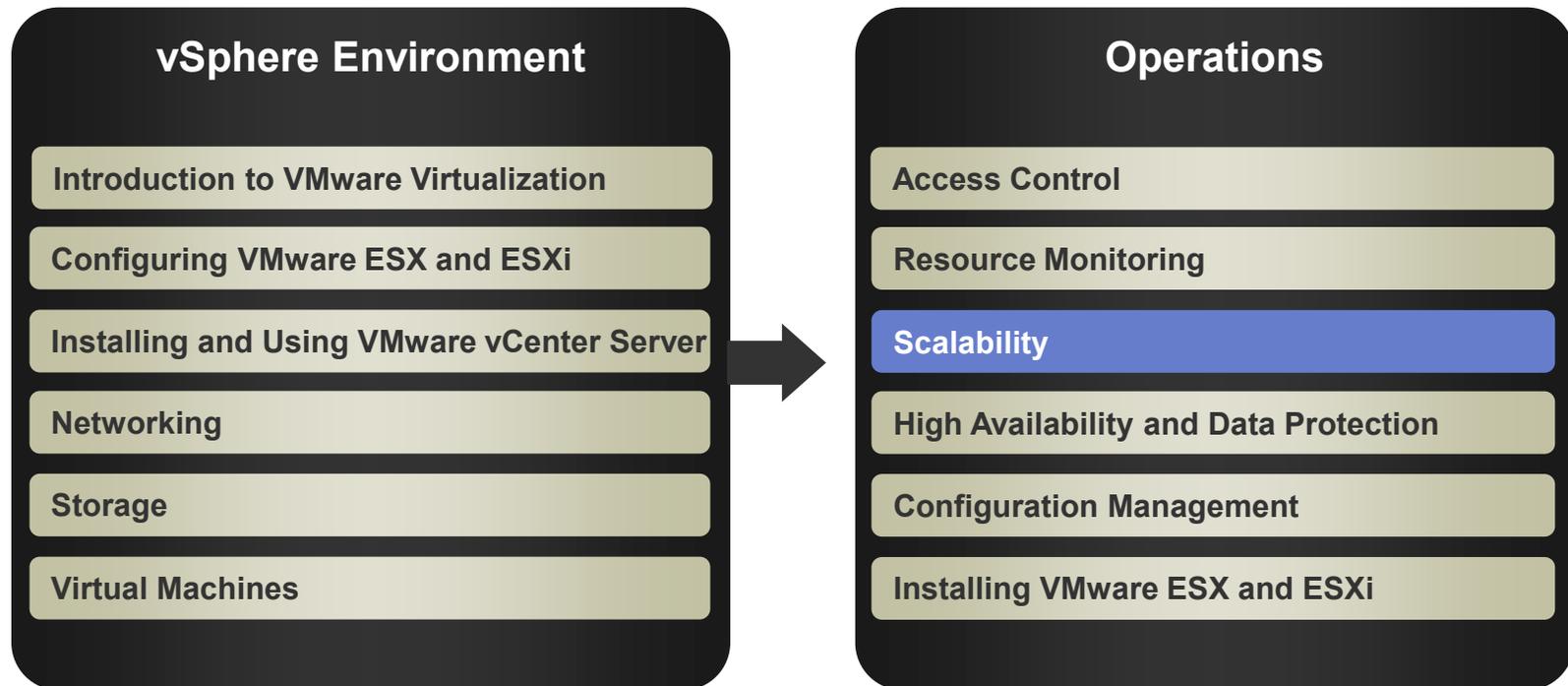




# Scalability

## Module 10

## You Are Here



## Importance

- Resource pools allow CPU and memory resources to be hierarchically assigned. Clusters enabled for VMware® Distributed Resource Scheduler (DRS) provide automated resource management for multiple VMware ESX™/ESXi hosts.

## Module Lessons

**Lesson 1:      Scaling CPU and Memory Management**

**Lesson 2:      Scaling Storage and Network  
Management**

**Lesson 3:      VMware VMotion Migration**

**Lesson 4:      VMware Distributed Resource Scheduler**



# Lesson 1: Scaling CPU and Memory Management

## Lesson Objectives

- Describe the CPU and memory resource allocation settings
- Describe a resource pool
- Create a resource pool
- View resource allocation

## Resource Management

**Resource management is the allocation of resources from providers (hosts and clusters) to consumers (virtual machines).**

- Resources include CPU, memory, storage, and network.

### **Resource management:**

- Resolves resource overcommitment
- Prevents virtual machines from monopolizing resources
- Exploits undercommitted resources
- Controls the relative importance of virtual machines

**Resource allocation settings – shares, reservation, and limit – are used to determine the amount of CPU and memory resources provided for a virtual machine.**

# Virtual Machine CPU Resource Settings

## Limit

- > This value is a cap on the consumption of CPU time by this virtual machine, measured in MHz.

## Reservation

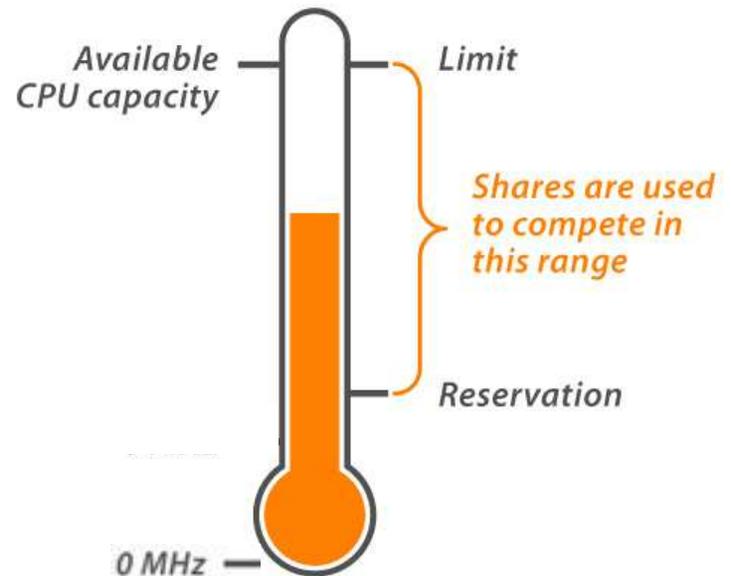
- > This value is a certain number of CPU cycles reserved for this virtual machine, measured in MHz.
- > The VMkernel chooses which CPUs it can migrate.

## Shares

- > More shares means that this virtual machine will win competitions for CPU time more often.

## All the VCPUs in a virtual machine must be simultaneously scheduled.

- > Therefore, a reservation of 1,000MHz might be generous for a one-VCPU virtual machine but not for a four-VCPU virtual machine.



*A virtual machine will power on only if its reservation can be guaranteed*

# Virtual Machine Memory Resource Settings

## Available memory

- > This value is the memory size defined when the virtual machine was created.

## Limit

- > This value is a cap on the consumption of physical memory by this virtual machine, measured in MB.

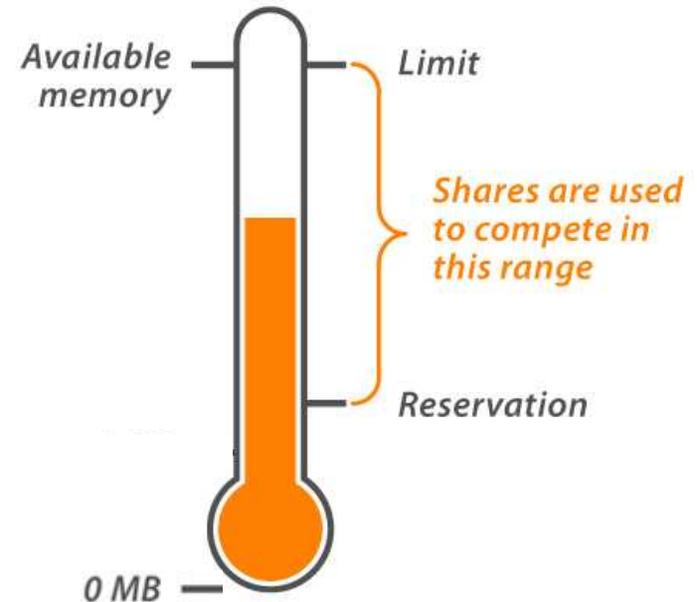
## Reservation

- > This value is a certain amount of physical memory reserved for this virtual machine, measured in MB.

## Shares

- > More shares means that this virtual machine will win competitions for physical memory more often.

**VMkernel allocates a per-virtual machine swap file to cover each virtual machine's range between available memory and reservation.**

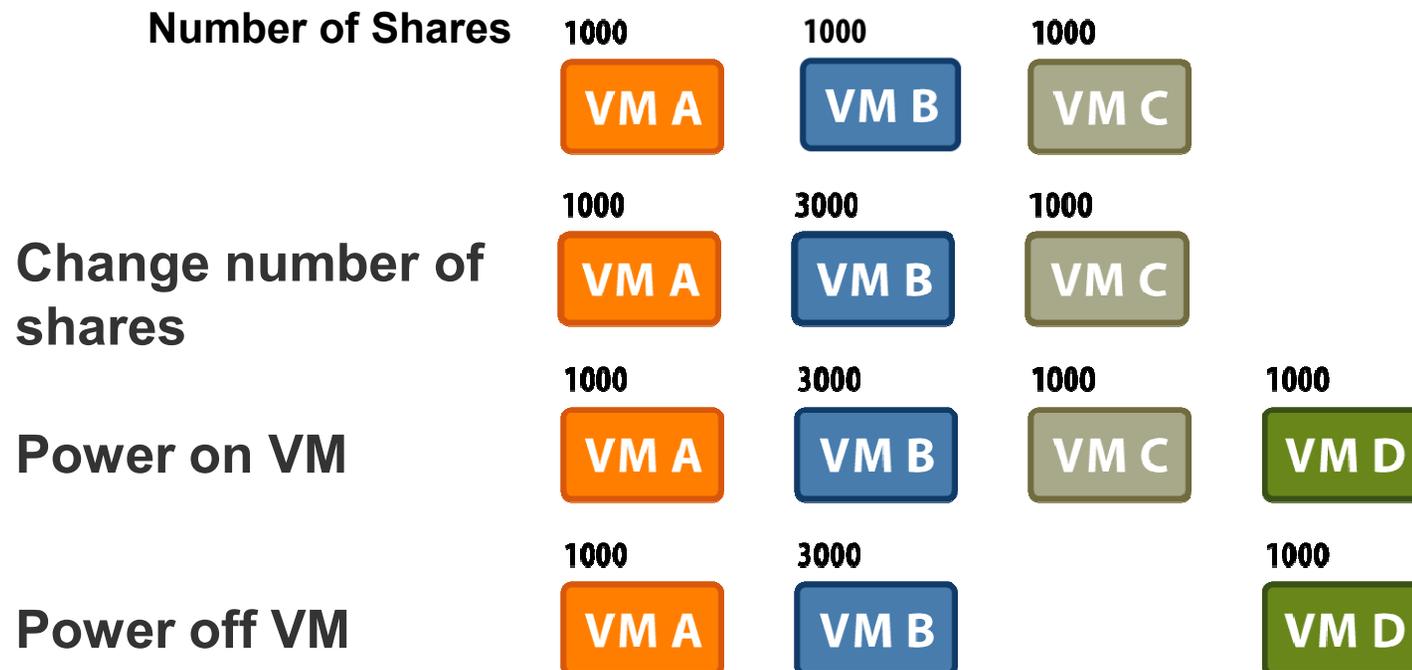


*A virtual machine will power on only if its reservation can be guaranteed*

# How Virtual Machines Compete for Resources

## Proportional-share system for relative resource management

- > Applied during resource contention
- > Prevents virtual machines from monopolizing resources
- > Guarantees predictable resource shares

