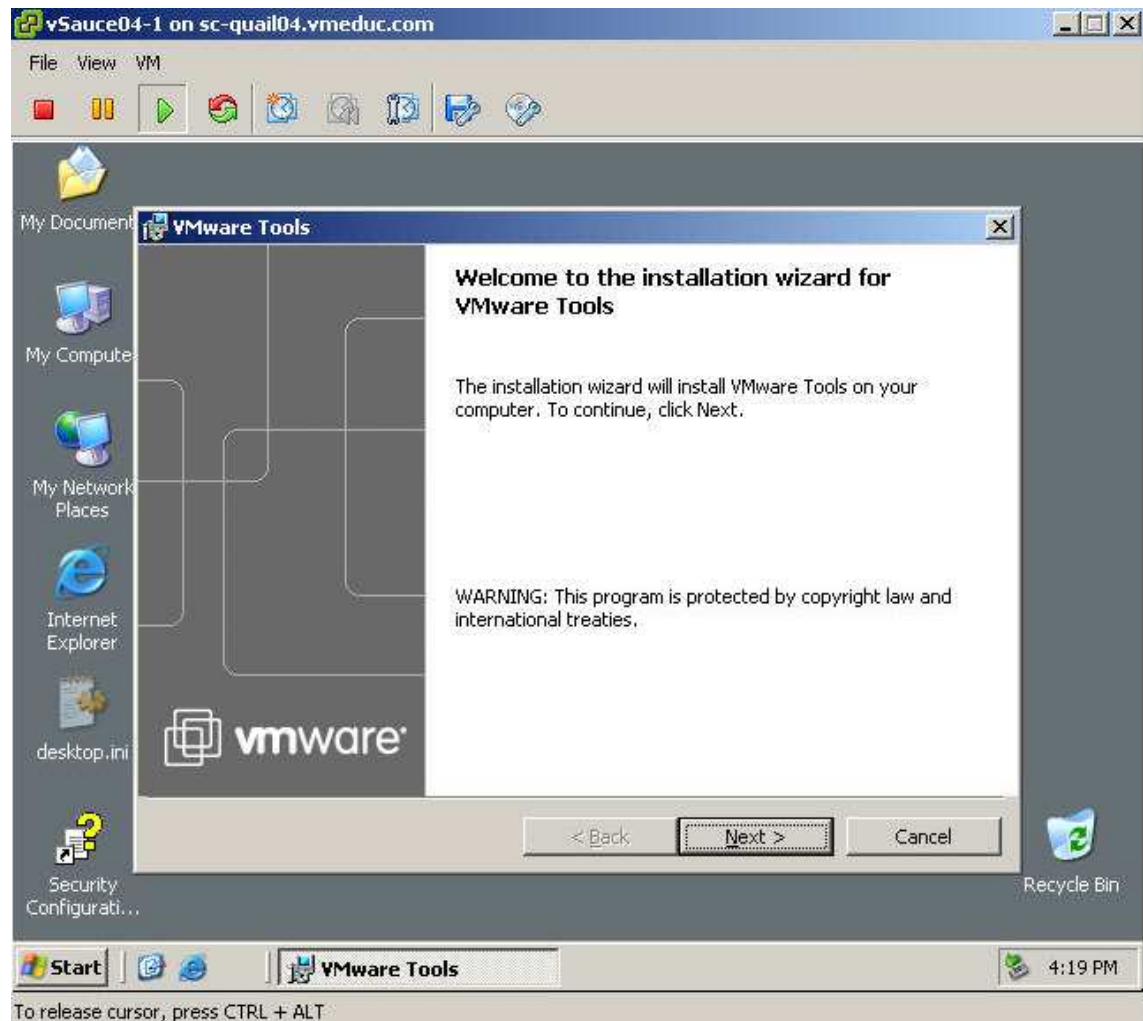
Install the guest operating system into the virtual machine.



## Installing VMware Tools

### Install VMware Tools.

- Right-click virtual machine in the inventory, then choose **Guest > Install/Update VMware Tools**.



## Virtual Appliances

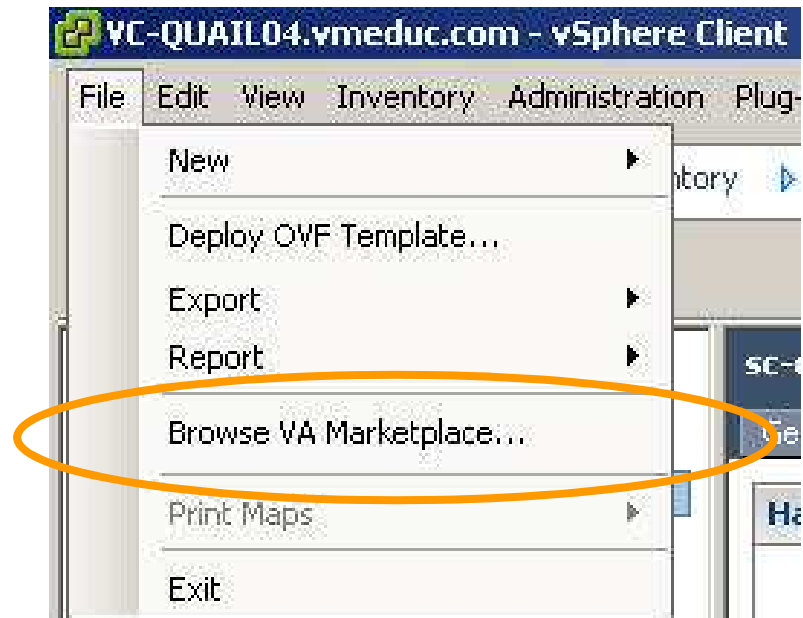
### Preconfigured virtual machines:

- > Usually designed for a single purpose (for example, a safe browser or firewall)
- > Deployed as an OVF template

### Available from the VMware Virtual Appliance Marketplace

- > <http://www.vmware.com/appliances>

### Upload into vCenter Server using the vSphere Client.



## Deploy OVF Template

Another way to deploy a virtual appliance: Deploy from an OVF template.

The screenshot shows the vSphere interface with the 'Deploy OVF Template...' menu option highlighted in orange. The 'Deploy OVF Template' dialog box is open, showing the 'Source' section with the following details:

- Source**
  - OVF Template Details
  - Name and Location
  - Datastore
  - Ready to Complete

The dialog box has two radio button options for the source location:

- Deploy from file:
  - Text input field with a dropdown arrow and a 'Browse...' button.
  - Text: Choose this option if the source OVF template (\*.ovf) is on the local file system. For example, your C: drive, a network share, or a CD/DVD drive.
- Deploy from URL:
  - Text input field with a dropdown arrow.
  - Text: Choose this option to download the OVF template from the Internet and enter a URL such as <http://www.example.com/template.ovf>

## Lab 9

**In this lab, you will create a virtual machine using the Create Virtual Machine wizard.**

1. Create a virtual machine.
2. Install a guest operating system in a virtual machine.
3. Create a virtual machine on an iSCSI VMFS datastore.
4. Import a virtual machine into the inventory.
5. Install VMware Tools into a Windows guest operating system.
6. Enable time synchronization between the virtual machine and the host.
7. Copy class lab files to your virtual machine.

## Lesson Summary

- Using the Create Virtual Machine wizard is one way to create a virtual machine.
- Always install VMware Tools into a virtual machine.
- Virtual appliances are preconfigured virtual machines and can be imported from Web sites like the Virtual Appliance Marketplace.



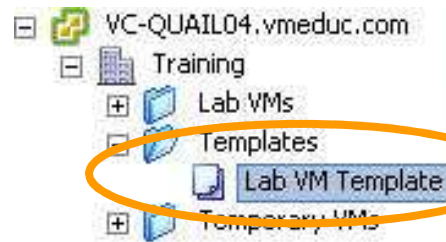
# Lesson 3: Creating Templates and Clones



## Lesson Objectives

- Create a template
- Deploy a virtual machine from a template
- Clone a virtual machine
- Allow guest operating system customization by vCenter Server

## What Is a Template?



**A master copy of a virtual machine used to create and provision new virtual machines**

**An image that typically includes a guest operating system, a set of applications, and a specific virtual machine configuration**

The screenshot shows the 'Lab VM Template' configuration page in vSphere. The page has tabs for 'Getting Started', 'Summary', 'Resource Allocation', and 'Tasks & Events'. The 'Summary' tab is selected, showing the following details:

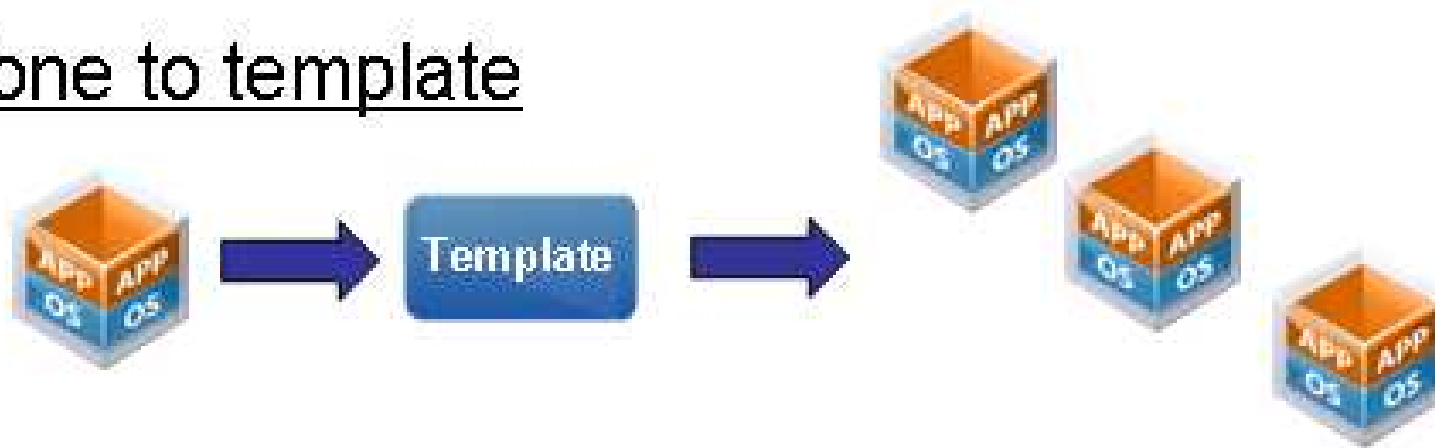
General	
Guest OS:	Microsoft Windows XP Professional (32-bit)
VM Version:	4
CPU:	1 vCPU
Memory:	256 MB
Memory Overhead:	109.02 MB
VMware Tools:	Not running
IP Addresses:	
DNS Name:	
State:	Powered Off
Host:	<a href="#">sc-quail04.vmeduc.com</a>
Active Tasks:	

Below the 'General' section is a 'Commands' section with two options:

- Deploy Virtual Machine from this Template
- Convert to Virtual Machine

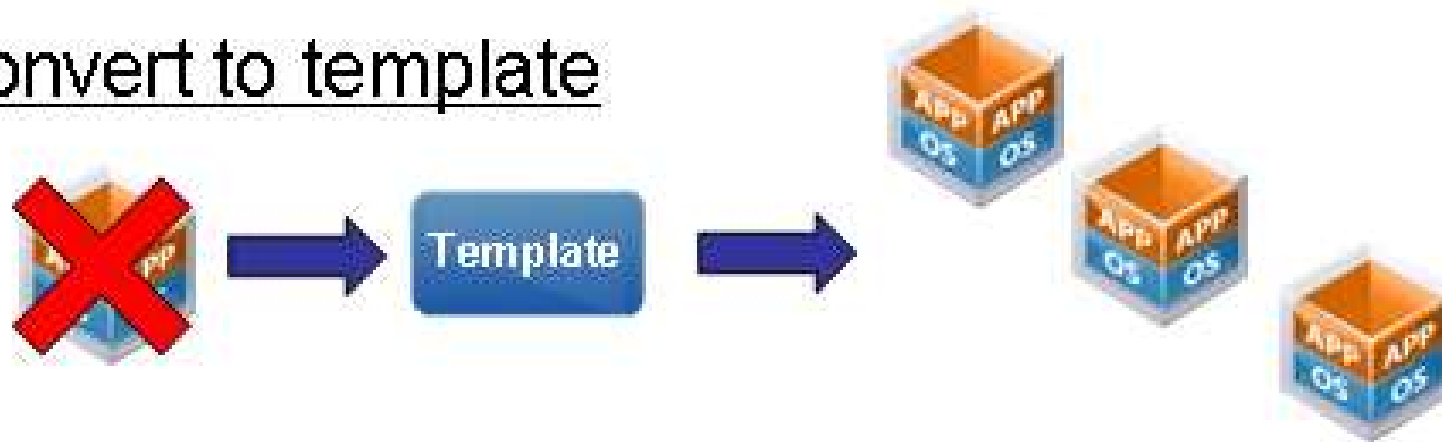
## Creating a Template

### Clone to template



---

### Convert to template



## Viewing Templates

There are two ways to view templates:

- Use the VMs and Templates inventory view.
- Use the Virtual Machines tab in the Hosts and Clusters inventory view.

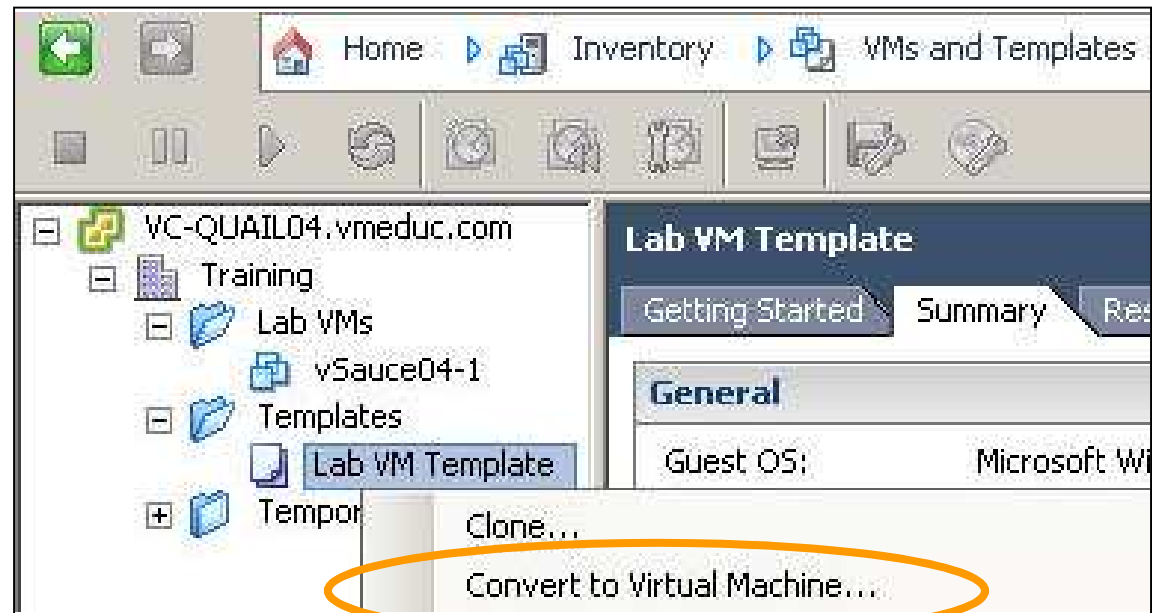
The screenshot displays the VMware vSphere interface. The breadcrumb navigation at the top indicates the path: Home > Inventory > Hosts and Clusters. The left-hand pane shows a tree view of the inventory, with 'VC-QUAIL04.vmeduc.com' expanded to show 'Training' > 'Lab Servers' > 'sc-quail04.vmeduc.com'. Under 'sc-quail04.vmeduc.com', three items are listed: 'VM-for-StudentA', 'vSauce04-1', and 'sc-quail07.vmeduc.com'. The right-hand pane shows the details for 'sc-quail04.vmeduc.com VMware ESX, 4.0.0, 16290'. The 'Virtual Machines' tab is selected, displaying a table of VMs:

Name	State	Status
VM-for-StudentA	Powered On	✓ Normal
Lab VM Template	Powered Off	✓ Normal
vSauce04-1	Powered Off	✓ Normal

## Updating a Template

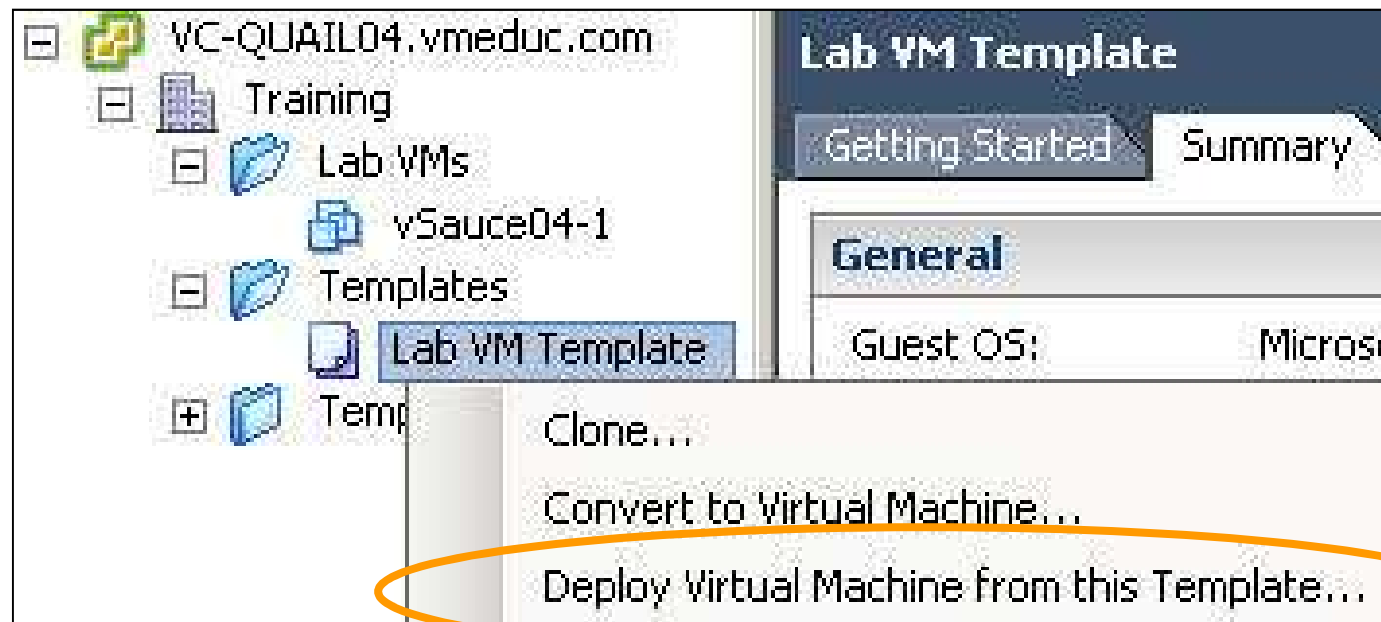
### To update a template:

- > Convert the template to a virtual machine.
- > Place the virtual machine on an isolated network to prevent user access.
- > Make appropriate changes to the virtual machine.
- > Convert the virtual machine back to a template.



## Deploying a Virtual Machine from Template

To deploy a virtual machine, provide such information as virtual machine name, inventory location, host, datastore, and guest operating system customization data.



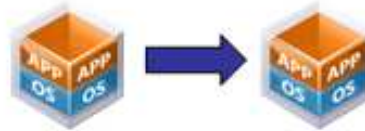
## Cloning a Virtual Machine

**Cloning is an alternative to deploying a virtual machine.**

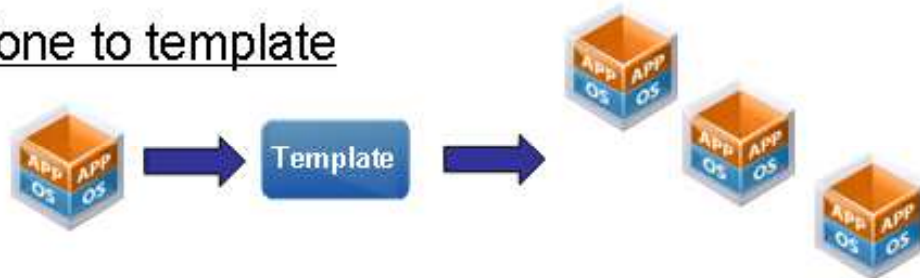
**A clone is an exact copy of the virtual machine.**

**The virtual machine being cloned can either be powered on or powered off.**

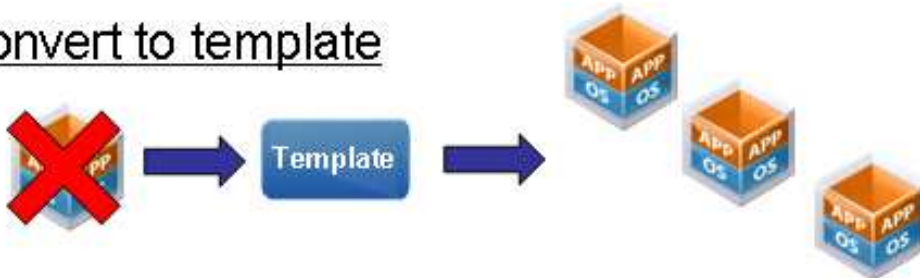
Clone



Clone to template



Convert to template



## Customizing the Guest Operating System

**During cloning or deploying from template, you have the option of running the Guest Customization wizard.**

- The wizard lets you create a specification you can use to prepare the guest operating systems of virtual machines.
- Specifications can be stored in the database.
- You can edit existing specifications using the Customization Specifications Manager.

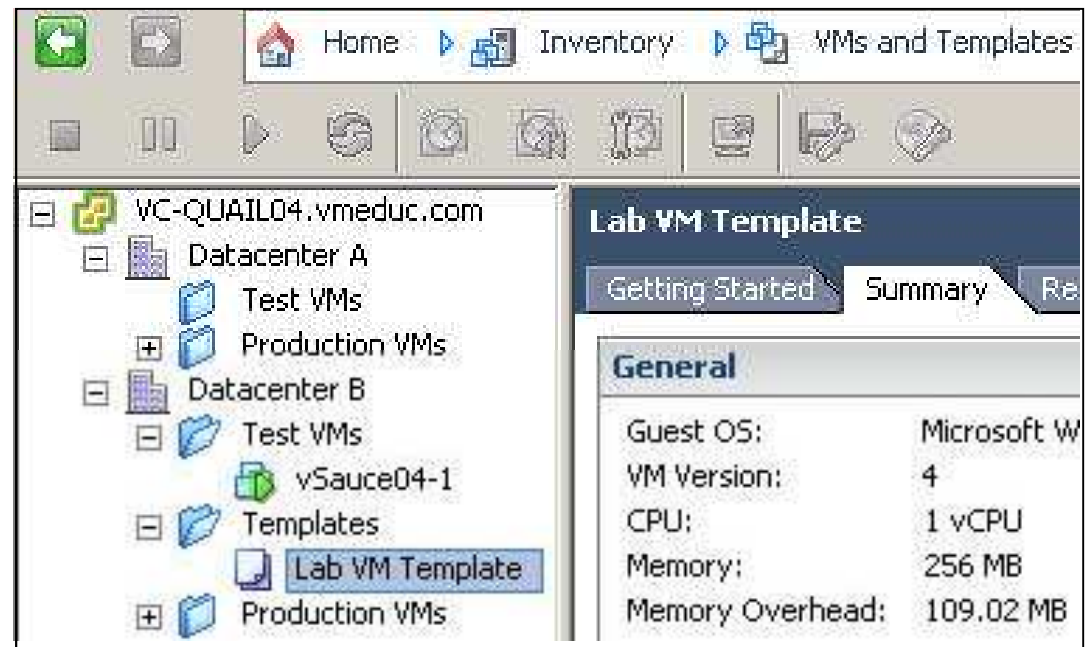
**Customization of a clone's guest is recommended to prevent software and network conflicts.**



## Deploying Virtual Machines Across Datacenters

**Virtual machine deployment is allowed across datacenters.**

- > Clone a virtual machine from one datacenter to another.
- > Deploy from a template located in one datacenter to a virtual machine in a different datacenter.



## Lab 10

**In this lab, you will deploy a virtual machine from a template and clone a virtual machine.**

1. Configure guest operating system customization on vCenter Server system.
2. Create a template.
3. Deploy a virtual machine from a template.
4. Clone a virtual machine that is powered on.

## Lesson Summary

- A template is a master copy of a virtual machine used to create and provision new virtual machines.
- Deploying a virtual machine from template should be the preferred method for provisioning virtual machines, over creating a virtual machine using the Create Virtual Machine wizard.
- Another way to provision a virtual machine is to clone a virtual machine that is either powered on or powered off.