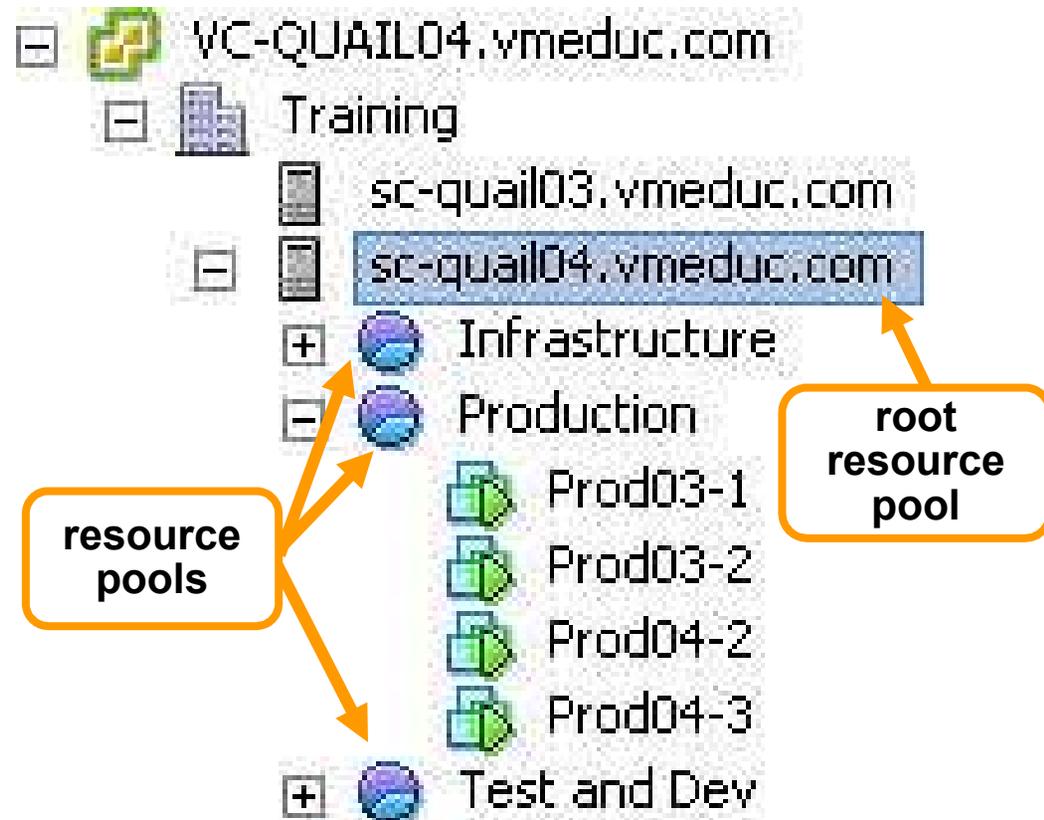


## What Is a Resource Pool?

**A logical abstraction for hierarchically managing CPU and memory resources**

**Used on standalone hosts or DRS-enabled clusters**

**Provides resources for virtual machines and child pools**



## Why Use Resource Pools?

**Using resource pools can result in these benefits:**

- Flexible hierarchical organization
- Isolation between pools, sharing within pools
- Access control and delegation
- Separation of resources from hardware
- Management of sets of virtual machines running a multitier service

## Resource Pool Attributes

Resource pools have the following attributes:

- > Shares
  - Low, Normal, High, Custom
- > Reservations, in MHz and MB
- > Limits, in MHz and MB
  - Unlimited access, by default (up to maximum amount of resource accessible)
- > Expandable reservation?
  - Yes – Virtual machines and subpools can draw from this pool's parent.
  - No – Virtual machines and subpools can draw only from this pool, even if its parent has free resources.

**Create Resource Pool**

Name: Production

**CPU Resources**

Shares: High 8000

Reservation: 0 MHz

Expandable

Limit: 15000 MHz

Unlimited

**Memory Resources**

Shares: Normal 655360

Reservation: 0 MB

Expandable

Limit: 2924 MB

Unlimited

▲ Remaining resources available

Help OK Cancel

## Resource Pool Scenario

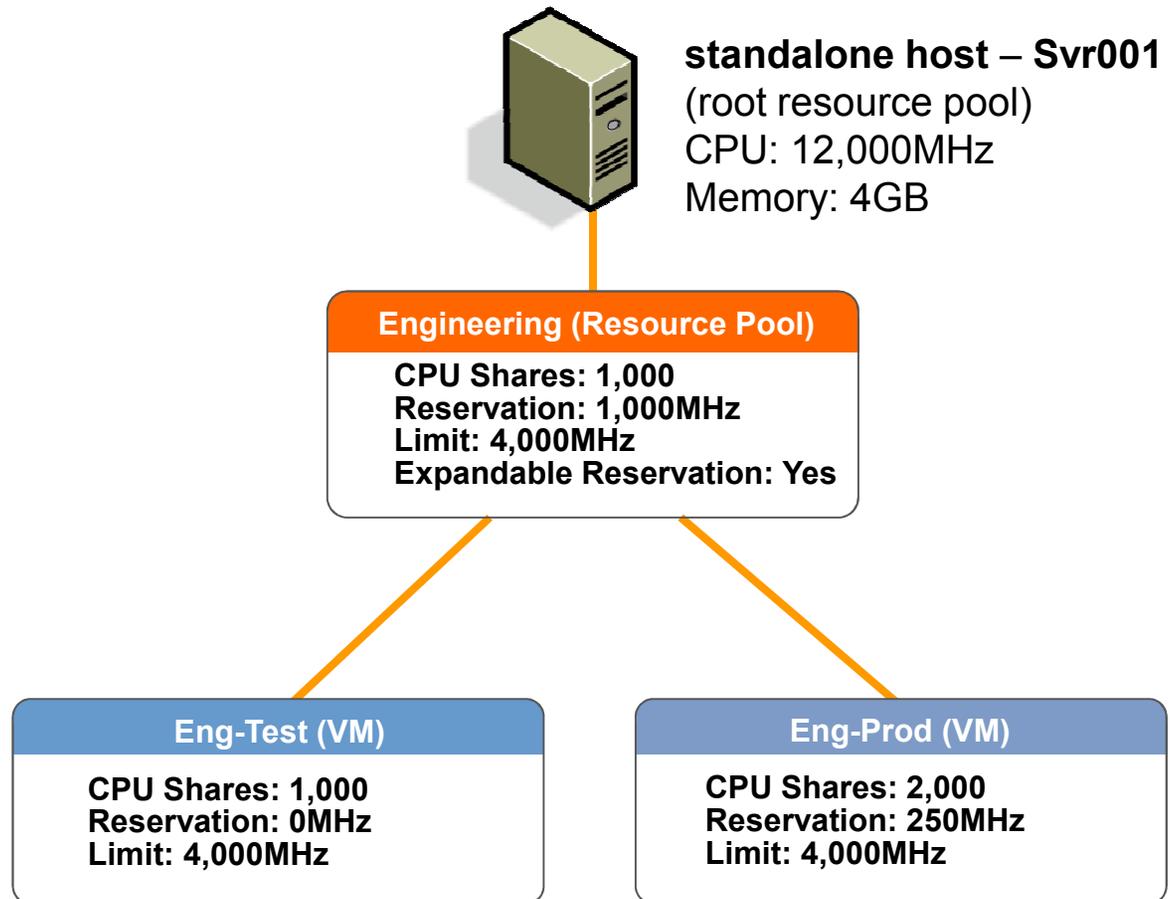
**Company X's IT department has two internal customers.**

- The finance department supplies two-thirds of the budget.
- The engineering department supplies one-third of the budget.

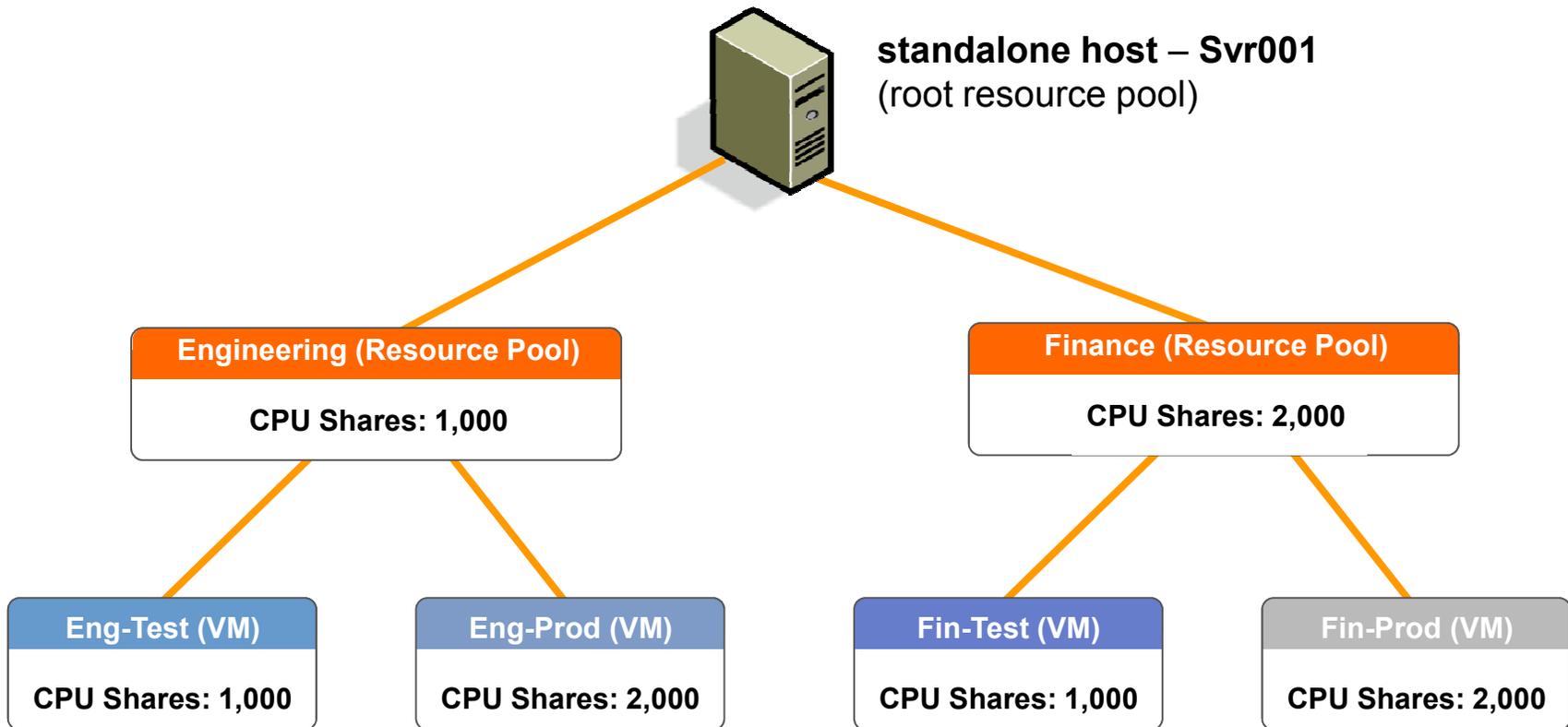
**Each internal customer has both production and test/dev virtual machines.**

**We must cap the test/dev virtual machines' resource consumption.**

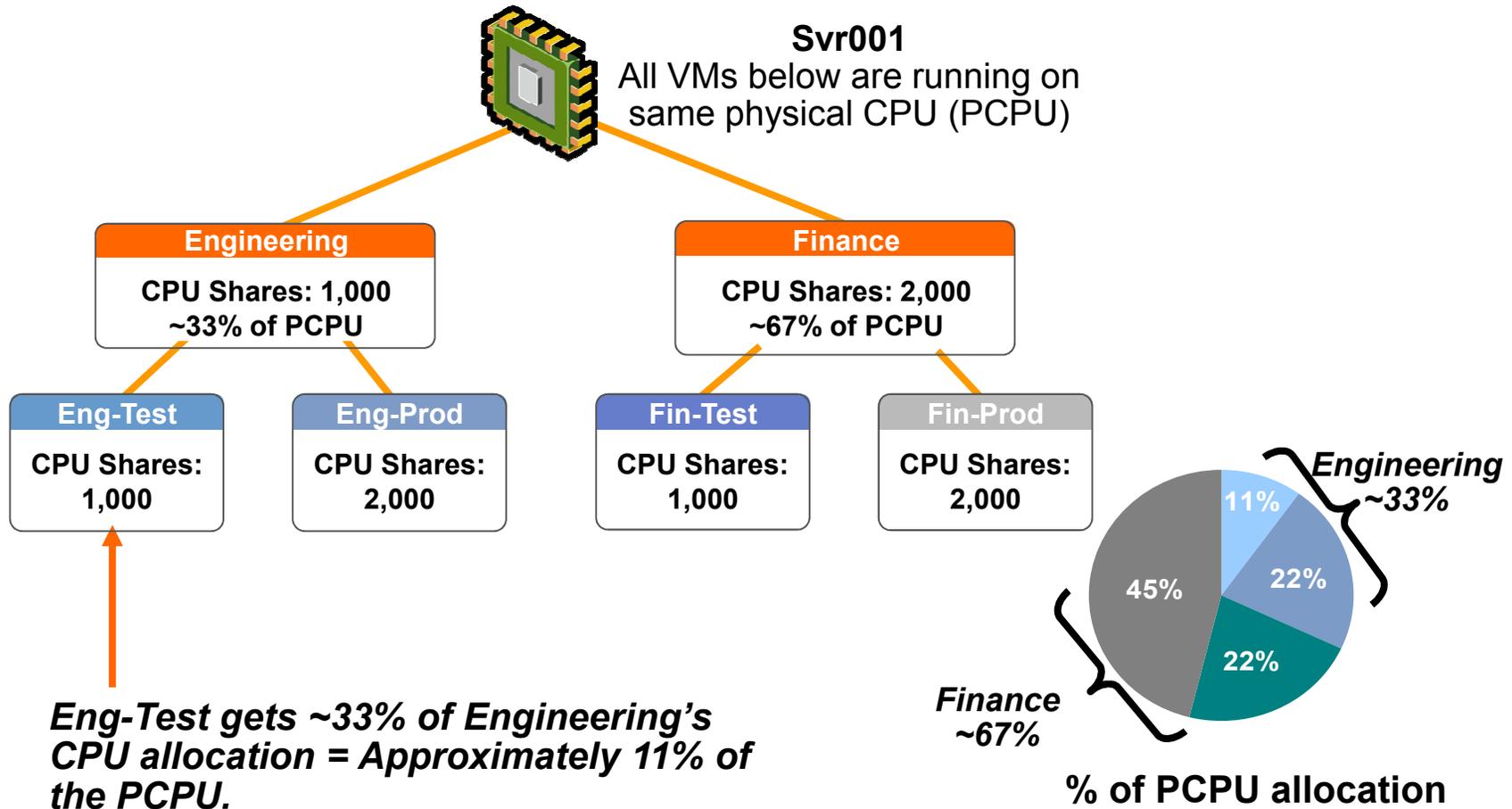
# Resource Pool Example



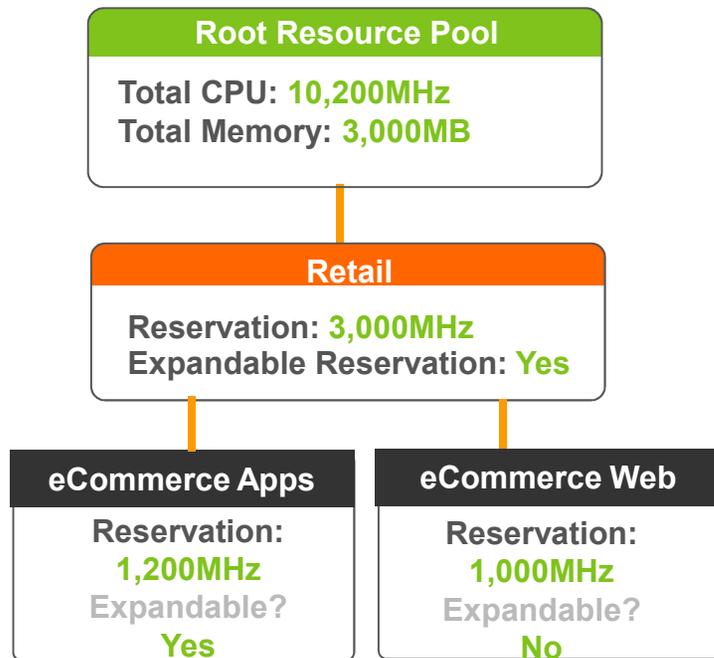
# Resource Pools Example: CPU Shares



# Resource Pools Example: CPU Contention



## Expandable Reservation



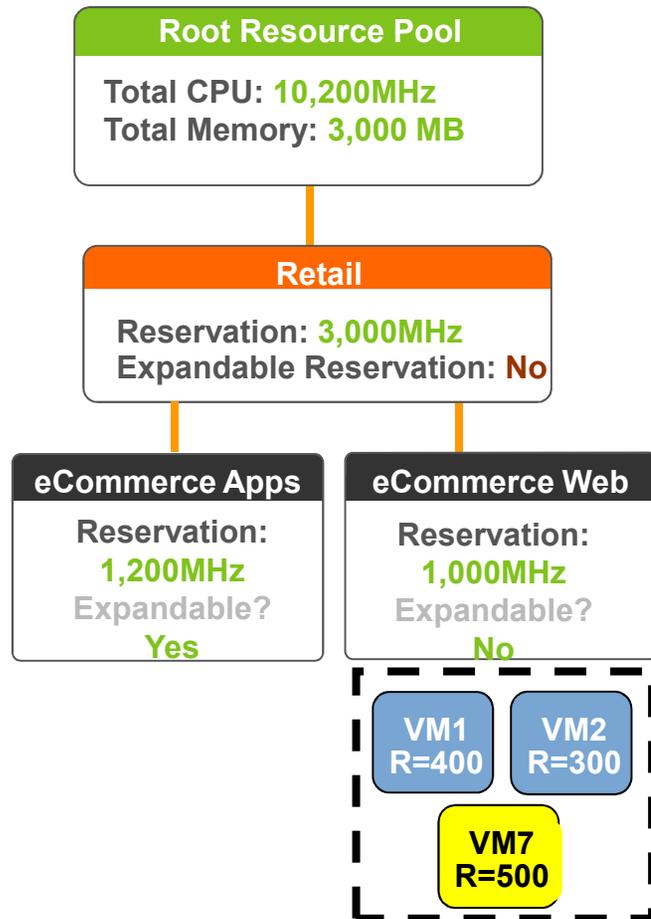
**Borrowing resources occurs recursively from the ancestors of the current resource pool.**

- > As long as **Expandable Reservation** is selected
- > Offers more flexibility but less protection

**Expanded reservations are not released until the virtual machine that caused the expansion is shut down or its reservation is reduced.**

**An expandable reservation could allow a rogue administrator to claim all unreserved capacity in the environment.**

## Example of Expandable Reservation (1)



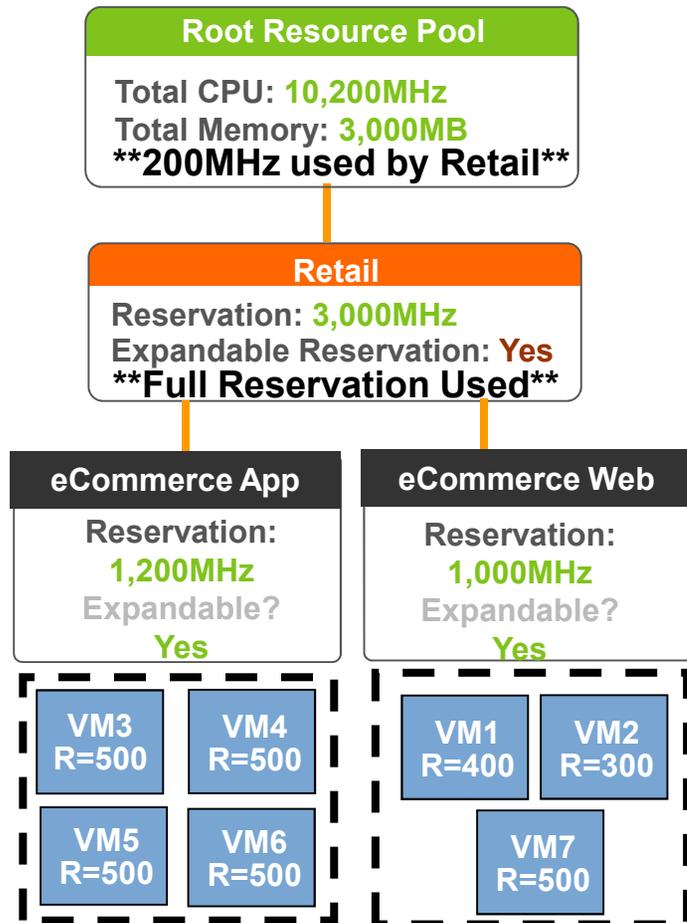
eCommerce resource pools reserve 2,200MHz of 3,000MHz the Retail resource pool has reserved.

Power on virtual machines in the eCommerce Web resource pool.

With expandable reservation disabled on the eCommerce Web resource pool, it is not possible to start VM7 with a reservation of 500MHz.

- > Lower the virtual machine reservation.
- > Select **Expandable Reservation**.
- > Increase eCommerce Web pool's reservation.

## Example of Expandable Reservation (2)



Enable expandable reservation on the eCommerce Web resource pool.

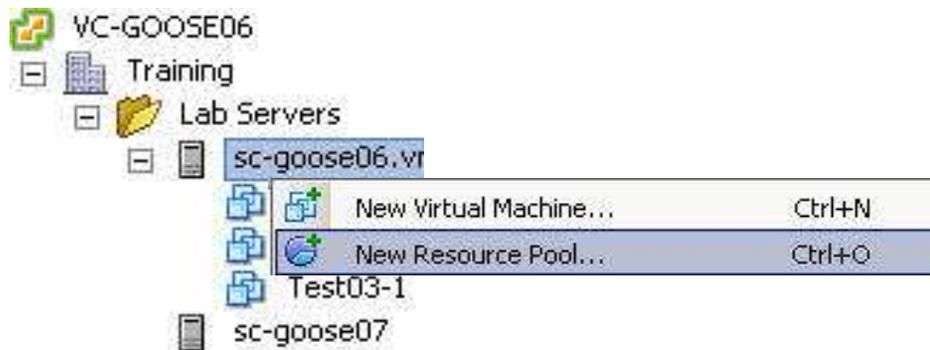
The system considers the resources available in the child resource pool and its direct parent resource pool.

The virtual machine's reservation is charged against the reservation for eCommerce Web.

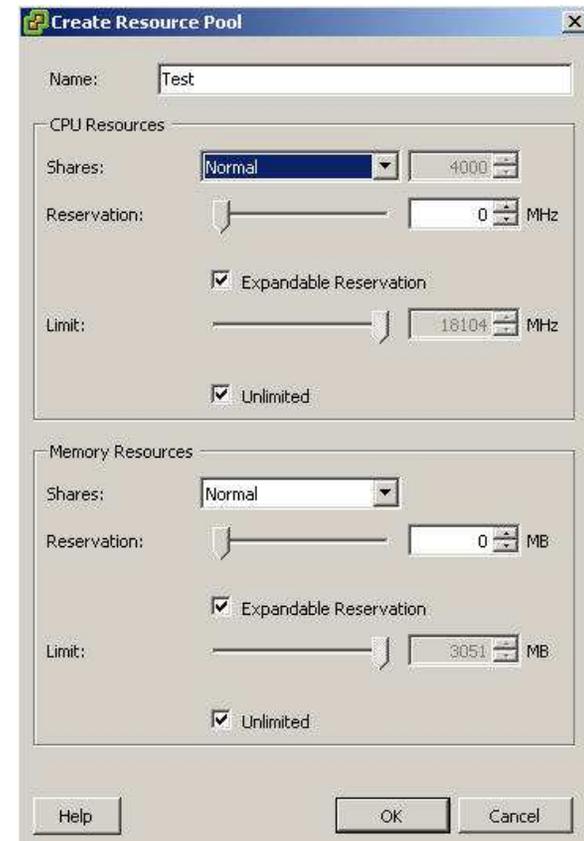
eCommerce Web's reservation is charged against the reservation for Retail.