# Lesson 4: VMware vCenter Converter

## Lesson Objectives

- Describe the capabilities of vCenter Converter
- Import a system into vCenter Server
- Describe hot cloning and cold cloning

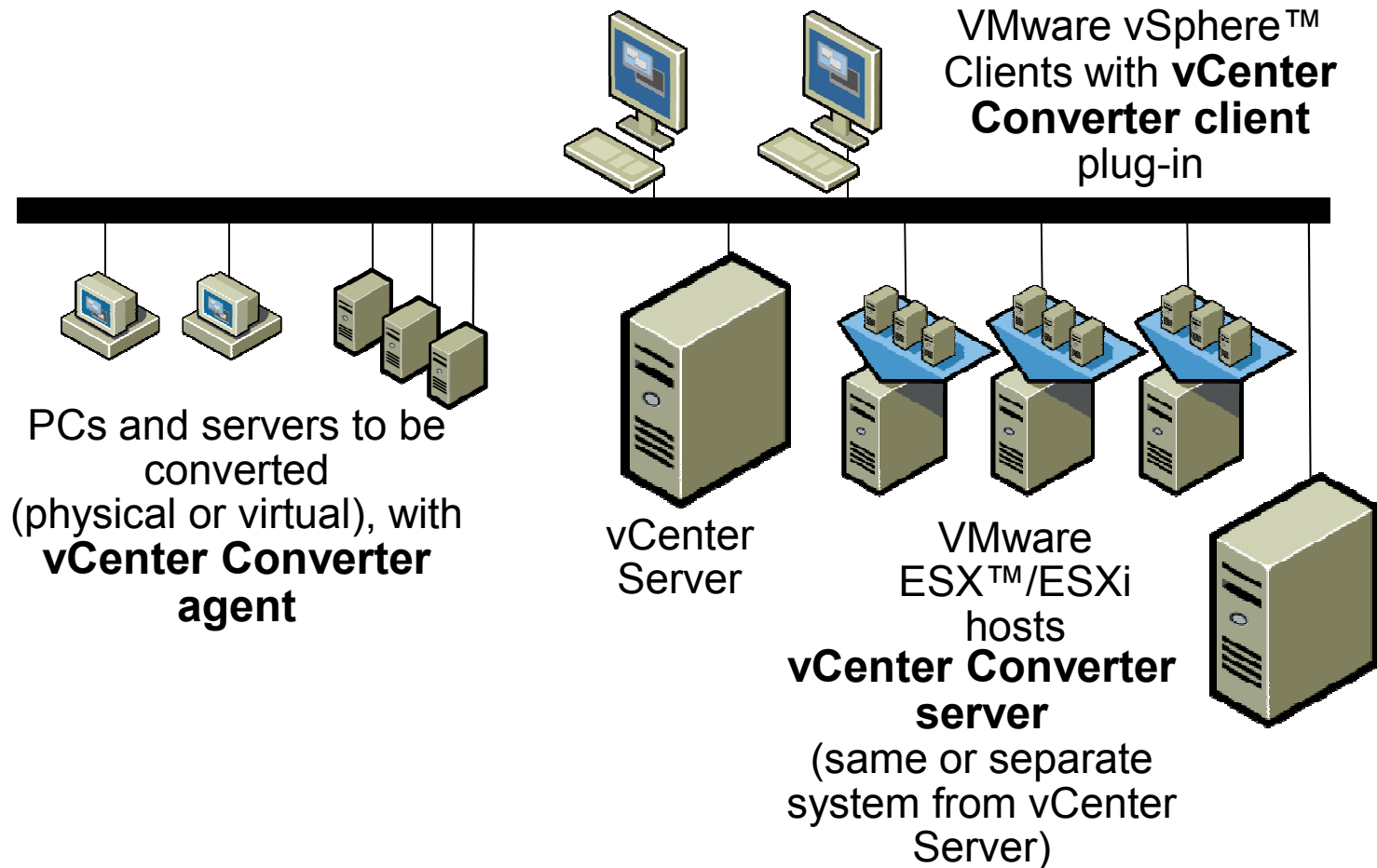
## vCenter Converter Capabilities

**vCenter Converter is a vCenter Server additional module used to import, export, or reconfigure physical or virtual machines or system images.**

- Convert the following types of systems to virtual machines and import them into vCenter Server:
  - Physical machines
  - Virtual machines, such as VMware Workstation, Microsoft Virtual Server 2005, and Windows Server 2008 Hyper-V
  - Third-party backups or disk images
- Restore VMware Consolidated Backup images to virtual machines.
- Export vCenter Server virtual machines to other VMware virtual machine formats.
- Customize virtual machines (for example, change the host name or network settings).

**A standalone version of vCenter Converter is also available.**

# vCenter Converter Components



## vCenter Converter Requirements

**Install vCenter Converter on the vCenter Server system or on a separate system.**

**Allocate disk space for the various vCenter Converter components:**

- > vCenter Converter server files, vCenter Converter CLI, vCenter Converter agent files, vCenter Converter client files, and the installers
- > Approximately 300MB of disk space is needed for all components.

**Memory requirements depend on whether hot or cold cloning is performed**

- > Hot cloning – 350MB of memory is required on source physical machine.
- > Cold cloning – At least 264MB of memory is required on source physical machine; 364MB or more is preferred.



## Importing a Physical System

**Cloning and system reconfiguration steps are used to create and reconfigure the virtual machine.**

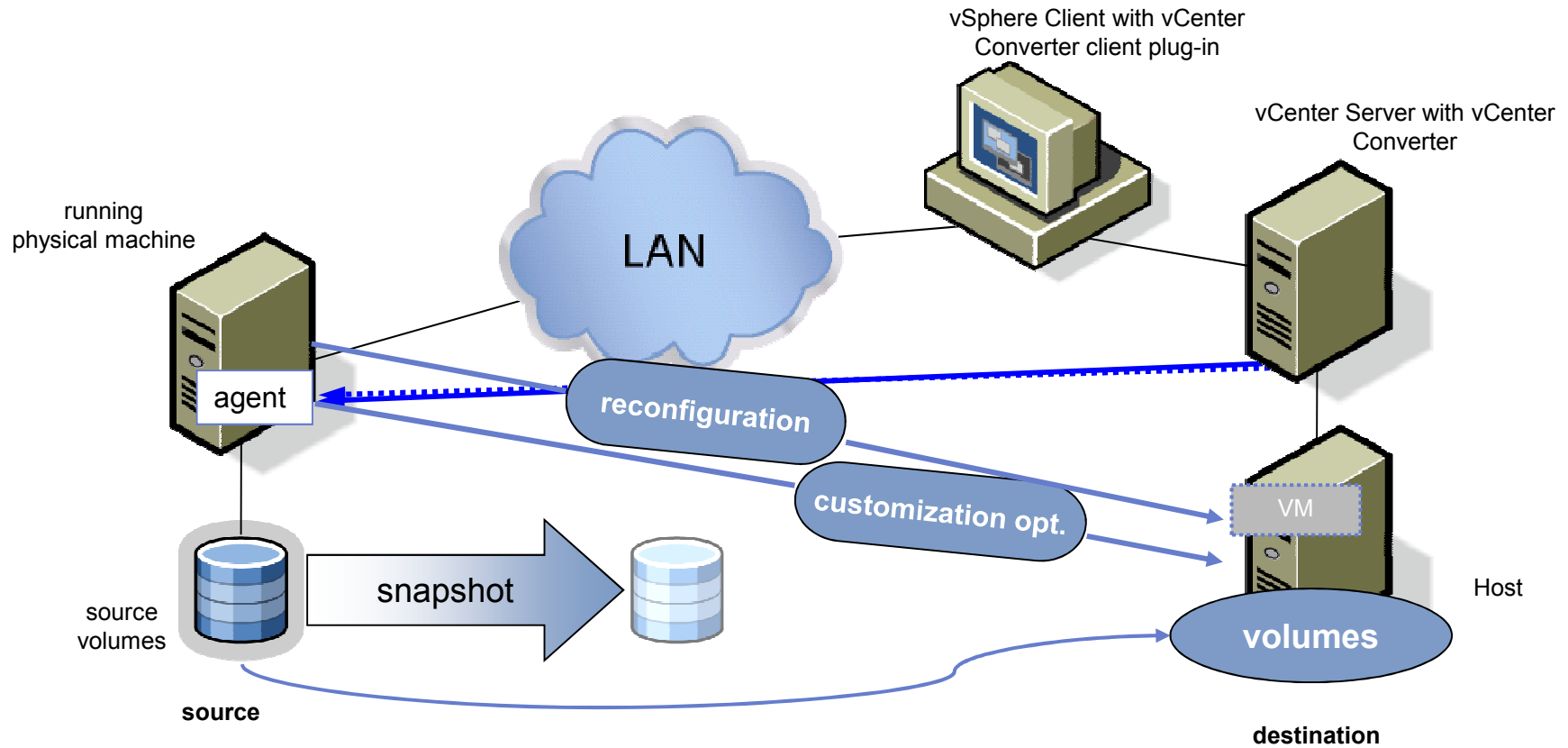
- Cloning – Create a cloned disk, where the cloned disk is a virtual disk that is an exact copy of the source physical disk.
- System reconfiguration – Adjust the migrated operating system to enable it to function on virtual hardware.

**vCenter Converter supports hot cloning and cold cloning:**

- Hot cloning – Clone a source machine while the operating system is running. The source machine can be accessed remotely.
- Cold cloning – Clone the source machine when the operating system is not running. Cloning can be performed locally, where Converter runs on the source machine.

# Remote Hot Cloning of a Physical Machine

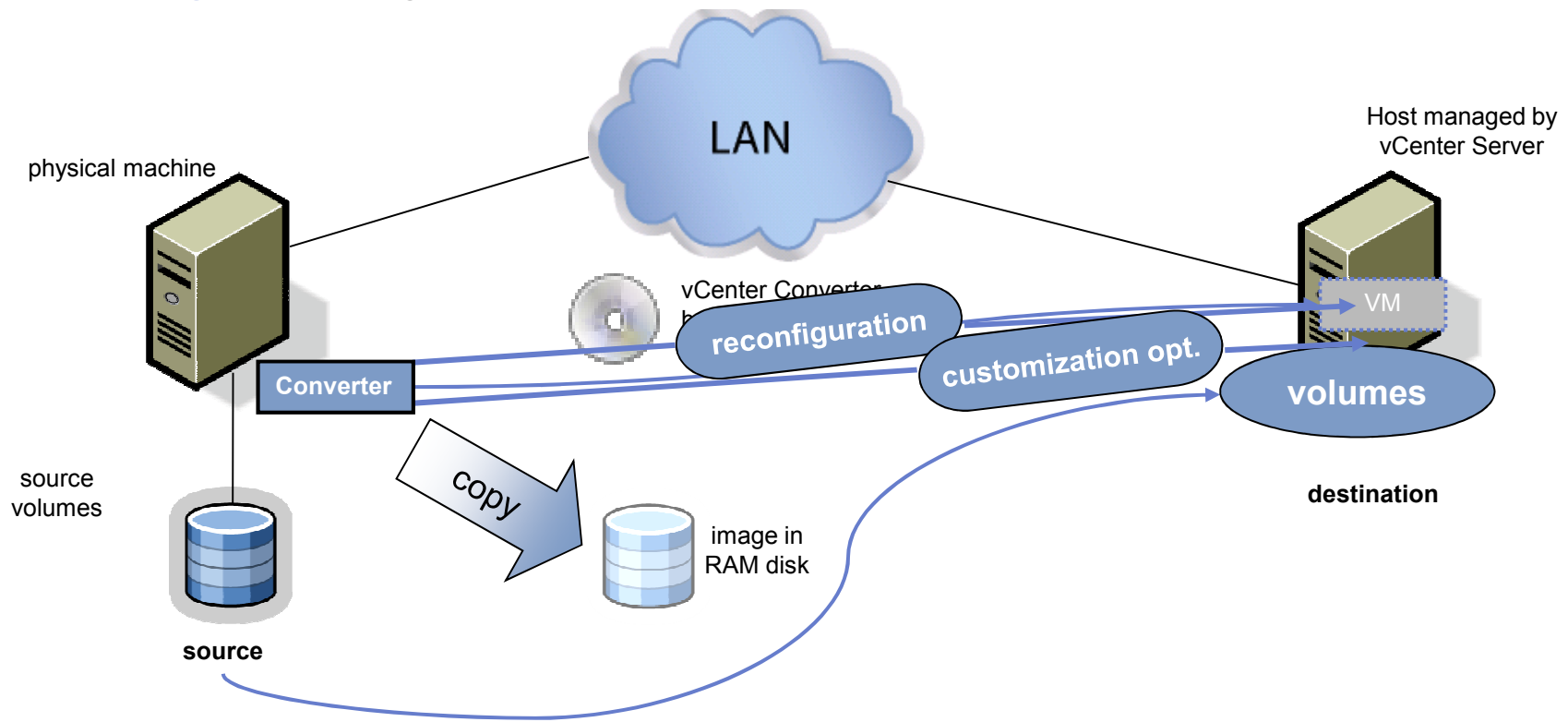
## Stage 4: Cleaning Up



vCenter Converter agent removes all traces from the source machine.

# Local Cold Cloning of a Physical Machine

## Stage 4: Cleaning Up



User removes boot CD and reboots the source physical machine. The virtual machine is ready to run.

# Importing a Physical System

The screenshot displays the VMware vSphere 4.0 interface. On the left, a context menu is open for the 'sc-quail04.vmeduc.com' virtual machine. The 'Import Machine...' option at the bottom of this menu is circled in orange. Overlaid on the right is the 'Import Wizard' dialog box. The wizard is titled 'Source Type' and shows a progress list on the left: 'Step 1: Source' (selected), 'Source Login', 'Source Data', 'Step 2: Destination', 'Step 3: Customization', 'Step 4: Schedule Task', and 'Ready to Complete'. The main area of the wizard asks 'What do you want to import?' and features a dropdown menu with 'Physical Computer' selected. Other options in the dropdown include 'vSphere Virtual Machine' and 'Other'. At the bottom of the wizard, there are buttons for 'Help', '< Back', 'Next >', and 'Cancel'. A 'Log Info >>' button is also present in the bottom right corner of the wizard's main area.

## Cloning Modes: Disk-Based and Volume-Based

### Disk-based cloning

- Transfers all sectors from all disks and preserves all volume metadata. It supports all basic and dynamic disks.
- Used for cold cloning and importing existing virtual machines

### Volume-based cloning

- Creates all volumes in the destination virtual machine as basic volumes, regardless of type of corresponding source volume
- Used for hot and cold cloning and for importing existing virtual machines
- Performed at the file or block level, depending on your size selections

## Changes to Virtual Hardware

**Most applications function correctly.**

**Watch for applications that depend on:**

- Specific hardware characteristics
- Different serial numbers
- Software licensed to MAC addresses
- Special graphics cards

## Lab 11 and eLearning Activity

**In this lab, you will use vCenter Converter to create a virtual machine from an existing system.**

1. Prepare a system for hot cloning.
2. Hot-clone a system.

**In this eLearning activity, you will view a self-paced demonstration on how to convert a physical machine to a virtual machine using the vCenter Converter boot CD.**

- Ask your instructor for access to the eLearning module.