## Creating a Resource Pool

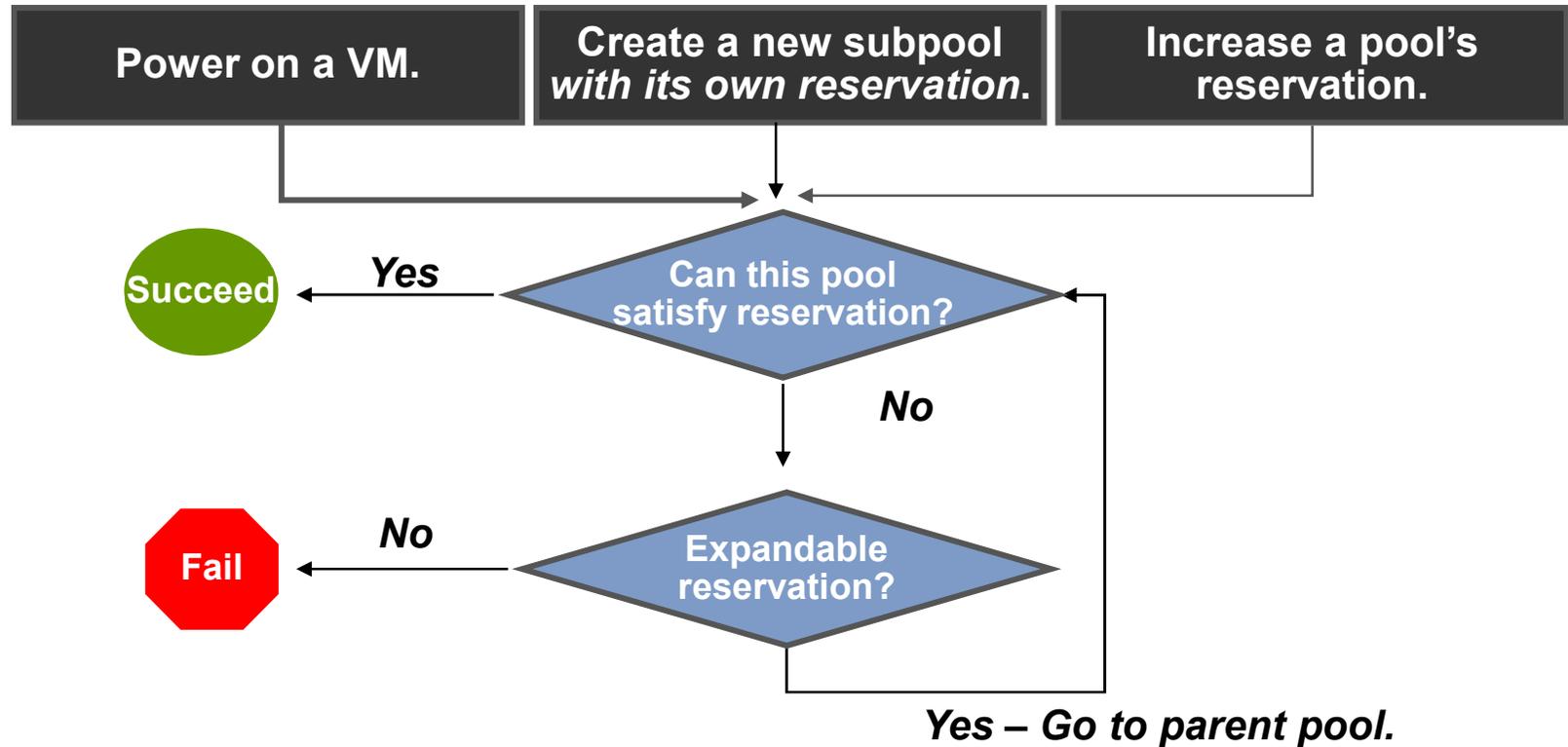
Right-click the host, then choose New Resource Pool.



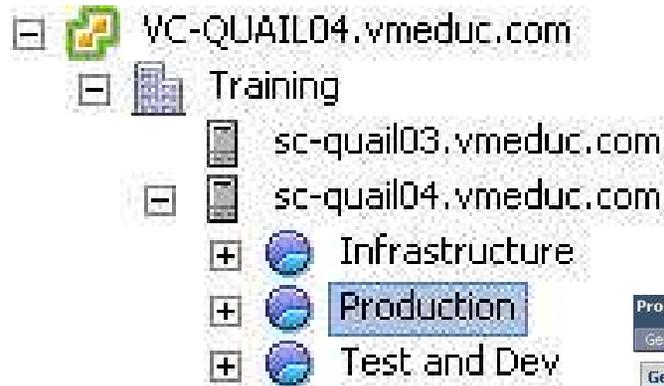
Drag virtual machines into the resource pool.



# Admission Control for CPU & Memory Reservations



# Resource Pool Summary Tab



Display the resource pool's Summary tab.

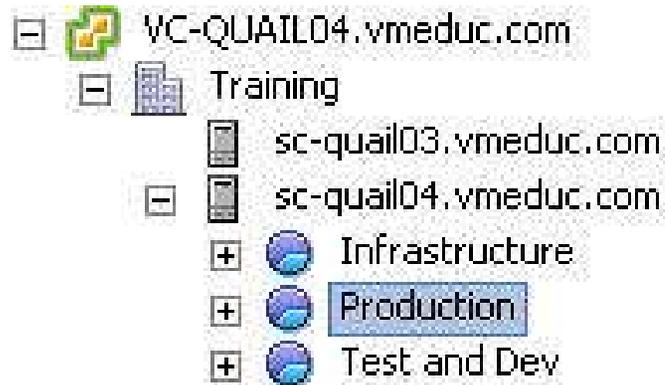
The screenshot shows the 'Production' resource pool Summary tab. The tabs at the top are: Getting Started, Summary (selected), Virtual Machines, Resource Allocation, Performance, Tasks & Events, Alarms, Permissions, Maps, and Storage Views.

**General**  
(This pool / Total descendants)  
Virtual Machines and Templates: 0/0  
Powered on Virtual Machines: 0/0  
Child Resource Pools: 0/0

**CPU**  
Host CPU: 0 MHz to 36394 MHz  
Consumed: 0 MHz  
Active: 0 MHz  
Resource Settings:  
Reservation: 500.00 MHz  
Limit: Unlimited  
Shares: Normal (4000)  
Worst Case Allocation: 0 MHz

**Memory**  
Host Memory: 0 MB to 100 MB  
Consumed: 0 MB  
Overhead Consumption: 0 MB  
Guest Memory: 0 MB to 100 MB  
Private: 0 MB, Shared: 0 MB, Swapped: 0 MB, Ballooned: 0 MB, Unaccessed: 0 MB, Active: 0 MB  
Resource Settings:  
Reservation: 1.00 GB  
Limit: Unlimited  
Configured: 0 MB  
Shares: Normal (163840)  
Worst Case Allocation Overhead: 0 MB

## Resource Allocation Tab



**Display the resource pool's Resource Allocation tab.**

**Production**

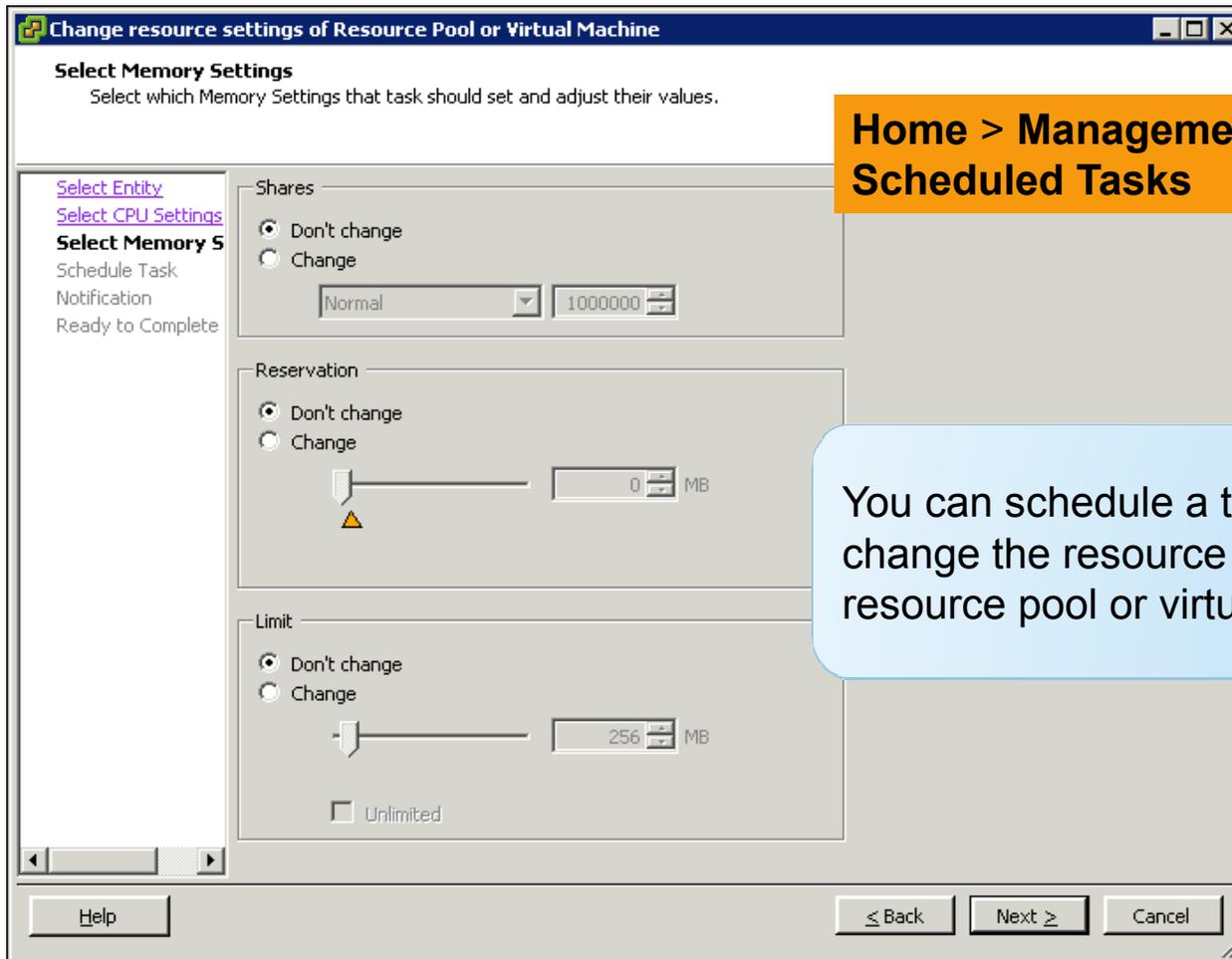
Getting Started Summary Virtual Machines **Resource Allocation** Performance Tasks & Events Alarms Permissions Maps Storage Views

CPU		Memory	
Total Capacity:	<b>500 MHz</b>	Total Capacity:	<b>1024 MB</b>
Reserved Capacity:	<b>500 MHz</b>	Reserved Capacity:	<b>106 MB</b>
Available Capacity:	<b>26382 MHz</b>	Overhead Reservation:	<b>106 MB</b>
Reservation Type:	<b>Expandable</b>	Available Capacity:	<b>2722 MB</b>
		Reservation Type:	<b>Expandable</b>

View: CPU Memory

Name	Reservation - MHz	Limit - MHz	Shares	Shares Value	% Shares	Worst Case Allocation - MHz	Type
Carla06-2	500	Unlimited	Normal	1000	100	2333	N/A

# Scheduling Changes to Resource Settings



Home > Management >  
Scheduled Tasks

You can schedule a task to change the resource settings of a resource pool or virtual machine.

## Lab 17

**In this lab, you will create and use resource pools on an ESX host.**

1. Create resource pools.
2. Verify resource pool functionality.

## Lesson Summary

- A virtual machine's CPU and memory allocation can be controlled using a combination of limits, reservations, and shares.
- Use resource pools for a flexible hierarchical organization of CPU and memory resources.
- Expandable reservation is a resource pool attribute that allows virtual machines and subpools to use resources from the pool's parent, if necessary.



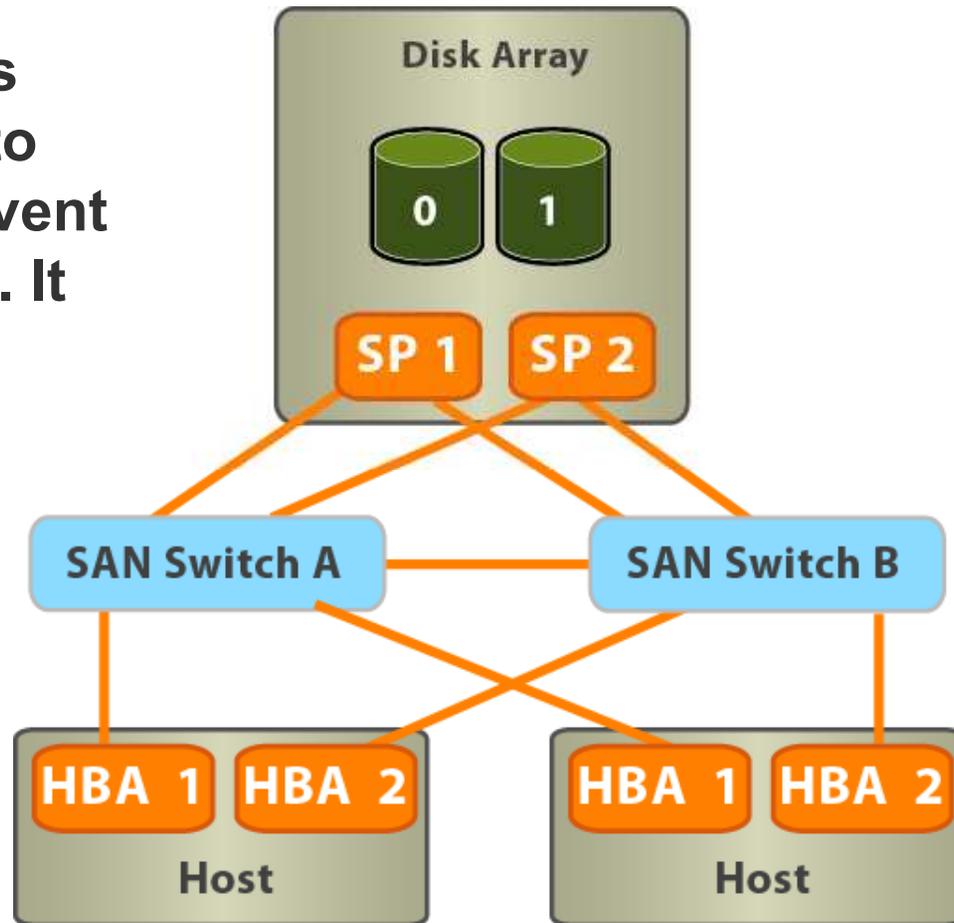
# Lesson 2: Scaling Storage and Network Management

## Lesson Objectives

- > Describe the methods for scaling storage management
  - Multipathing
    - Load balancing
- > Describe the Pluggable Storage Architecture (PSA)
- > Describe the methods for scaling network management
  - NIC teaming
  - Multipathing for iSCSI storage

## Storage Multipathing

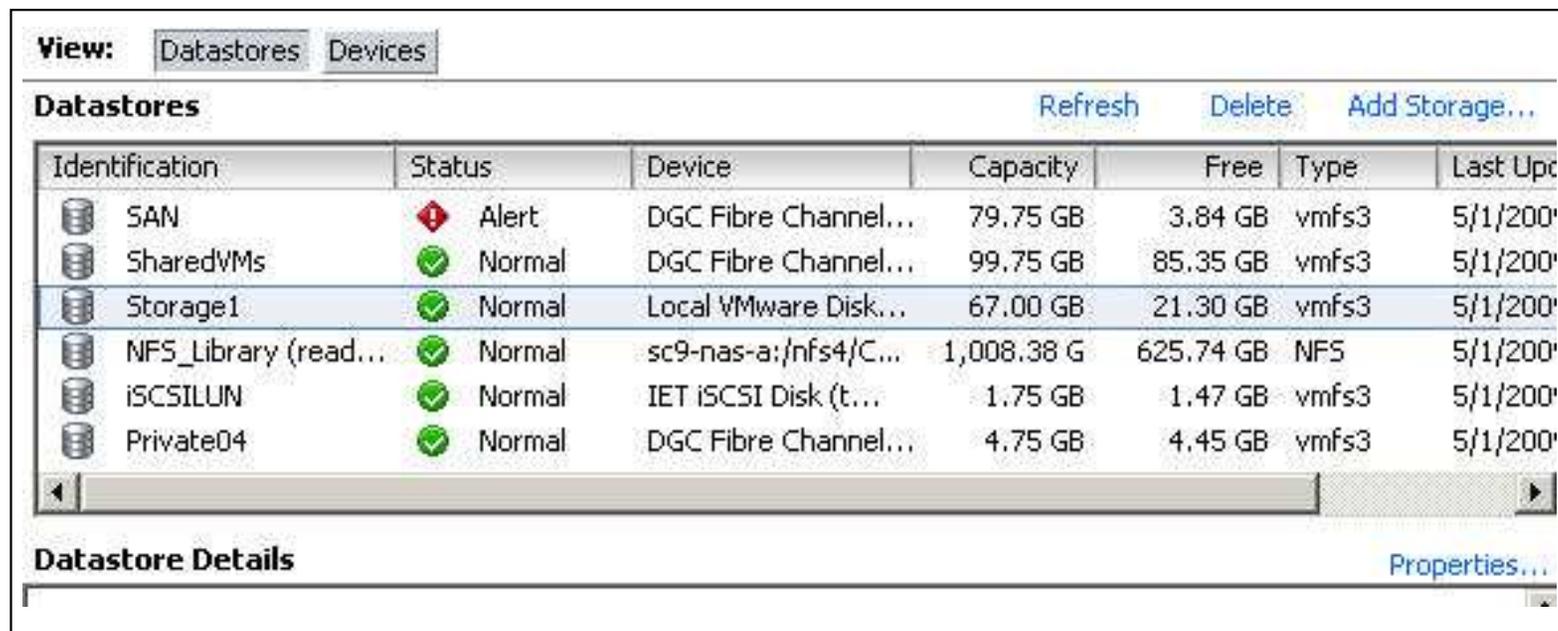
**Multipathing allows continued access to SAN LUNs in the event of hardware failure. It also provides load balancing.**



## Managing Multiple Storage Paths

Multiple paths can exist to a datastore on the host.

To modify storage path information, click the datastore's Properties link.



The screenshot shows the VMware vSphere interface with the 'Datastores' view selected. The table below lists the available datastores on the host.

Identification	Status	Device	Capacity	Free	Type	Last Update
 SAN	 Alert	DGC Fibre Channel...	79.75 GB	3.84 GB	vmfs3	5/1/200...
 SharedVMs	 Normal	DGC Fibre Channel...	99.75 GB	85.35 GB	vmfs3	5/1/200...
 Storage1	 Normal	Local VMware Disk...	67.00 GB	21.30 GB	vmfs3	5/1/200...
 NFS_Library (read...	 Normal	sc9-nas-a:/nfs4/C...	1,008.38 G	625.74 GB	NFS	5/1/200...
 iSCSILUN	 Normal	IET iSCSI Disk (t...	1.75 GB	1.47 GB	vmfs3	5/1/200...
 Private04	 Normal	DGC Fibre Channel...	4.75 GB	4.45 GB	vmfs3	5/1/200...

Below the table, the 'Datastore Details' section is visible, with a 'Properties...' link on the right.

## Configuring Storage Load Balancing

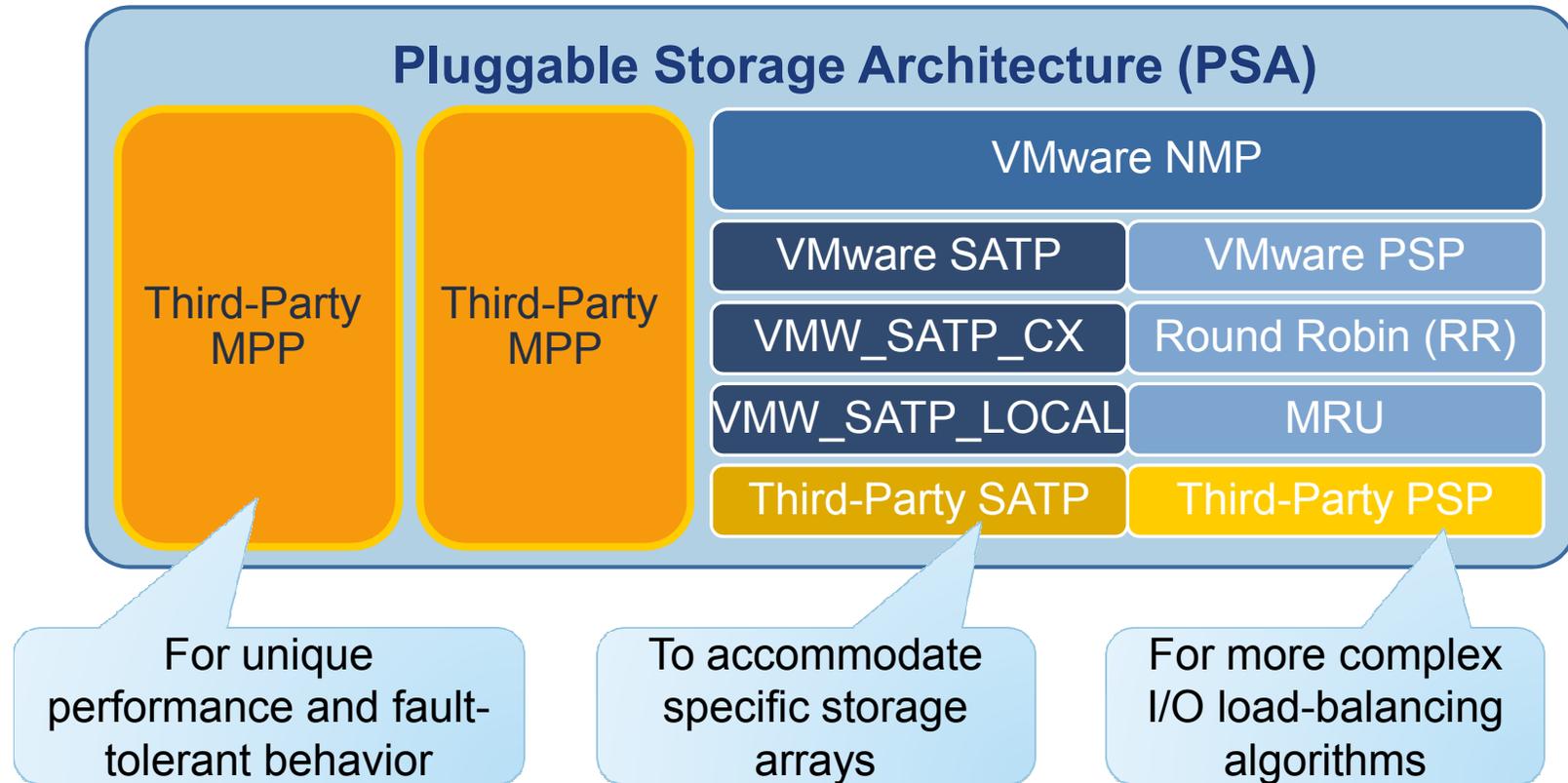
### Path selection policies exist for:

- > Scalability
  - Round Robin – a multipathing policy that performs load balancing across paths.
- > Availability
  - MRU and Fixed (discussed in a later module)

The screenshot shows the 'Manage Paths' configuration window for a 'DGC Fibre Channel Disk (naa.60060160d2b02000348e21afd6b1dd11)'. The 'Policy' section is expanded, showing 'Path Selection' set to 'Round Robin (VMware)' and 'Storage Array Type' set to 'VMW\_SATP\_CX'. Below this, the 'Paths' section contains a table with two rows of path information.

Runtime Name	Target	LUN	Status	Preferred
vmhba1:C0:T1:L31	50:06:01:60:c1:e0:eb:0a 50:06:01:69:41:e0:eb:0a	31	◆ Active (I/O)	
vmhba1:C0:T0:L31	50:06:01:60:c1:e0:eb:0a 50:06:01:61:41:e0:eb:0a	31	◇ Stand by	