## Lesson Summary

- vCenter Converter is a vCenter Server additional module used to import, export, or reconfigure physical or virtual machines or system images.
- vCenter Converter can also be used to restore Consolidated Backup images to virtual machines.
- Cloning of a physical machine can be done in a hot mode, while the physical machine continues to run.





# Lesson 5: vCenter Guided Consolidation

## Lesson Objectives

- > Describe the Guided Consolidation architecture
- > Understand how Guided Consolidation works
  - Find physical systems
  - Analyze physical systems
  - Convert physical systems to virtual machines

## Guided Consolidation

**Guided Consolidation enables you to streamline your datacenter by transforming your physical machines, running business applications, into virtual machines.**

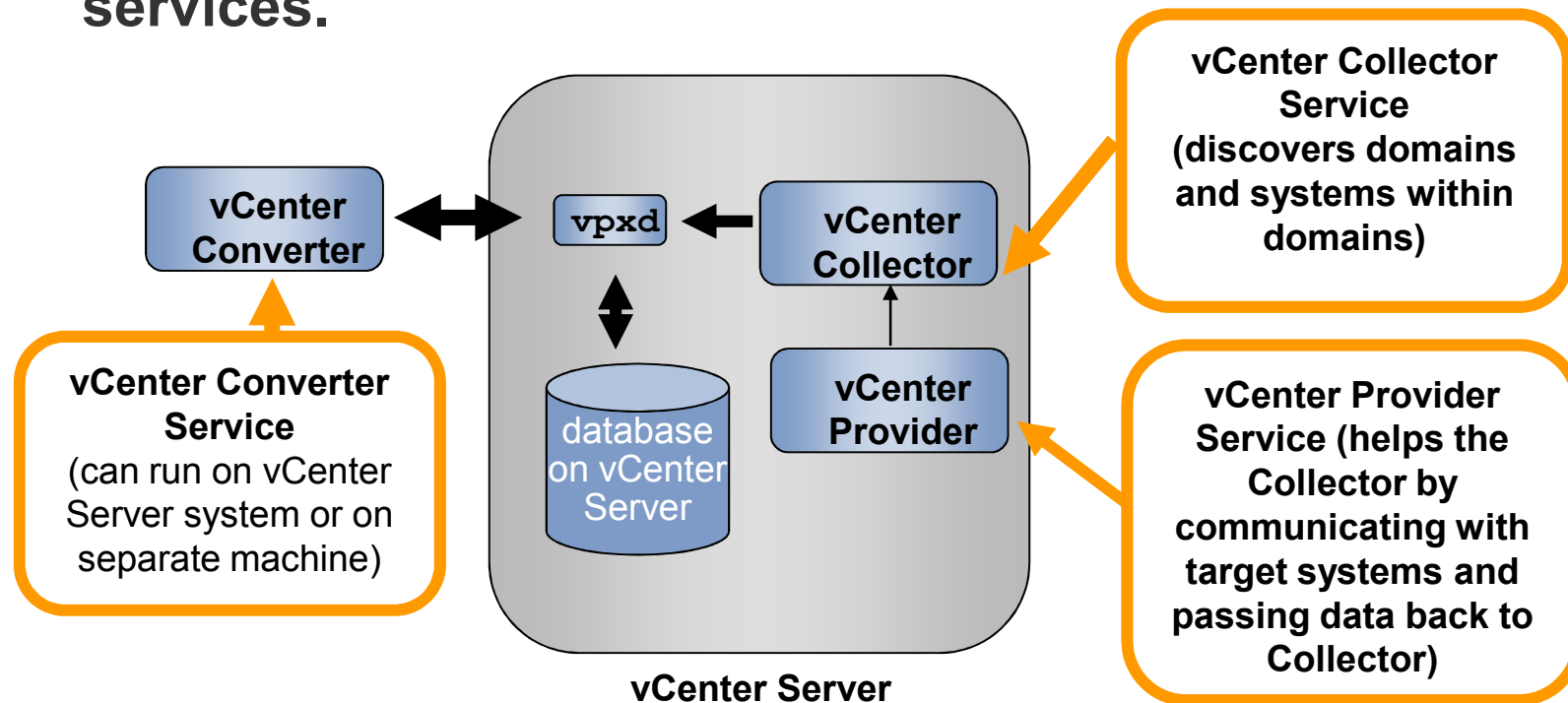
- Recommended for small IT environments

**Consolidating your datacenter involves the following:**

- Find – Search for and select physical systems that you want analyzed.
- Analyze – Analyze the physical systems and collect performance data.
- Consolidate – Compare performance to available host resources, convert physical systems to virtual machines, and import virtual machines into vCenter Server.

## Guided Consolidation Architecture

Guided Consolidation depends on the vCenter Collector, vCenter Provider, and vCenter Converter services.

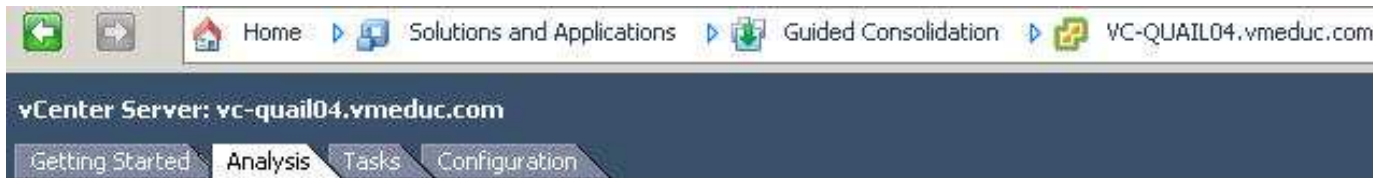


## Guided Consolidation Prerequisites

**Guided Consolidation requires that your VMware vSphere is populated and that you provide credentials to the target physical systems.**

**Ensure that vCenter Converter and Guided Consolidation plug-ins are installed and enabled in the vSphere Client.**

# Finding Physical Systems to Consolidate



Click **Start Analysis** to find systems on the network to analyze.



## Guided Consolidation

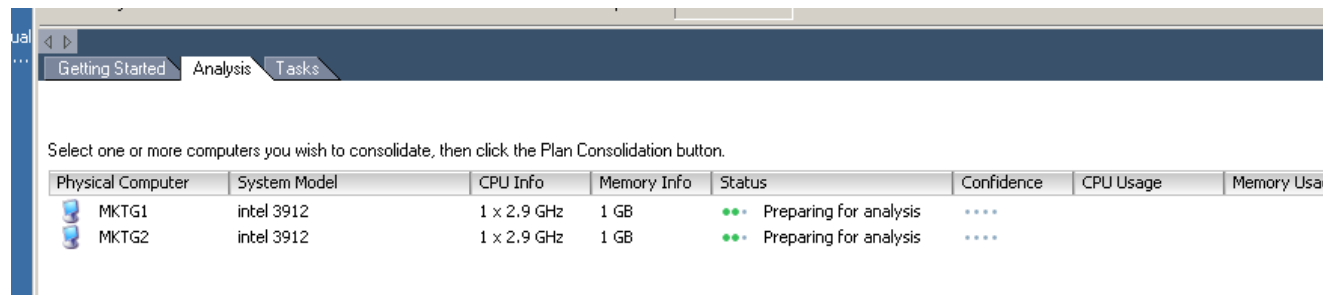
Which physical computers should you virtualize to best c  
Guided Consolidation will analyze your physical computer  
virtualization. Click Start Analysis to add computers to a

Start Analysis

Search for systems by computer name or IP address, or within a domain.

A screenshot of the 'Add To Analysis' dialog box. The title bar says 'Add To Analysis'. The main text reads: 'Enter the physical computers to consider for consolidation. Click Add to Analysis to begin analyzing these computers and to determine if they are good candidates for consolidation.' There are two radio buttons: 'Manually specify the computers.' (which is selected) and 'Select the computers by domains'. Under the first option, there are three input fields: 'Computer Names/ IP Addresses:' with the value 'SVR-9157-249' and a hint '(example: hostname.domain.com, a.b.c.d, w.x.y.z, ...)'; 'IP Range:' with a hint '(example: a.b.c.x - a.b.c.y)'; and 'File Name:' with a 'Browse...' button and a hint '(list of computer names or IP addresses, one per line)'. Under the second option, there is a 'Domain:' dropdown menu with 'Select a domain...' selected. At the bottom, there is a search filter section with 'Name or Analyzing contains:' and a 'Clear' button, and a table with columns 'Name' and 'Analyzing'.

## Analyzing Potential Candidates



Select one or more computers you wish to consolidate, then click the Plan Consolidation button.

Physical Computer	System Model	CPU Info	Memory Info	Status	Confidence	CPU Usage	Memory Usage
MKTG1	intel 3912	1 x 2.9 GHz	1 GB	●●● Preparing for analysis	●●●●		
MKTG2	intel 3912	1 x 2.9 GHz	1 GB	●●● Preparing for analysis	●●●●		

### Statistics are collected on each host.

- 10–12 metrics total: CPU, memory, disk, network
- Columns populated as information obtained

### Data is compared to host resources to get recommendation.

### Confidence metric is calculated.

- Refers to the reliability of the recommendation
- Recommendations based on longer periods of analysis, and therefore more performance data, receive a higher level of confidence

## Consolidating Candidates

After analysis, select the systems you want to convert. vCenter Server selects appropriate destinations and configuration parameters for each resulting virtual machine.

VC-40.vi40.vmware.com - VMware Infrastructure Client

File Edit View Inventory Administration Plug-ins Help

Home Solutions and Applications Guided Consolidation Search Inventory

VirtualCenter Server: vc-40 Change Server

Getting Started Analysis Tasks Configuration

Guided Consolidation is analyzing these computers:

Physical Computer	IP Address	CPU Info	Memory Info	Status	Confidence	CPU Usage	Memory Usage
JB-WIN2003X64	10.16.152...	2 / 3.00 G...	2047 MB	Ready for consolidati...	High	169 MHz	1185 MB
VC40-STANDALONE	10.21.68.78	2 / 1.80 G...	2048 MB	Ready for consolidati...	High	227 MHz	1921 MB
VC40-LINKED-MODE	10.21.68.9	2 / 1.80 G...	2048 MB	Ready for consolidati...	High	263 MHz	1922 MB

**Virtualize one candidate at a time.**

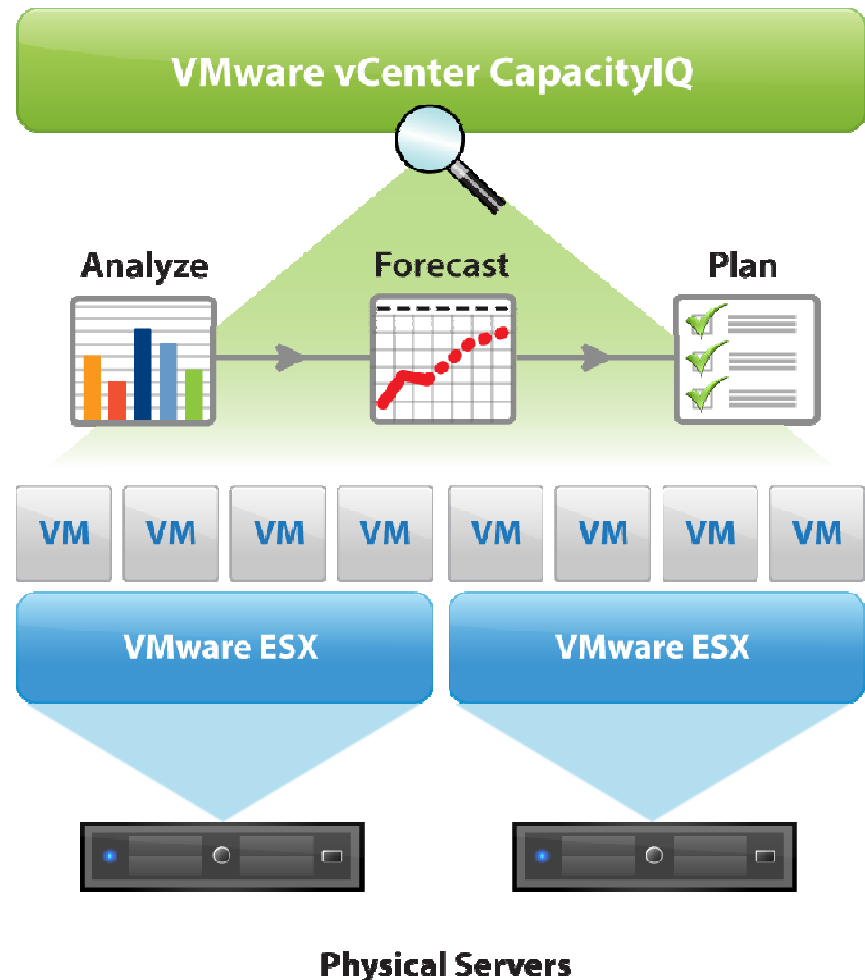
Plan Consolidation... Add To Analysis... Set Authentication... Remove



## Capacity Planning with vCenter CapacityIQ

### CapacityIQ allows you to:

- Perform “what if” impact analysis to model the effect of capacity changes
- Identify and reclaim inefficient, unused capacity
- Forecast timing of capacity shortfalls and bottlenecks



## eLearning Activity

**In this eLearning activity, you will view a self-paced demonstration of how to analyze a physical machine and convert the physical machine to a virtual machine using Guided Consolidation.**

- Ask your instructor for access to the eLearning module.

## Lesson Summary

- Guided Consolidation allows you to consolidate your datacenter by
  - Finding physical systems in one or more domains
  - Analyzing these physical systems for potential consolidation candidates
  - Converting the best candidates to virtual machines and importing them into vCenter Server



# Lesson 6: Modifying Virtual Machines

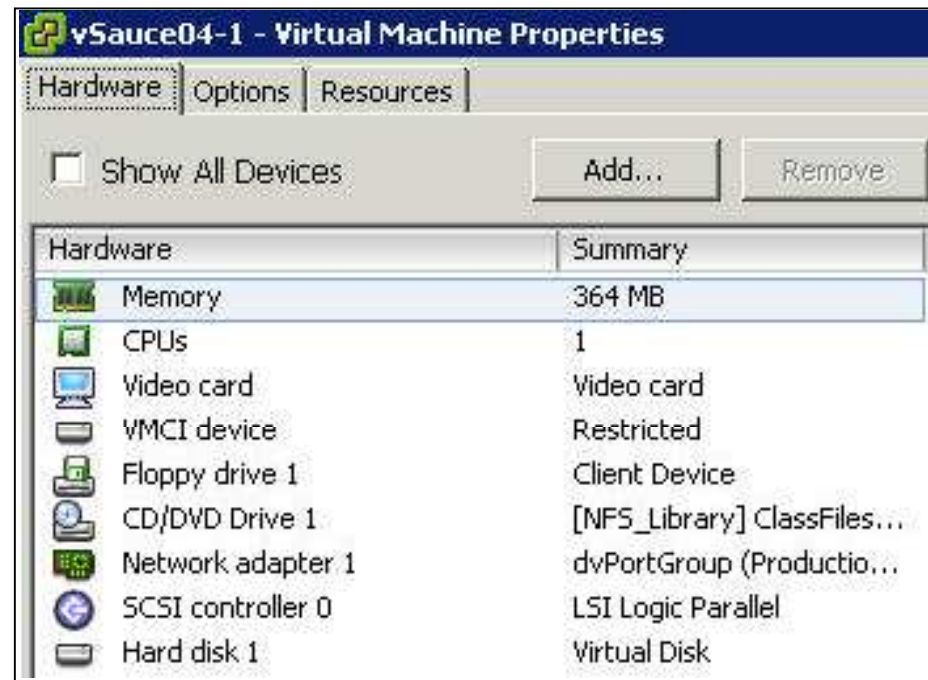
## Lesson Objectives

- Understand the various virtual machine settings and options
- Add a hot-pluggable device
- Increase the size of a virtual disk using Hot Extend
- Add an RDM

## Modifying Virtual Machine Settings

**A virtual machine's configuration can be modified using its Properties dialog box.**

- Add virtual hardware.
  - Some hardware can be added while the virtual machine is powered on.
- Remove virtual hardware.
- Set virtual machine options.
- Control a virtual machine's CPU and memory resources.



## Hot-Pluggable Devices

**Hot-pluggable devices are USB controllers, Ethernet adapters, hard disks, and SCSI devices.**

**CPU and memory can also be added while the virtual machine is powered on.**



## Increasing Virtual Disk Size: Hot Extend Feature

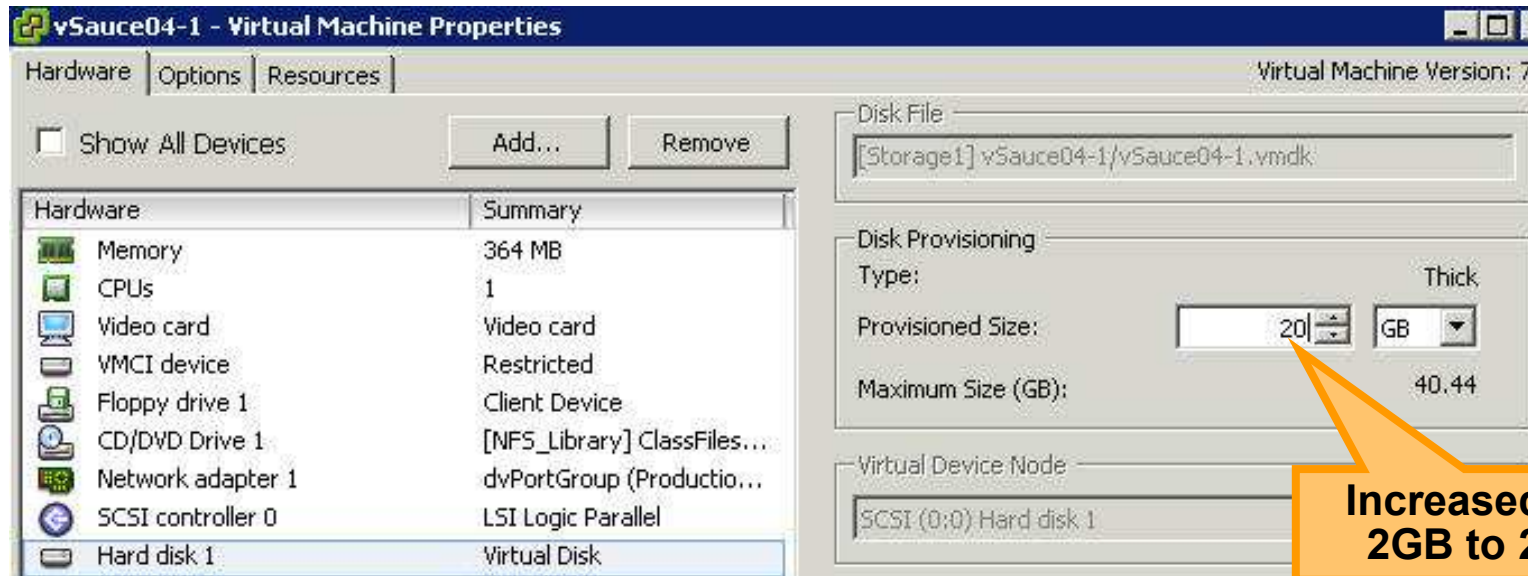
### Hot Extend

- Is used to increase the size of a virtual disk
- Is supported for vStorage VMFS flat virtual disks in persistent mode and without any virtual machine snapshots.

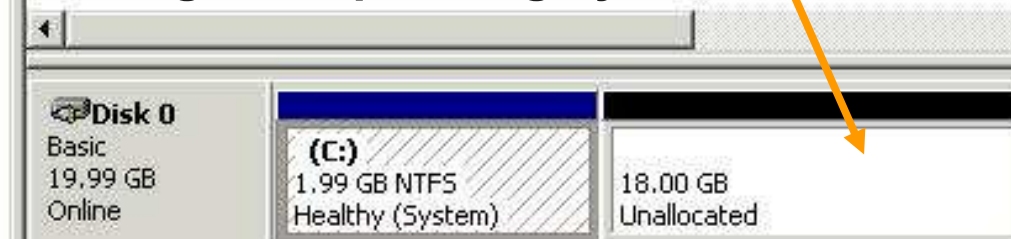
**Using appropriate tools, the guest operating system can dynamically grow the file system to use this new allocated disk space.**



# Hot Extend Example

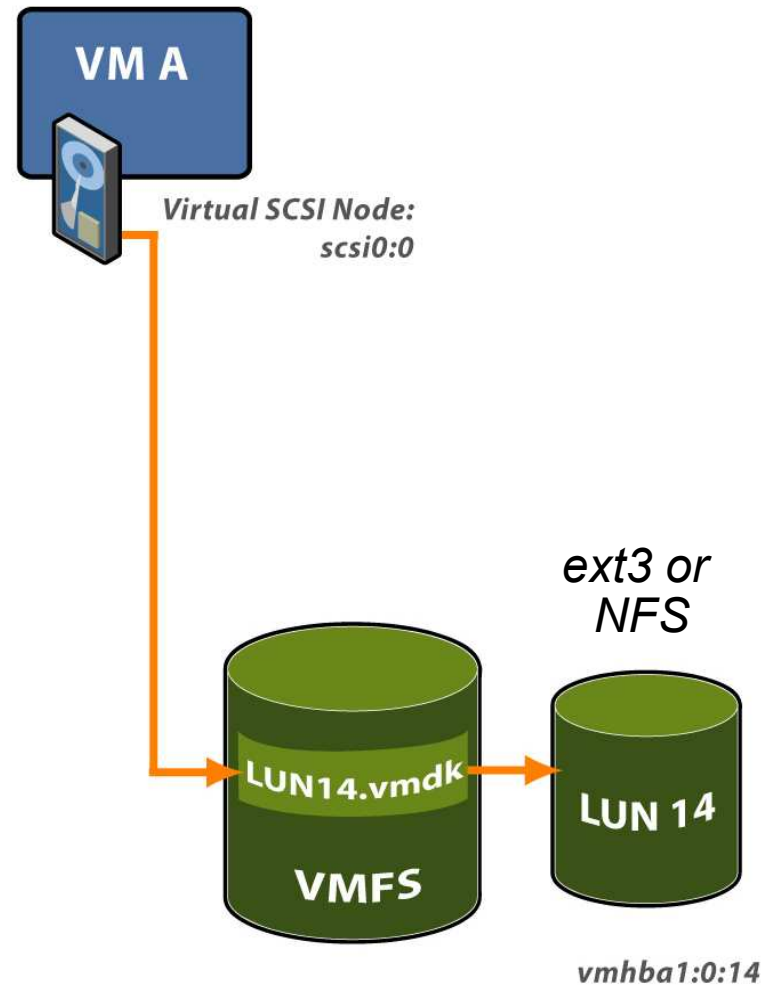


**Format new space within the guest operating system.**

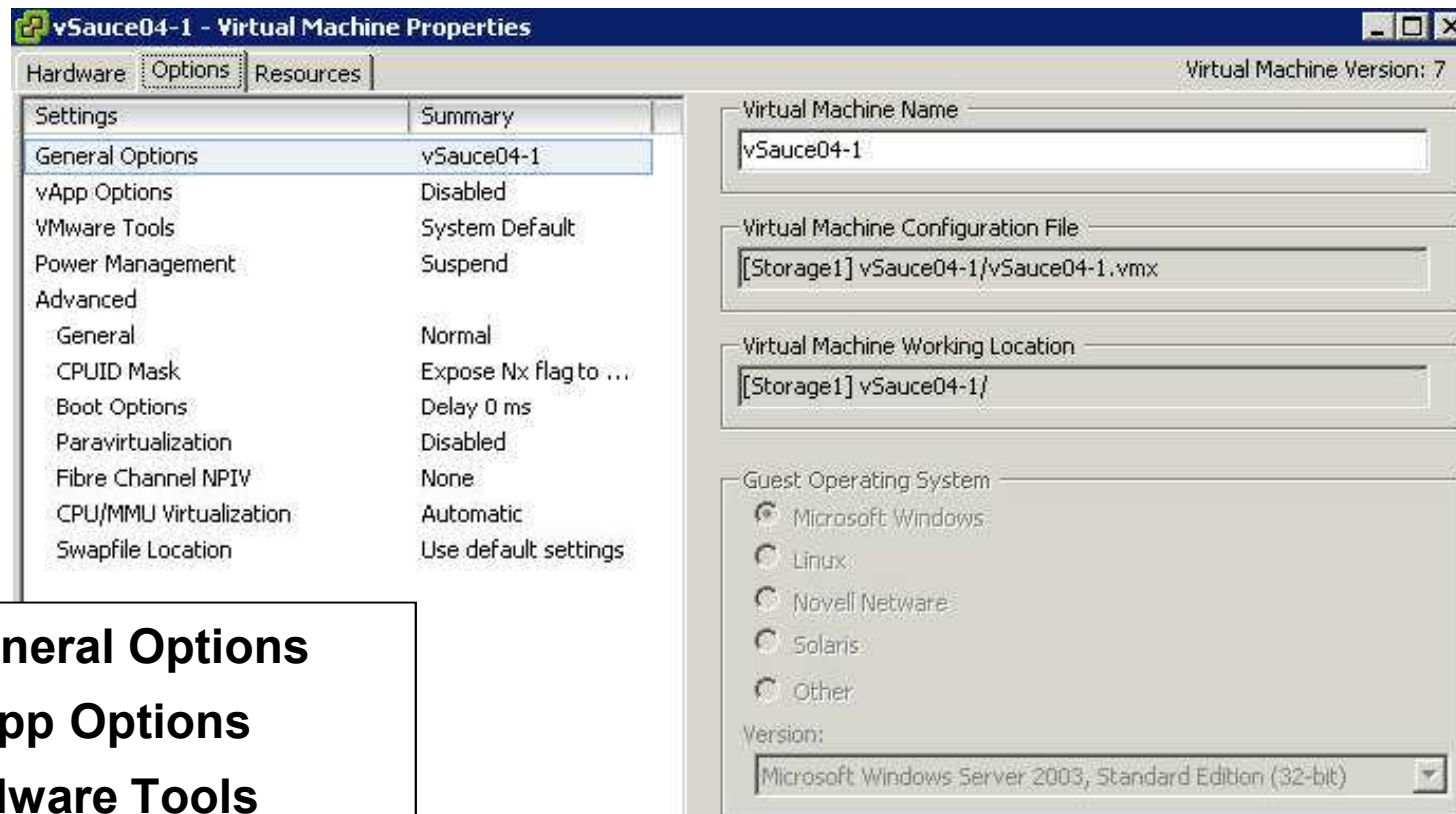


## Creating a Raw Device Mapping

To create an RDM, go to the virtual machine's Properties dialog box and add a hard disk device of type raw device mappings.