# Pluggable Storage Architecture



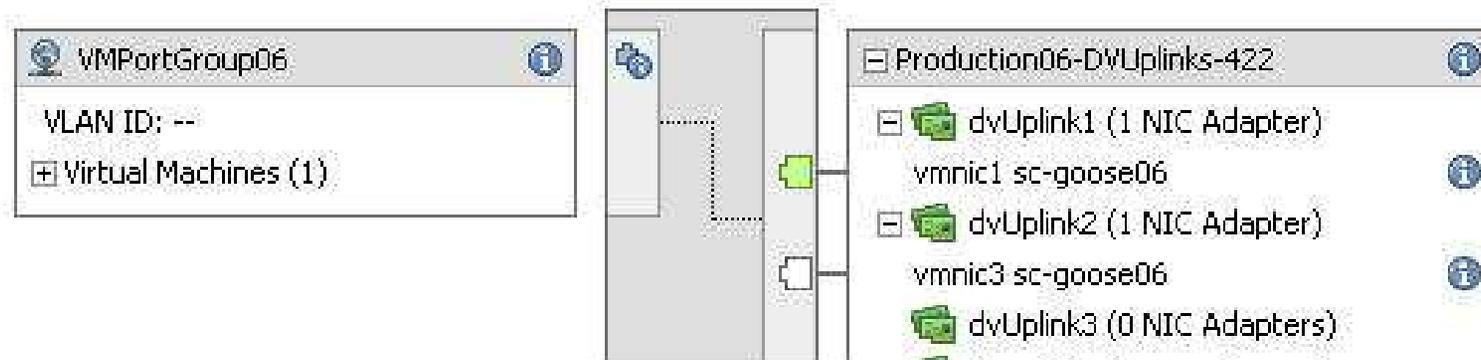
# Configuring NIC Teaming

## NIC teaming

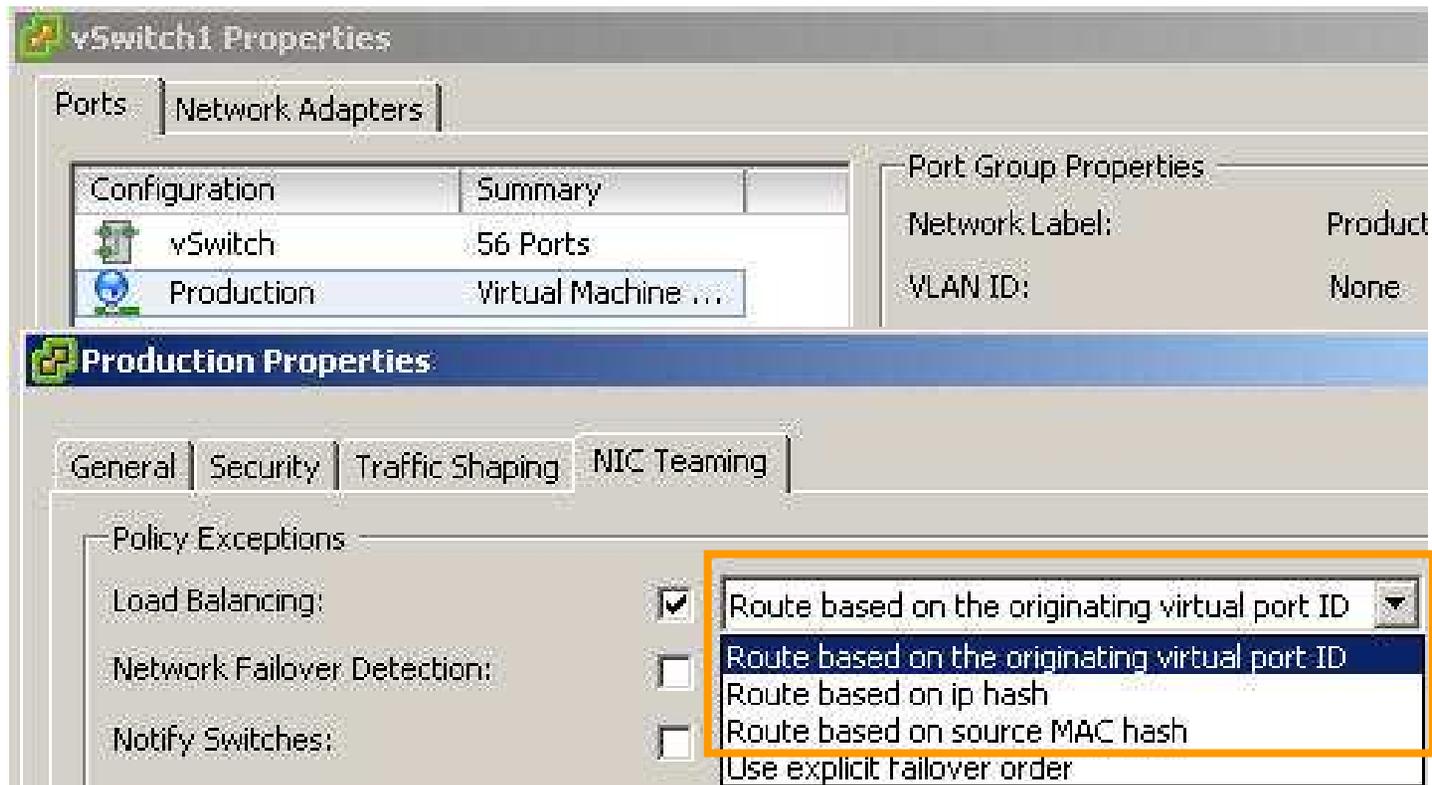
- > Provides multipathing for ESX/ESXi networks
- > Occurs when multiple uplinks are associated with a single vSwitch
- > Can share the network traffic load or provide NIC failover