# Virtual Machine Options



- > **General Options**
- > **vApp Options**
- > **VMware Tools**
- > **Power Management**
- > **Advanced**

# Options: General Options

The screenshot shows the 'Virtual Machine Properties' dialog box for a VM named 'vSauce04-1'. The 'Options' tab is selected, and the 'General Options' section is expanded. The following fields are highlighted with orange callouts:

- Virtual Machine Name:** vSauce04-1 (labeled 'VM display name')
- Virtual Machine Configuration File:** [Storage1] vSauce04-1/vSauce04-1.vmx (labeled '. vmx file location')
- Virtual Machine Working Location:** [Storage1] vSauce04-1/ (labeled 'VM directory')
- Guest Operating System:** Microsoft Windows (selected) (labeled 'Guest operating system type')

The 'Version' dropdown is set to 'Microsoft Windows Server 2003, Standard Edition (32-bit)'. The 'Virtual Machine Version' is 7.

# Options: VMware Tools

The screenshot shows the 'Virtual Machine Properties' dialog box for a VM named 'vSauce04-1'. The 'Options' tab is selected, and the 'VMware Tools' section is highlighted in the left-hand tree view. The right-hand pane shows the configuration for VMware Tools, including power controls and script execution options.

Settings	Summary
General Options	vSauce04-1
vApp Options	Disabled
<b>VMware Tools</b>	<b>System Default</b>
Power Management	Suspend
Advanced	
General	Normal
CPUID Mask	Expose Nx flag to ...
Boot Options	Delay 0 ms
Paravirtualization	Disabled
Fibre Channel NPIV	None
CPU/MMU Virtualization	Automatic
Swapfile Location	Use default settings

**Power Controls**

- System Default (Shut Down Guest)
- System Default (Suspend)
- Power on / Resume virtual machine
- System Default (Restart Guest)

**Run VMware Tools Scripts**

- After powering on
- After resuming
- Before suspending
- Before shutting down Guest

**Advanced**

- Check and upgrade Tools before each power-on
- Synchronize guest time with host

**Customize power button actions.**

**When to run VMware Tools scripts**

**Update checks and time sync.**

# Options: Power Management

The screenshot shows the 'Virtual Machine Properties' dialog box for a VM named 'vSauce04-1'. The 'Options' tab is selected, and the 'Power Management' section is highlighted in the left-hand tree view. The main pane shows the 'Guest Power Management' settings. The 'Suspend the virtual machine' radio button is selected. Below it, the 'Put the guest OS into standby mode and leave the virtual machine powered on' radio button is unselected. Underneath, the 'Wake on LAN for virtual machine traffic on:' section has a checkbox for 'Network adapter 1 (dvPortGroup)' which is currently unchecked. An orange arrow points from a callout box to this checkbox.

Settings	Summary
General Options	vSauce04-1
vApp Options	Disabled
VMware Tools	System Default
<b>Power Management</b>	<b>Suspend</b>
<b>Advanced</b>	
General	Normal
CPUID Mask	Expose Nx flag to ...
Boot Options	Delay 0 ms
Paravirtualization	Disabled
Fibre Channel NPIV	None
CPU/MMU Virtualization	Automatic
Swapfile Location	Use default settings

**Suspend or standby  
the guest operating  
system gracefully.  
Wake on LAN.**



## Advanced: Boot Options

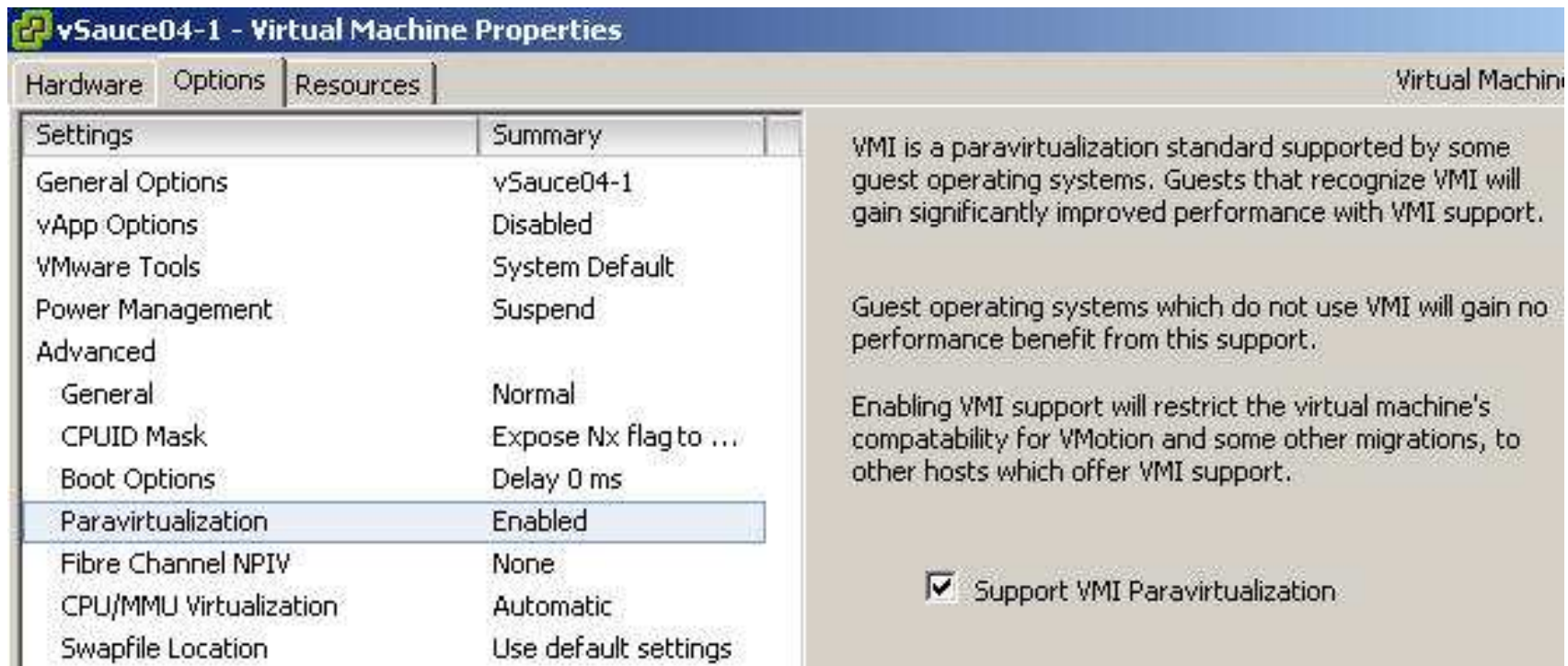
The screenshot shows the 'vSauce04-1 - Virtual Machine Properties' dialog box. The 'Options' tab is selected, and the 'Boot Options' sub-tab is active. The 'Power-on Boot Delay' is set to 0 ms, and the 'Force BIOS Setup' checkbox is checked. Two orange callout boxes with arrows point to these settings: 'Delay power on.' points to the 'Power-on Boot Delay' field, and 'Boot into BIOS.' points to the 'Force BIOS Setup' checkbox.

Settings	Summary
General Options	vSauce04-1
vApp Options	Disabled
VMware Tools	System Default
Power Management	Suspend
Advanced	
General	Normal
CPUID Mask	Expose Nx flag to ...
Boot Options	Delay 0 ms
Paravirtualization	Disabled
Fibre Channel NPIV	None
CPU/MMU Virtualization	Automatic
Swapfile Location	Use default settings

**Advanced options usually do not need to be set.**

## Advanced: Paravirtualization

Paravirtualization, supported by some guest operating systems, makes a guest operating system aware that it is running inside a virtual machine rather than on physical hardware.



The screenshot shows the 'Virtual Machine Properties' dialog box for a VM named 'vSauce04-1'. The 'Options' tab is selected, and the 'Paravirtualization' setting is highlighted in the left-hand list, showing it is 'Enabled'. The right-hand pane contains explanatory text about VMI and a checked checkbox for 'Support VMI Paravirtualization'.

Settings	Summary
General Options	vSauce04-1
vApp Options	Disabled
VMware Tools	System Default
Power Management	Suspend
Advanced	
General	Normal
CPUID Mask	Expose Nx flag to ...
Boot Options	Delay 0 ms
Paravirtualization	Enabled
Fibre Channel NPIV	None
CPU/MMU Virtualization	Automatic
Swapfile Location	Use default settings

Virtual Machine Properties

VMI is a paravirtualization standard supported by some guest operating systems. Guests that recognize VMI will gain significantly improved performance with VMI support.

Guest operating systems which do not use VMI will gain no performance benefit from this support.

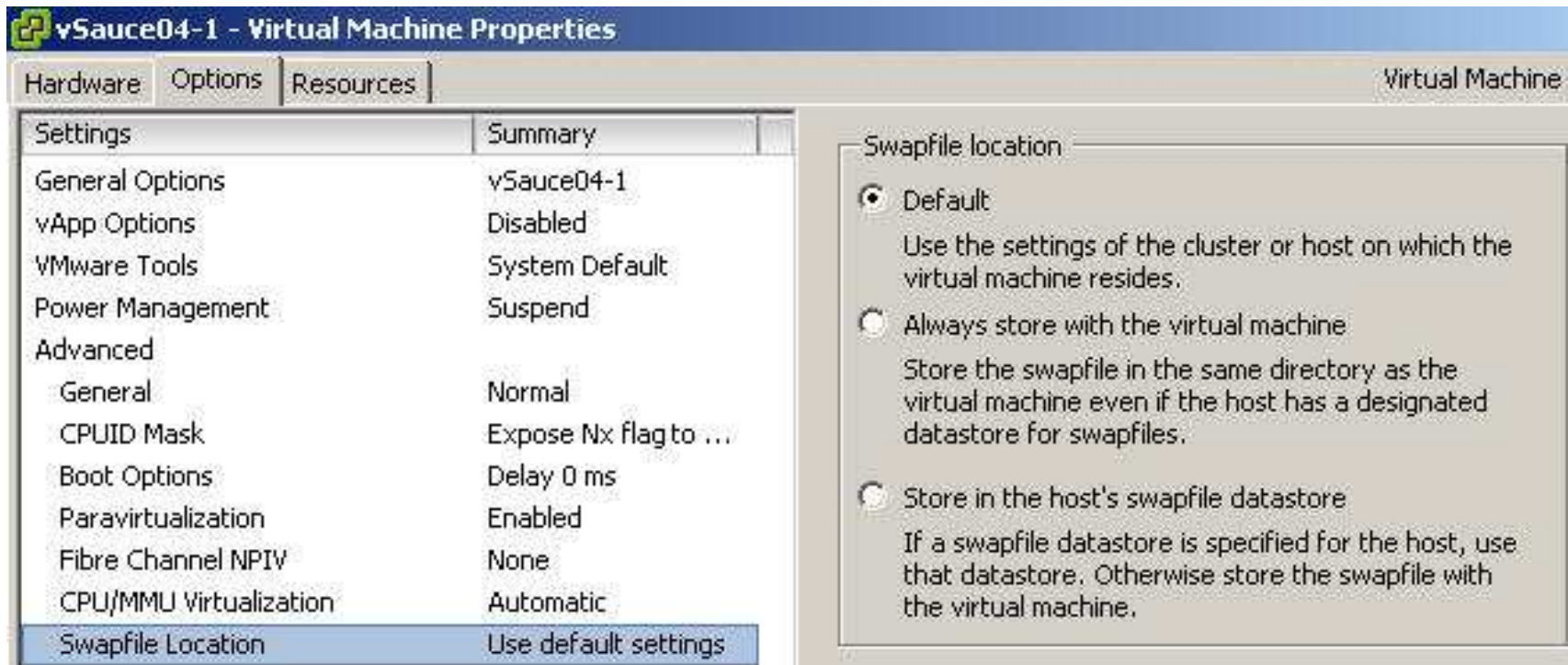
Enabling VMI support will restrict the virtual machine's compatibility for VMotion and some other migrations, to other hosts which offer VMI support.

Support VMI Paravirtualization



## Swap File Location

Each host or cluster can have a custom swap file datastore location defined.



The screenshot shows the 'Virtual Machine Properties' dialog box for 'vSauce04-1'. The 'Resources' tab is selected, and the 'Swapfile Location' setting is highlighted in the left-hand tree view. The right-hand pane shows the configuration options for the swapfile location.

Settings	Summary
General Options	vSauce04-1
vApp Options	Disabled
VMware Tools	System Default
Power Management	Suspend
Advanced	
General	Normal
CPUID Mask	Expose Nx flag to ...
Boot Options	Delay 0 ms
Paravirtualization	Enabled
Fibre Channel NPIV	None
CPU/MMU Virtualization	Automatic
Swapfile Location	Use default settings

**Swapfile location**

- Default**  
Use the settings of the cluster or host on which the virtual machine resides.
- Always store with the virtual machine**  
Store the swapfile in the same directory as the virtual machine even if the host has a designated datastore for swapfiles.
- Store in the host's swapfile datastore**  
If a swapfile datastore is specified for the host, use that datastore. Otherwise store the swapfile with the virtual machine.

## Lab 12

**In this lab, you will modify a virtual machine's hardware and add a raw LUN to a virtual machine.**

1. Modify a virtual machine's disk, memory, and name.
2. Add a raw LUN to an existing virtual machine and verify that the guest operating system sees the new disk.

## Lesson Summary

- USB controllers, Ethernet adapters, and hard disks can be added to a virtual machine while it is powered on.
- The size of virtual machine's disk, such as the C: drive, can be increased while the virtual machine is powered on.
- When a raw LUN is added to a virtual machine, an RDM pointing to the raw LUN is create in the specified VMFS datastore.



# Lesson 7: Managing Virtual Machines

## Lesson Objectives

- Snapshot a virtual machine and manage multiple snapshots
- Remove a virtual machine from the vCenter Server inventory and completely from disk
- Describe the different types of migration
- Perform a migration using VMware Storage VMotion

## Virtual Machine Snapshots

**Snapshots allow you to preserve the state of the virtual machine so that you can return to the same state repeatedly.**

**For example, if you are testing software, snapshots allow you to back out of these changes.**

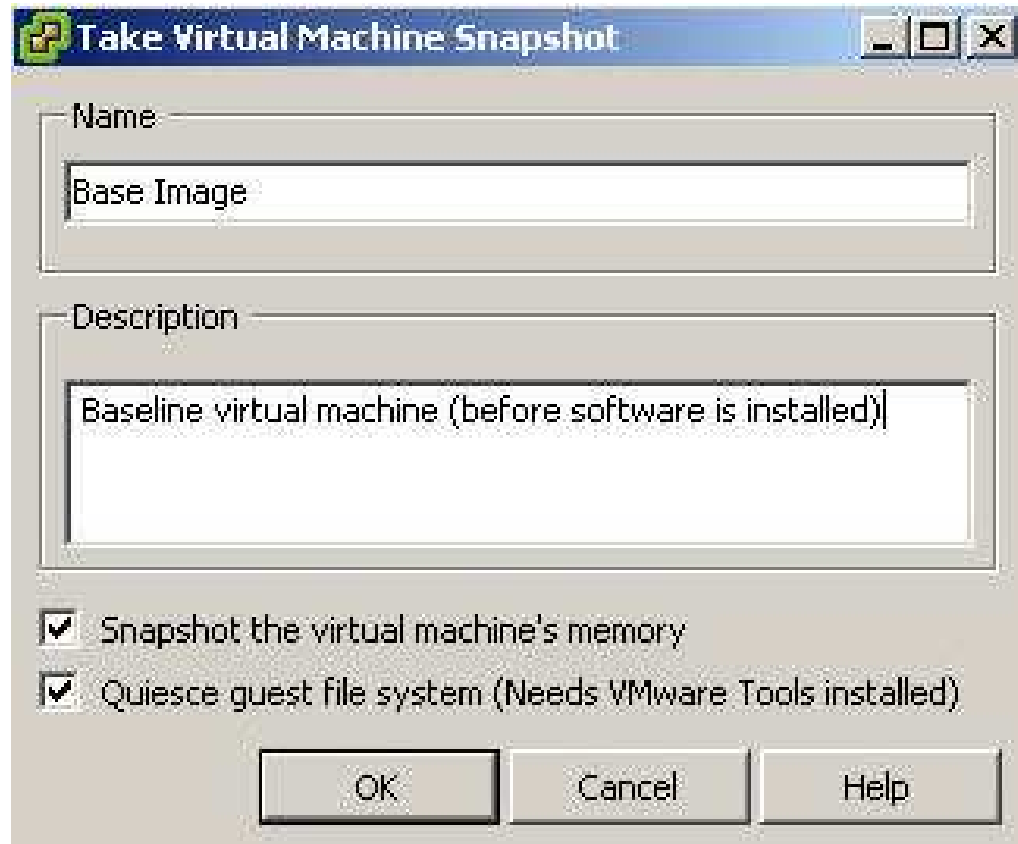


## Taking a Snapshot

**You can take a snapshot while a virtual machine is powered on, powered off, or suspended.**

**A snapshot captures the entire state of the virtual machine:**

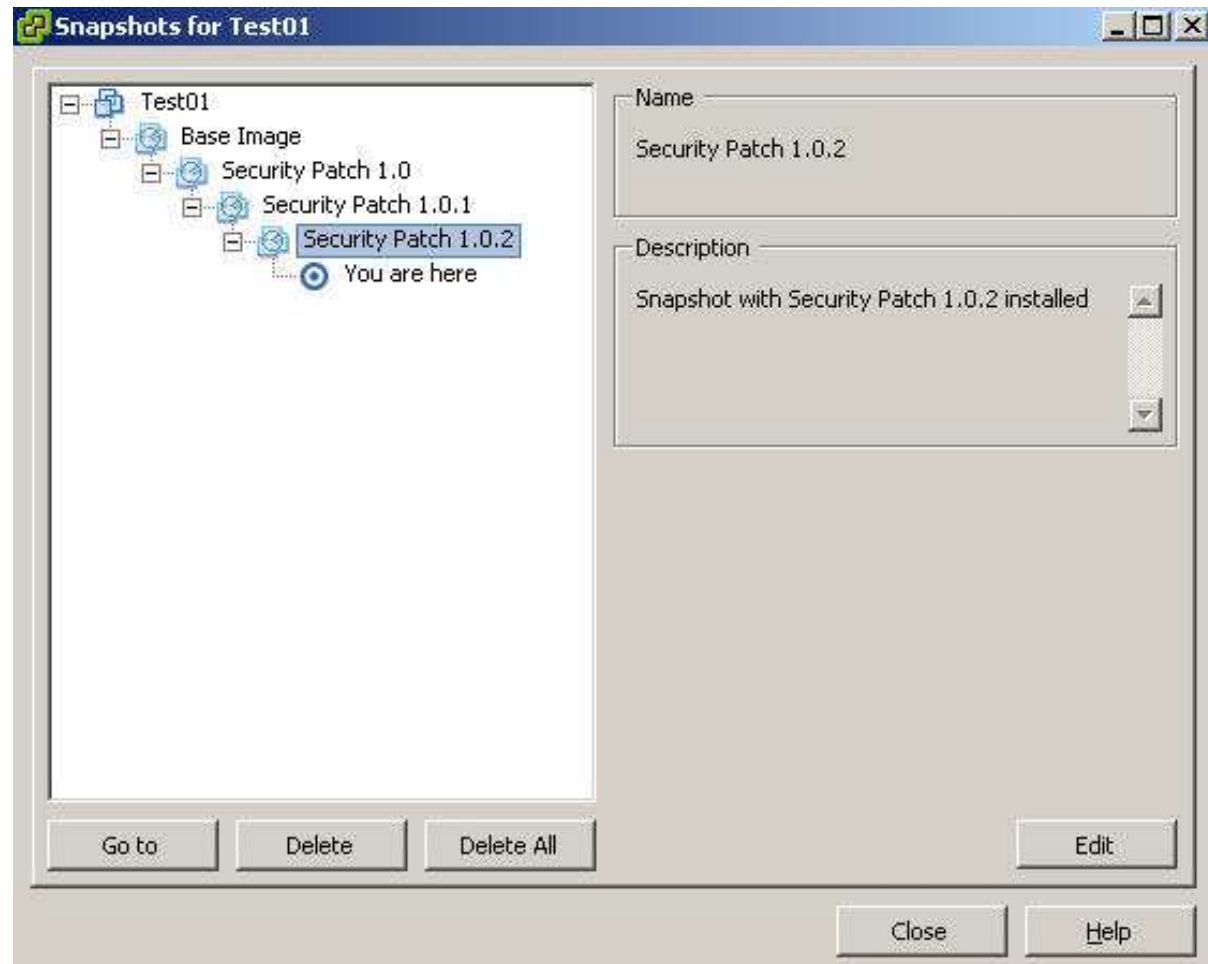
- Memory state, settings state, and disk state



## Managing Snapshots

**The Snapshot Manager lets you review all snapshots for the active virtual machine and act on them directly.**

- Revert to a snapshot.
- Delete one or all snapshots.





## Virtual Machine Snapshot Files

A snapshot consists of a set of files: the memory state (.vmsn), the description file (-00000#.vmdk), and the delta file (-00000#-delta.vmdk).

The snapshot list file (.vmsd) keeps track of the virtual machine's snapshots.

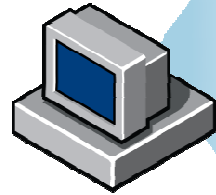
View: [Reports](#) [Maps](#)

Show all Virtual Machine Files ▾

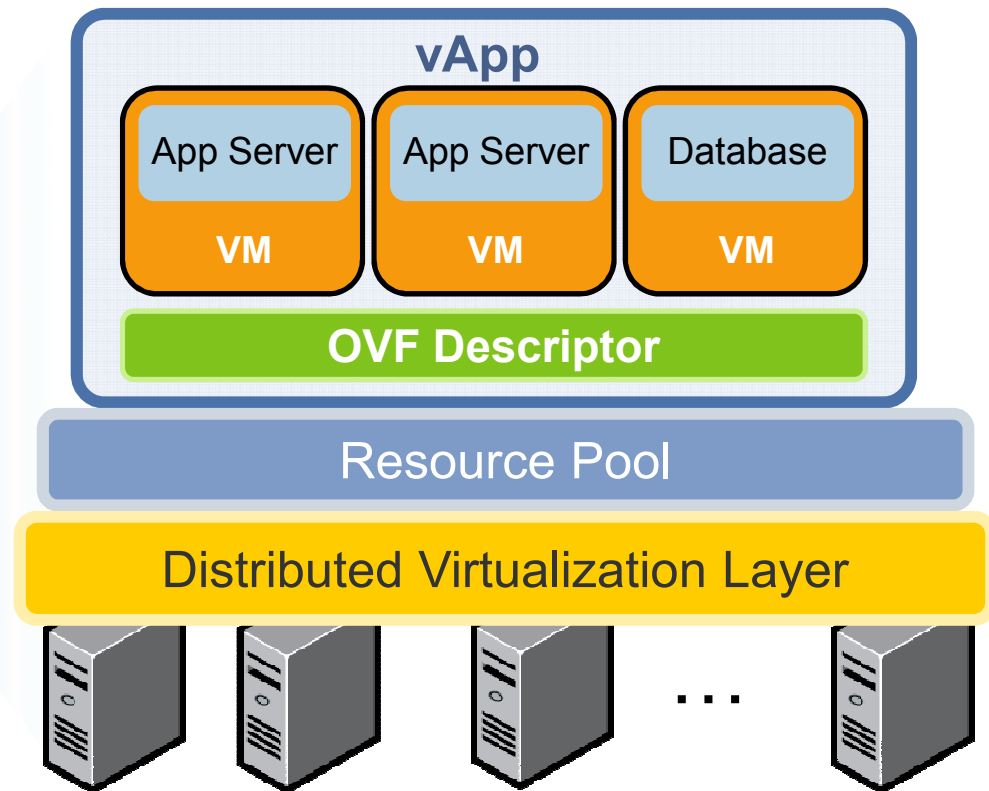
Name	Path	File type	Datastore	Size
vmware-1.log	[Local06] Carla07-4/vmware-1.log	Log	Local06	148.46 KB
Carla07-4-Snapshot1.vmsn	[Local06] Carla07-4/Carla07-4-Snapshot1.vmsn	Snapshot Data	Local06	381.19 MB
Carla07-4-000001.vmdk	[Local06] Carla07-4/Carla07-4-000001.vmdk	Disk Descriptor	Local06	243.00 B
Carla07-4.vmdk	[Local06] Carla07-4/Carla07-4.vmdk	Disk Descriptor	Local06	443.00 B
Carla07-4.vmsd	[Local06] Carla07-4/Carla07-4.vmsd	Snapshot List	Local06	480.00 B
Carla07-4.vmx	[Local06] Carla07-4/Carla07-4.vmx	Extended Configuration	Local06	264.00 B
vmware.log	[Local06] Carla07-4/vmware.log	Log	Local06	113.99 KB
Carla07-4.nvram	[Local06] Carla07-4/Carla07-4.nvram	NVRAM	Local06	8.48 KB
Carla07-4.vmx	[Local06] Carla07-4/Carla07-4.vmx	Configuration	Local06	2.99 KB
Carla07-4-000001-delta.vmdk	[Local06] Carla07-4/Carla07-4-000001-delta.vmdk	Disk Extent	Local06	16.01 MB
Carla07-4-flat.vmdk	[Local06] Carla07-4/Carla07-4-flat.vmdk	Disk Extent	Local06	1019.00 MB
Carla07-4-a6a81051.vswp	[Local06] Carla07-4/Carla07-4-a6a81051.vswp	Swap	Local06	364.00 MB

## Managing Virtual Machines Using vApp

A VMware vApp is a multitier application service that you can manage as a single inventory item.