**To configure, add network adapters to the virtual switch.**

Production06

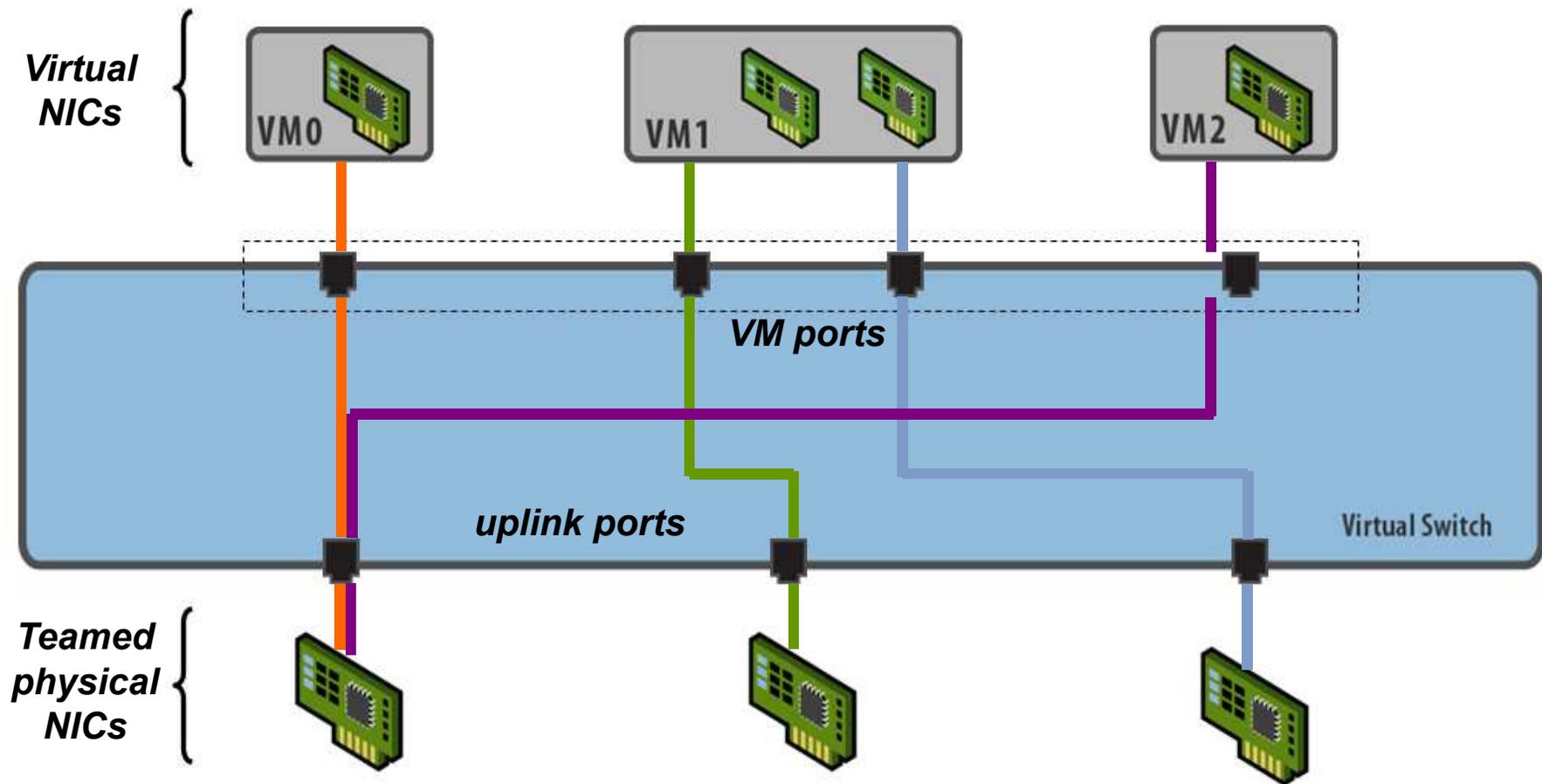


## Configuring Network Load Balancing

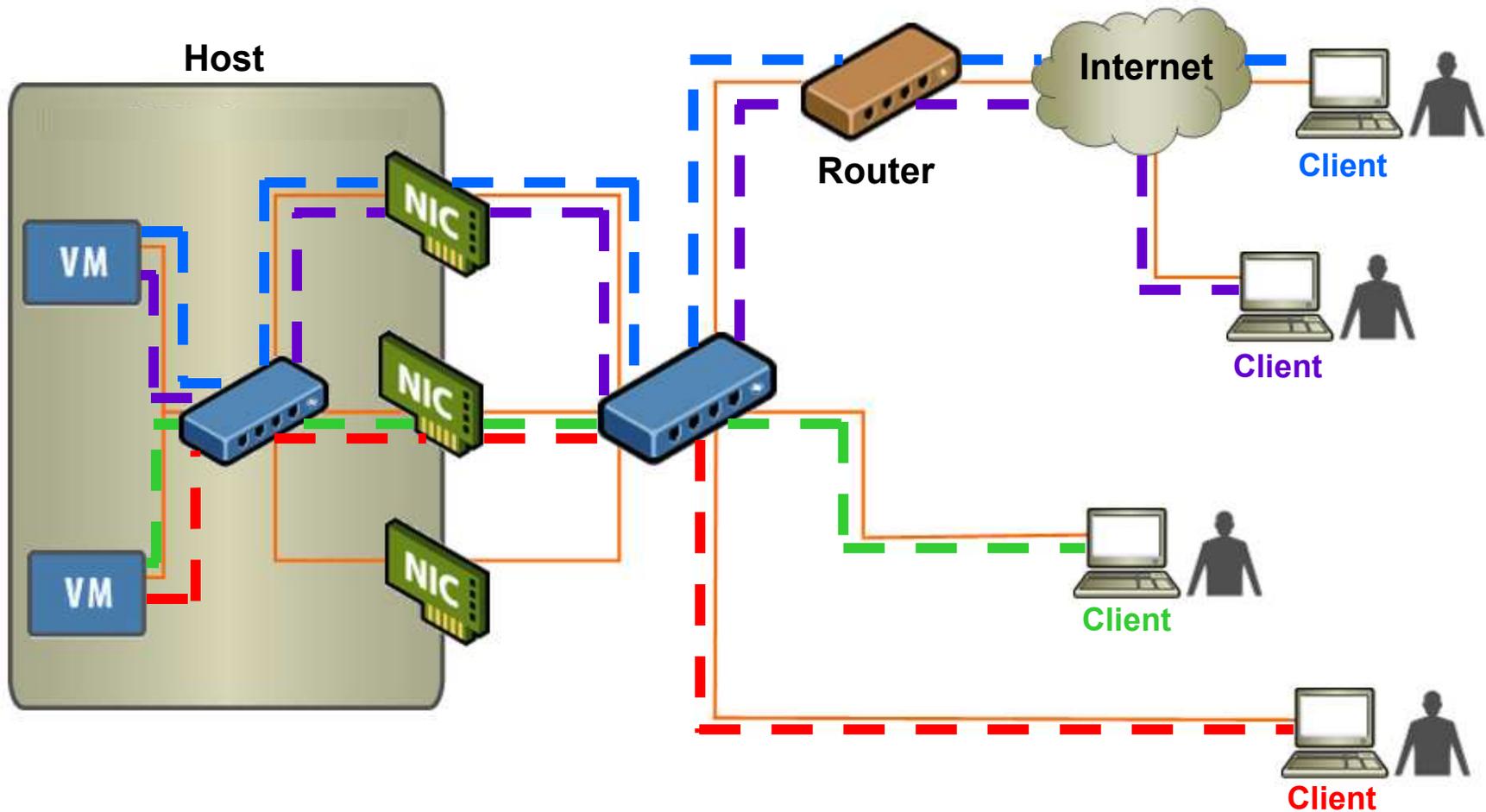


**The NIC Teaming configuration allows you to set a load-balancing policy.**

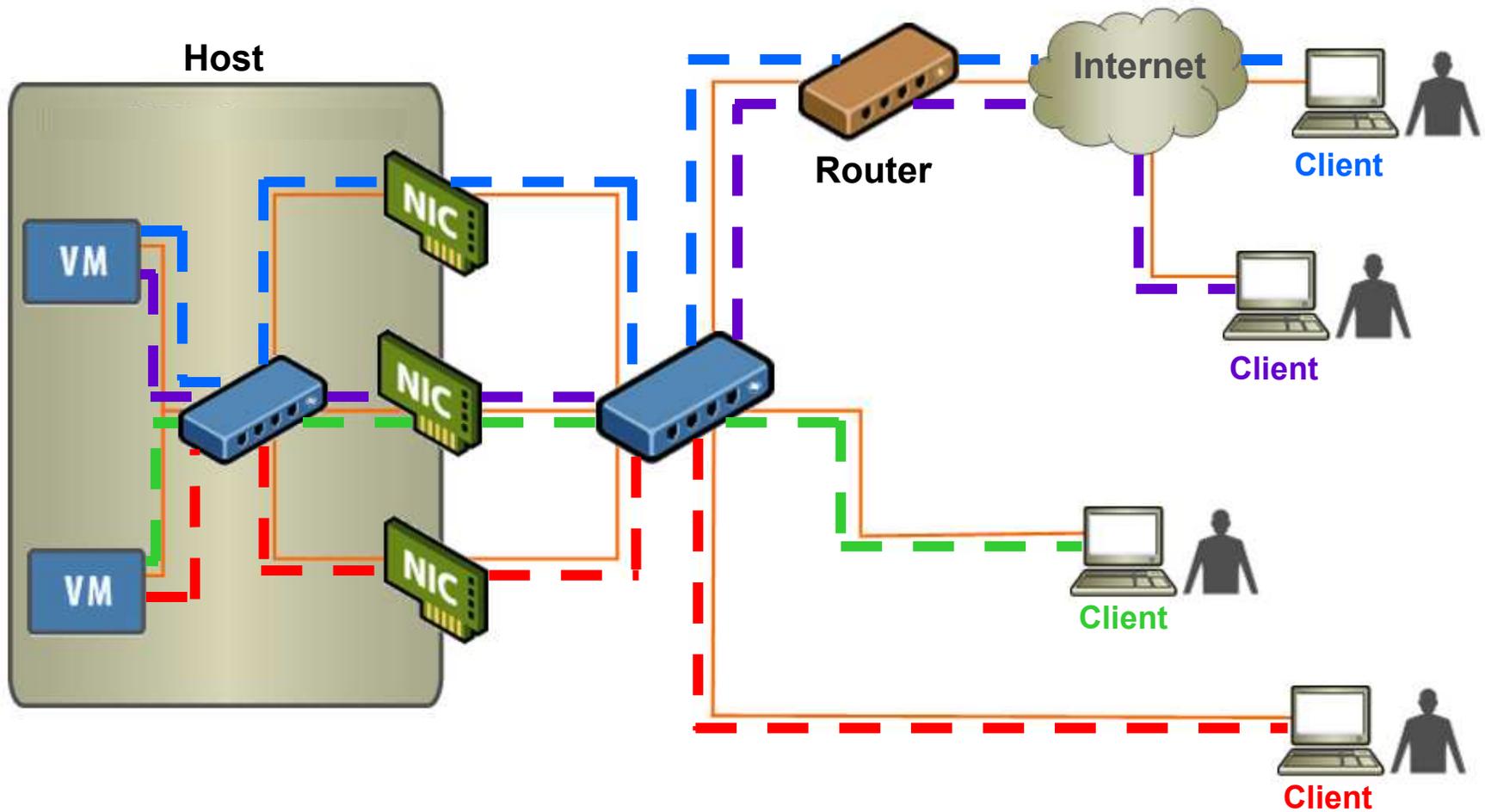
## Load-Balancing Method: Port-ID Based



## Load-Balancing Method: Source MAC-Based



## Load-Balancing Method: IP-Based



## Multipathing with iSCSI Storage

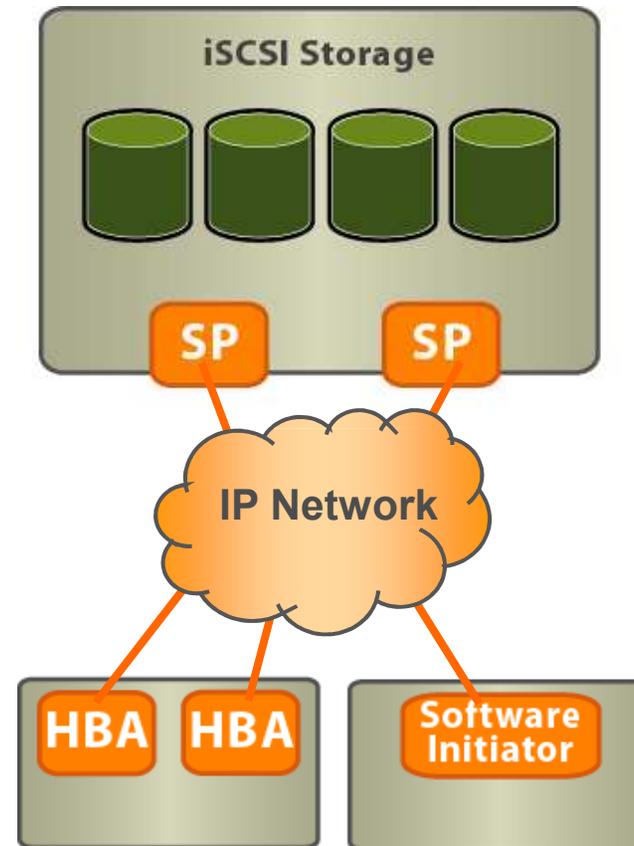
### SendTargets advertises multiple routes.

- It reports different IP addresses to allow different paths to the iSCSI LUNs.

### Routing done via IP network.

### For the software initiator:

- This counts as one network interface.
- NIC teaming and multiple SPs allow for multiple paths.



## Lesson Summary

- The Round Robin multipathing policy performs load balancing across multiple paths to the datastore.
- Pluggable Storage Architecture (PSA) is a VMkernel layer responsible for managing multiple paths, load balancing across paths, and path failover.
- Three NIC teaming policies exist for load balancing: Using the virtual port ID, using the IP hash, and using the source MAC hash.



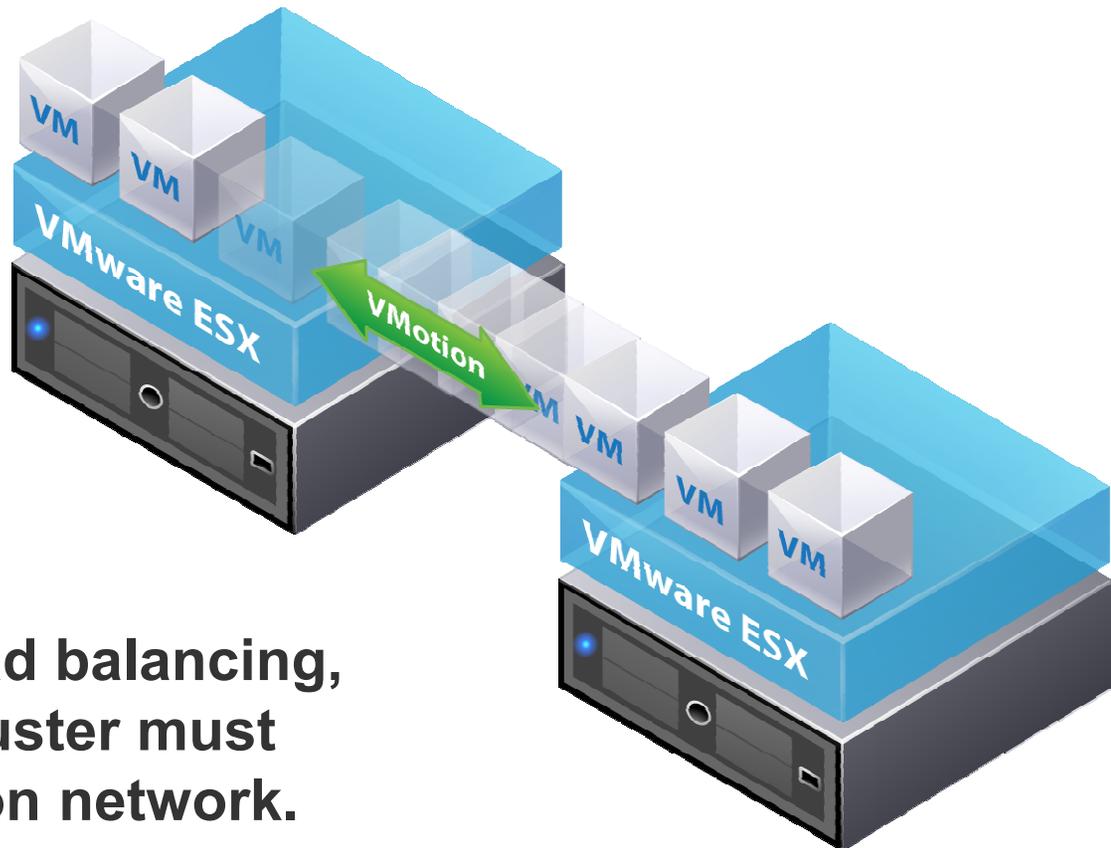
# Lesson 3: VMware VMotion Migration

## Lesson Objectives

- Understand the importance of VMware vMotion™
- Identify vMotion requirements
  - Virtual machine
  - Host
- Verify vMotion requirements
- Perform a vMotion migration

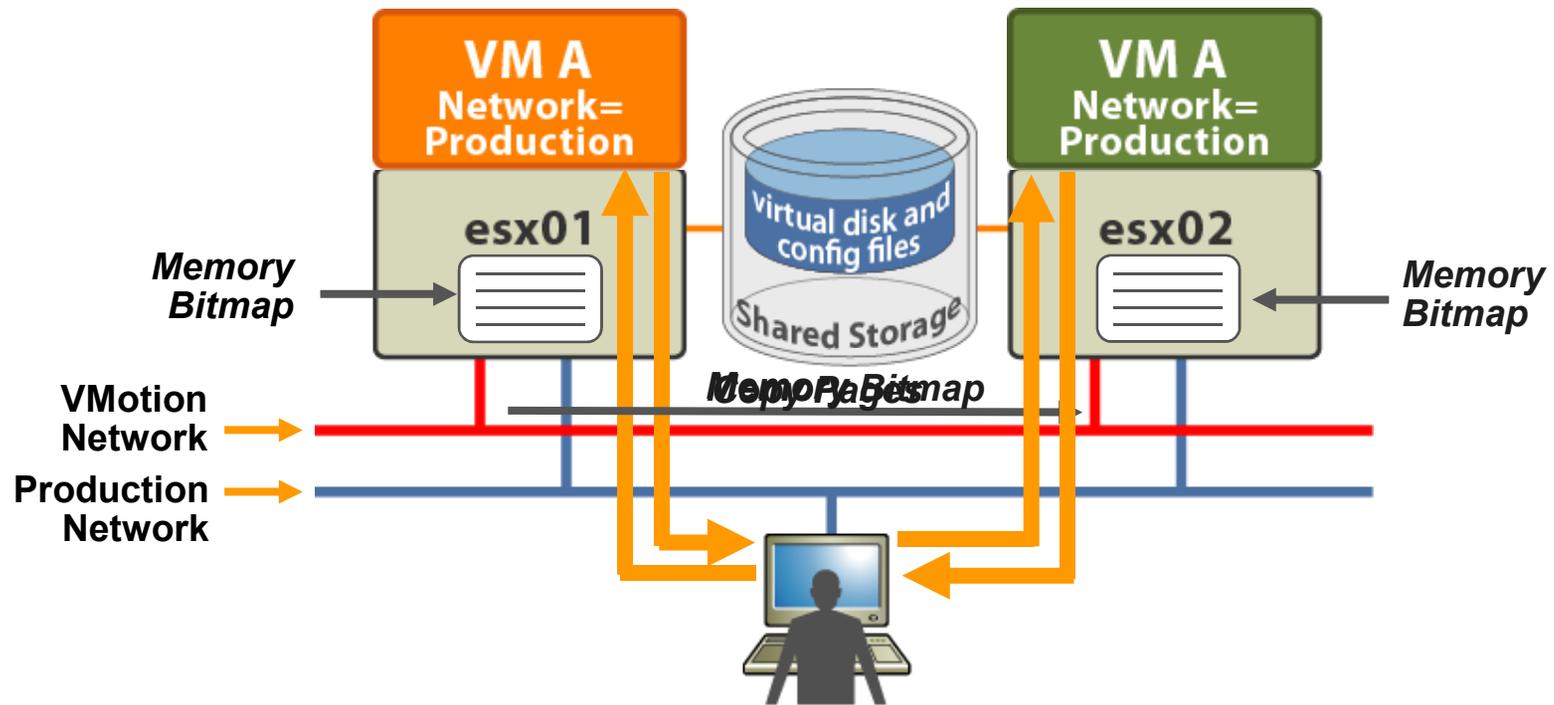
## VMotion Migration

**A VMotion migration moves a powered-on virtual machine from one host to another.**



**To use DRS for load balancing, the hosts in the cluster must be part of a VMotion network.**

# How VMotion Works



## Virtual Machine Requirements for VMotion

### A virtual machine must meet the following requirements:

- A virtual machine must not have a connection to an internal vSwitch (vSwitch with zero uplink adapters).
- A virtual machine must not have a connection to a virtual device (such as CD-ROM or floppy drive) with a local image mounted.
- A virtual machine must not have CPU affinity configured.
- A virtual machine must not be in an MSCS cluster relationship with another virtual machine.
- A virtual machine's swap file must be accessible by the destination host.
- If a virtual machine uses an RDM, the RDM must be accessible by the destination host.

## Host Requirements for VMotion

### Source and destination ESX hosts must have:

- Visibility to all storage (Fibre Channel, iSCSI, or NAS) used by the virtual machine
- A Gigabit Ethernet backplane
- Access to the same physical networks
- Compatible CPUs
  - CPU feature sets of both the source and destination host must be compatible.
  - Some features can be hidden using Enhanced VMotion Compatibility (EVC) or compatibility masks.