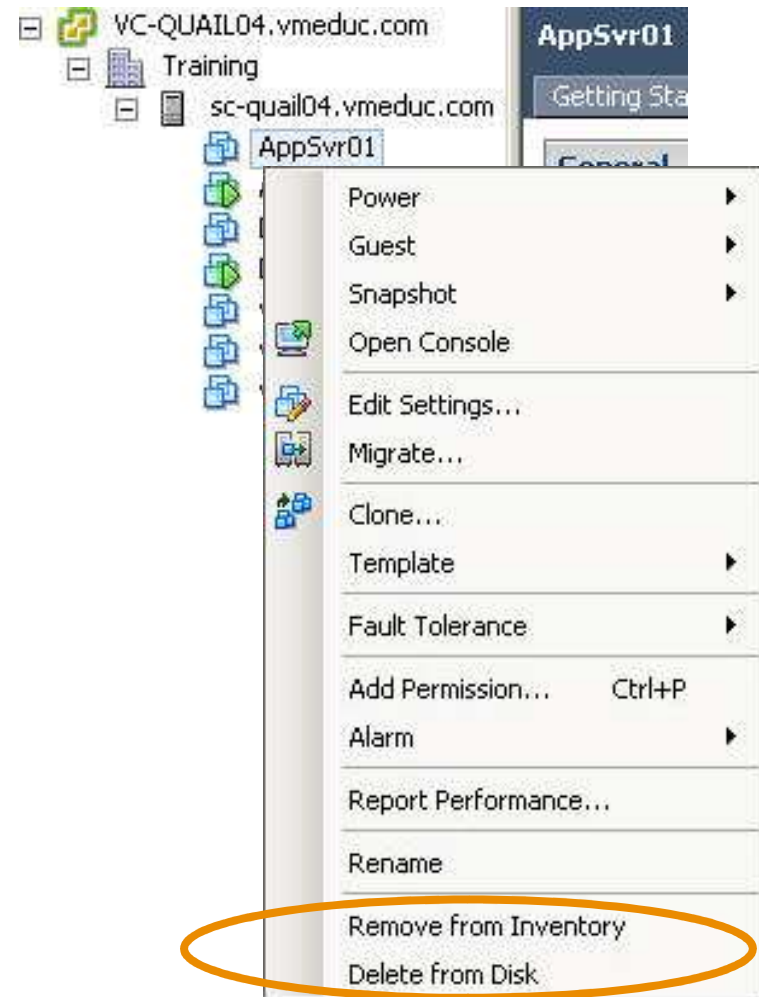
A vApp has the same basic operations as a virtual machine, but it contains multiple virtual machines.



## Removing a Virtual Machine

### There are two ways to remove a virtual machine:

- Remove a virtual machine from the inventory.
  - The virtual machine's files still remain on disk.
  - The virtual machine can be re-added to the inventory at a later time.
- Delete a virtual machine from disk.
  - The virtual machine is removed from the inventory, and its files are permanently deleted from disk.



## Migrating Virtual Machines

**Migration is the process of moving a virtual machine from one host or storage location to another. Types of migrations:**

- > Cold – Migrate a virtual machine that is powered off.
- > Suspend – Migrate a virtual machine that is suspended.
- > VMware VMotion™ – Migrate a virtual machine that is powered on.
- > Storage VMotion – Migrate just a virtual machine's files, while the virtual machine is powered on, to a different datastore.

**A main use of migration is to improve overall hardware utilization.**

**VMotion has additional uses:**

- > It allows continued virtual machine operation while accommodating scheduled hardware downtime.
- > It allows VMware Distributed Resource Scheduler to balance virtual machines across hosts.

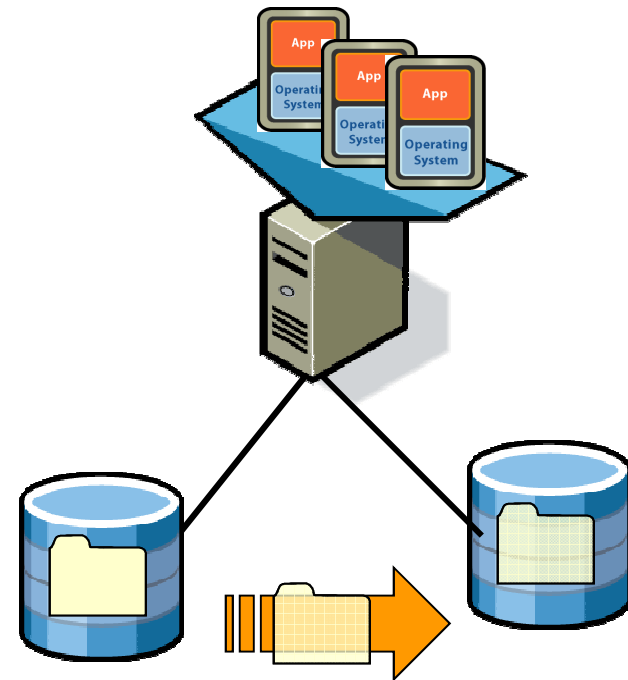
## Comparison of Migration Types

Migration type	Power state	Change host/ datastore ?	Across datacenters ?	Shared storage required?	CPU compatibility?
Cold	Off	Host or datastore or both	Yes	No	Different CPU families allowed
Suspended VM	Suspended	Host or datastore or both	Yes	No	Must meet CPU compatibility requirements
VMotion	On	Host	No	Yes	Must meet CPU compatibility requirements
Storage VMotion	On	Datastore	No	No	N/A

## Benefits of Storage VMotion

### Migration with Storage VMotion:

- Performing storage maintenance and reconfiguration
- Redistributing storage load
- Evacuating physical storage about to be retired
- Storage tiering
- Upgrading ESX/ESXi hosts without virtual machine downtime

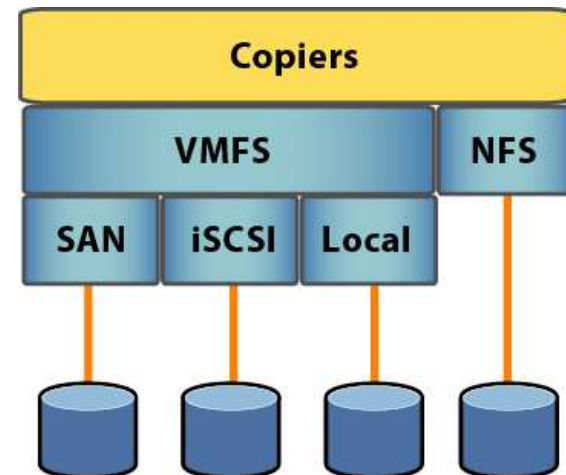
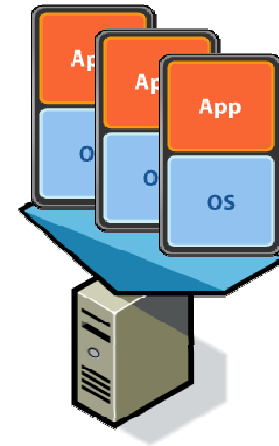


## Storage Type Independency

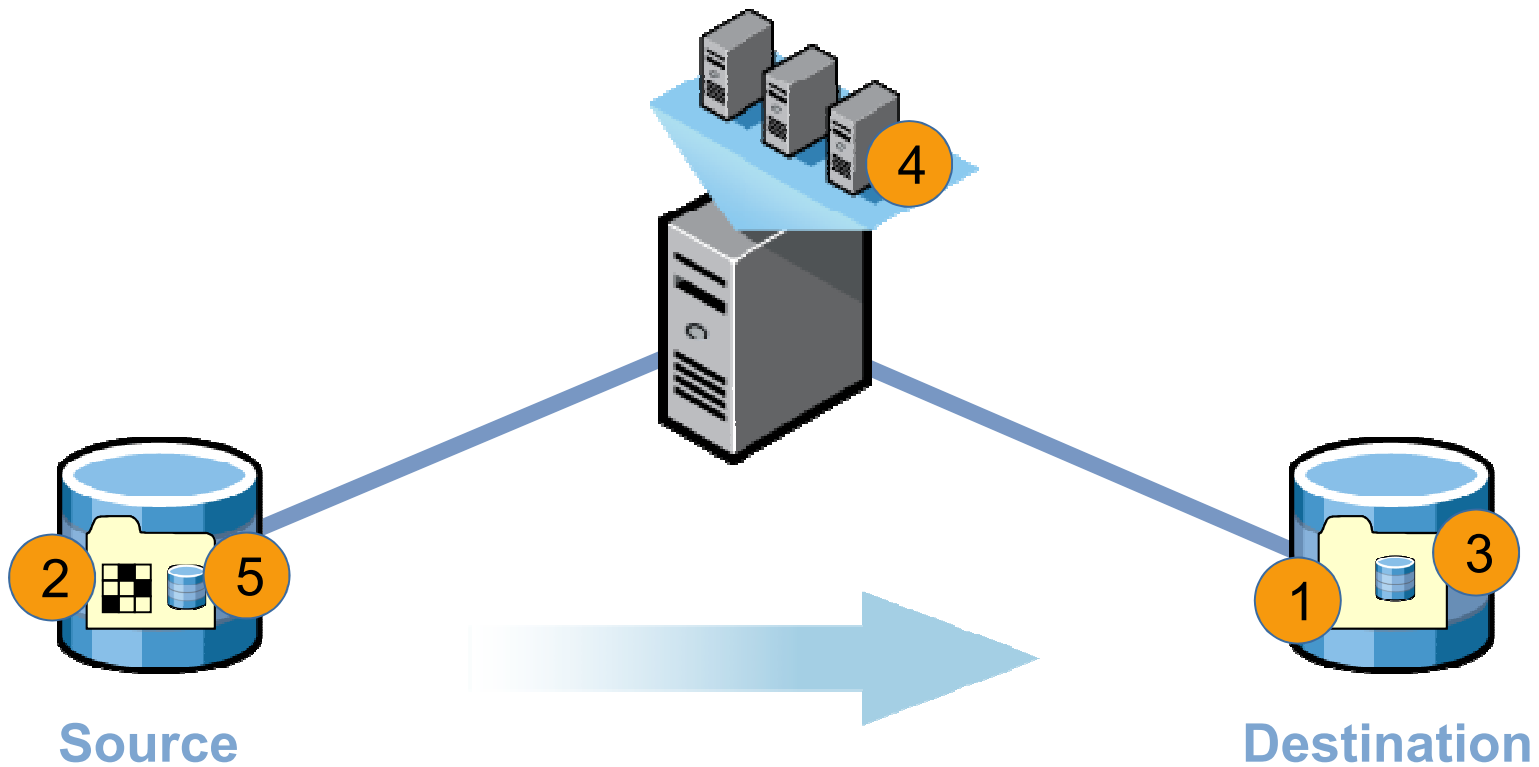
### Storage VMotion is storage type-independent.

- Virtual machine disks are moved with snapshot technology.
- Virtual machine home files are copied using a network file copier.
- Copiers are not storage type-specific, located “above” the file system layer.

**Source and destination can be different storage types.**



## Storage VMotion In Action





# Migrating Using Storage VMotion

Virtual Machine > Migrate

**Migrate Virtual Machine**

**Select Migration Type**  
Change the virtual machine's host, datastore or both.

**Select Migration Type**  
Select Destination  
Select Resource Pool

- Change host**  
Move the virtual machine to another host.
- Change datastore**  
Move the virtual machine's storage to another datastore.
- Change both host and datastore**  
Move the virtual machine to another host and move its storage to another datastore.  
 The virtual machine must be powered off to perform this function.

Storage VMotion

Available when  
virtual machine  
is powered off

## Storage VMotion Guidelines and Limitations

### Guidelines:

- Spend time planning and coordinating with administrators.
- Perform during off-peak hours.
- Ensure that source host has access both to source and target datastores.

### Limitations:

- Virtual machines with snapshots cannot be migrated.
- The virtual machine must be powered off to concurrently migrate to another host and datastore.
- Up to four concurrent Storage VMotion migrations can occur.

## Lab 13

**In this lab, you will perform several virtual machine management tasks.**

1. Remove a virtual machine from the vCenter Server inventory.
2. Re-add the virtual machine and verify that it appears in the inventory.
3. Delete a virtual machine from disk and verify that it can no longer be accessed.
4. Take snapshots of a virtual machine.
5. Revert to a snapshot.
6. Migrate a virtual machine using Storage VMotion.

## Lesson Summary

- The Snapshot Manager allows you to revert back to a snapshot and delete one or more of a virtual machine's snapshots.
- A virtual machine that is removed from the vCenter Server inventory can be returned to the inventory because its files are not deleted from disk.
- Storage VMotion allows you to migrate a virtual machine from one datastore to another while the virtual machine is powered on.

## Key Points

- There are various methods to create a virtual machine. Choose the method that best fits your needs.
- Deploying virtual machines from a template allows you to easily create many virtual machines.
- vCenter Server provides useful features for provisioning virtual machines, such as vCenter Converter and Guided Consolidation.