## CPU Constraints on VMotion

CPU characteristics	Exact match required?	Why or why not?
Clock speeds, cache sizes, hyperthreading, and number of cores	No	Virtualized away by VMkernel
Manufacturer ( <i>Intel or AMD</i> ) Family ( <i>P3, P4, Opteron</i> )	Yes	Instruction sets contain many small differences.
Presence or absence of SSE3, SSSE3, or SSE4.1 instructions	Yes	Multimedia instructions usable directly by applications
Virtualization hardware assist	For 32-bit VMs: No	Virtualized away by VMkernel
	For 64-bit VMs on Intel: Yes	VMware's Intel 64-bit implementation leverages VT.
Execution-disable (Nx/Xd bit)	Yes (but customizable)	Guest operating system relies on NX/XD bit if detected.

## Exposing or Hiding NX/XD

VC-QUAIL04.vmeduc.com

- Training
  - Production
    - Prod03-1
      - Prod03-1 - Virtual Machine Properties
  - Test

Settings	Summary
General Options	Prod03-1
vApp Options	Disabled
VMware Tools	System Default
Power Management	Standby
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

**CPU Identification Mask**

Hiding the NX/XD flag will increase VMotion compatibility between hosts, at the cost of disabling certain CPU performance features for some guest operating systems and applications.

- Hide the NX/XD flag from guest.
- Expose the NX/XD flag to guest.
- Keep current Advanced setting values for the Nx flag.

Advanced...

Choose between NX/XD security features or broadest VMotion compatibility.

For future CPU features, edit mask at the bit level.

## Identifying CPU Characteristics

```
Random_Init: Using random seed: 2044292605 (0x79d96dfd)
Reporting CPUID for 2 logical CPUs...
```

```
All CPUs are identical
```

```
Family: 06 Model: 17 Stepping: 6
```

```

  ID1ECX      ID1EDX      ID81ECX      ID81EDX
  0x00082201  0x0febfbff  0x00000001  0x20100000
```

```
Vendor          : Intel
Brand String    : "Intel(R) Xeon(R) CPU           X5482  @ 3.20GHz"
SSE Support     : SSE1, SSE2, SSE3, SSSE3, SSE4.1
Supports NX / XD : Yes
Supports CMPXCHG16B : Yes
Supports RDTSCP : No
Hyperthreading  : No
Supports Flex Migration : Yes
Supports 64-bit Longmode : Yes
Supports 64-bit VMWare : No
Supported EVC modes : None

PASS: Test 56983: CPUID
Press any key to reboot.
```

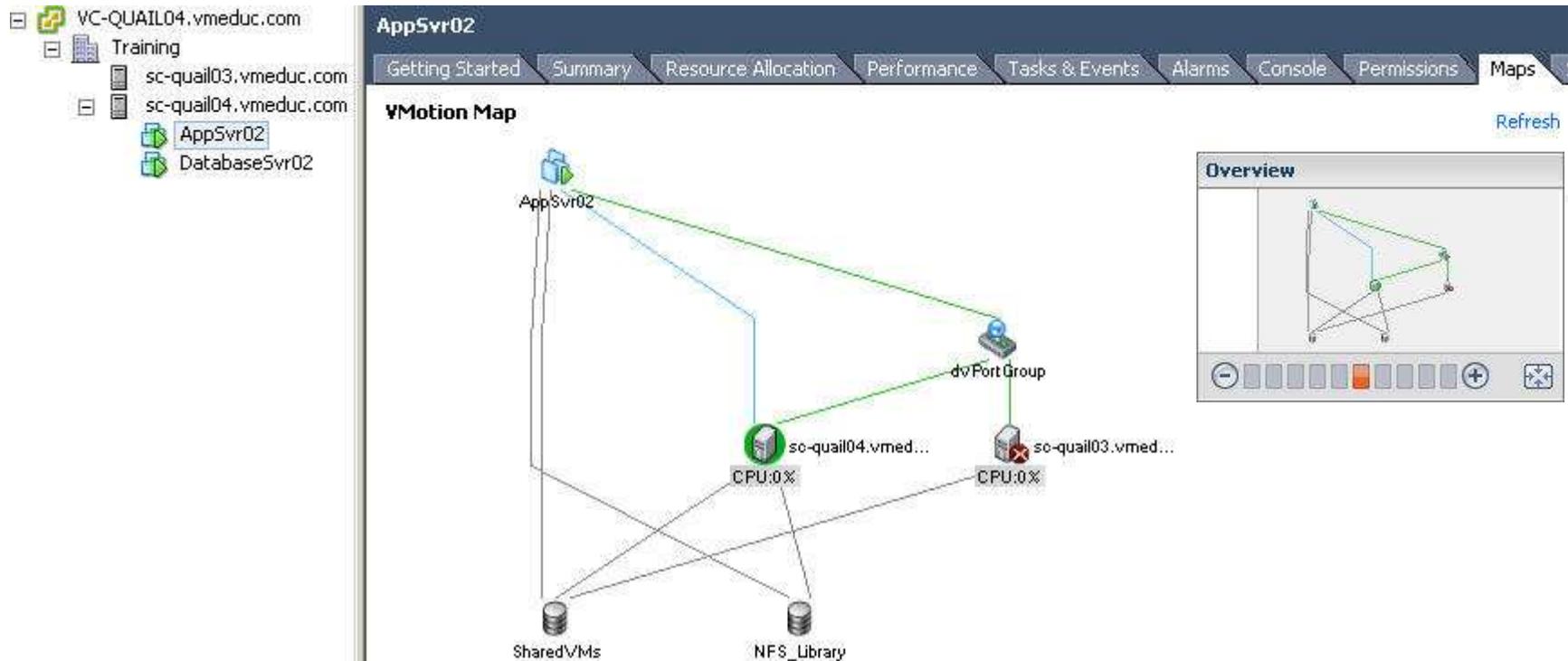
**In most cases, use server and CPU family/model specifications.**

**Use VMware bootable CPUID utility.**

# Verifying VMotion Layout: Custom Maps

The screenshot displays the VMware vSphere interface for a cluster named 'VC-QUAIL04.vmeduc.com'. The left sidebar shows a tree view with 'Training' selected, containing sub-items 'sc-quail03.vmeduc.com', 'sc-quail04.vmeduc.com', 'AppSvr02', and 'DatabaseSvr02'. The main window is titled 'Training' and has a navigation bar with tabs: 'Getting Started', 'Summary', 'Virtual Machines', 'Hosts', 'IP Pools', 'Performance', 'Tasks & Events', 'Alarms', 'Permissions', and 'Maps'. The 'Maps' tab is active, showing 'Virtual Machine Resources'. The central diagram illustrates the layout of virtual machines and their connections to various resources. 'AppSvr02' is connected to 'NFS\_Library', 'SharedVMS', and 'dv Port Group'. 'DatabaseSvr02' is connected to 'SharedVMS', 'Storage1', and 'Storage1 (1)'. 'sc-quail04.vmeduc...' is connected to 'SharedVMS' and 'dv Port Group'. Below the diagram are icons for 'iSCSILUN', 'VMotion...', 'VM Network', 'ProdTemplate', 'SAN', and 'Product...'. On the right, there is an 'Overview' section with a small diagram and a 'Map Relationships' section. The 'Map Relationships' section has two sub-sections: 'Virtual Machine Resources' and 'Host Options'. Under 'Virtual Machine Resources', there are three options: 'Host to VM' (checked), 'Host to Network' (unchecked), and 'Host to Datastore' (unchecked). Under 'Host Options', there are three options: 'Fault Tolerance relationships' (checked), 'VM to Network' (checked), and 'VM to Datastore' (checked). There is also an unchecked option 'Show only powered on VMs'. An 'Apply Relationships' button is located at the bottom of the 'Map Relationships' section.

# Verifying VMotion Layout: Virtual Machine Map



## Performing a VMotion Migration

From the VMware vCenter™ Server inventory, right-click a virtual machine that is powered on, then choose Migrate.

### Select Migration Type

Change the virtual machine's host, datastore or both.

#### Select Migration Type

Select Destination

Select Resource Pool

Migration Priority

Ready to Complete

**Change host**

Move the virtual machine to another host.

**Change datastore**

Move the virtual machine's storage to another datastore.

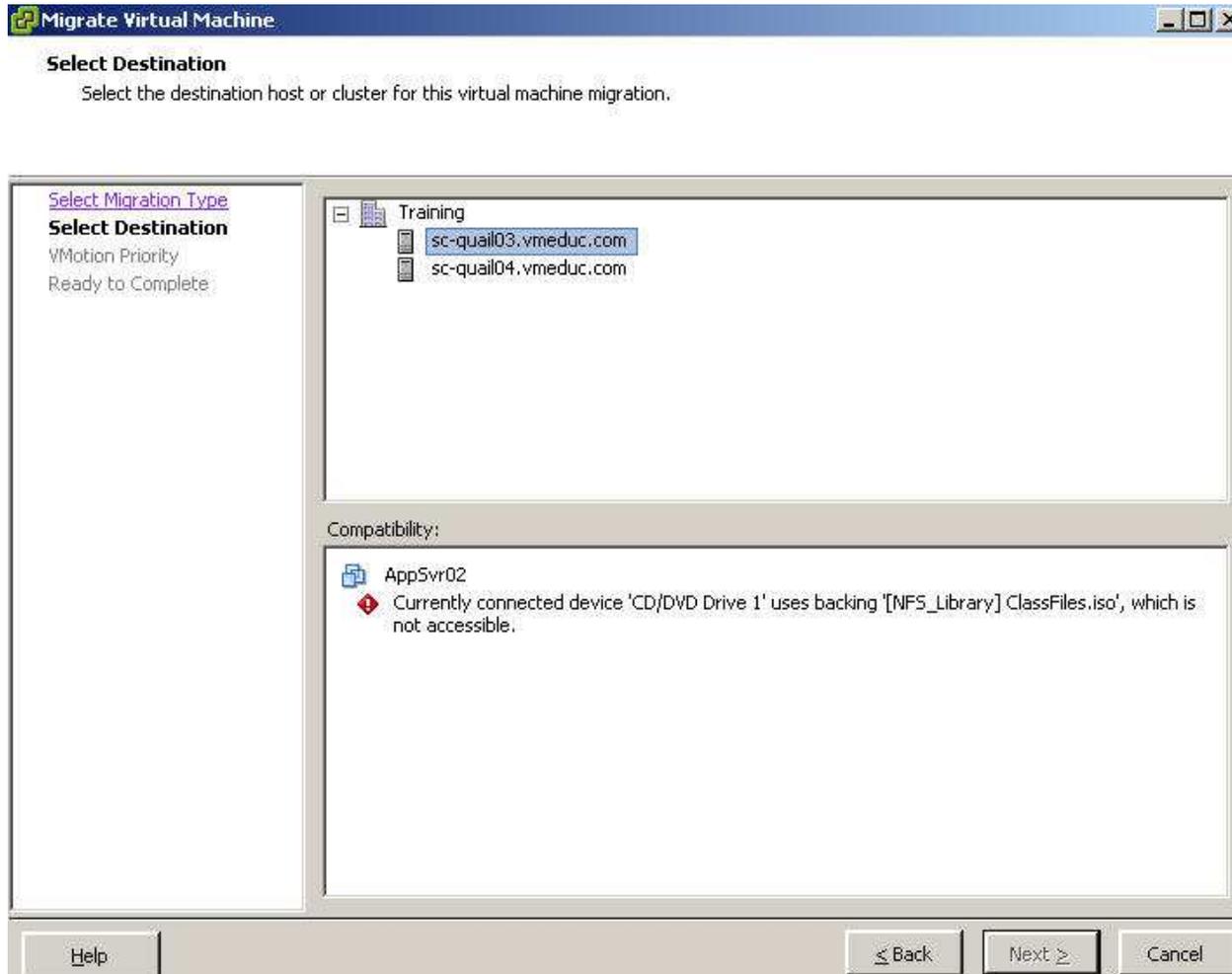
**Change both host and datastore**

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.

VMotion migration

# Checking VMotion Errors



## Lab 18

### **In this lab, you will migrate virtual machines using VMotion.**

1. Add a second ESX host to the Training datacenter.
2. Add a second ESX host to the VMotion distributed switch.
3. Create a VMkernel port for your host on the VMotion distributed switch.
4. Verify that your virtual machines' settings meet VMotion requirements.
5. Verify that your ESX host meets VMotion requirements.
6. Connect virtual machines to the Production network of the lower-number ESX host.
7. Perform a VMotion migration of your virtual machine.

## Lesson Summary

- VMotion is the underlying technology required for DRS to function properly.
- Use the host or virtual machine's Maps tab to help you verify your VMotion layout.
- If a virtual machine or host does not meet one or more VMotion requirements, the Migrate Virtual Machine wizard catches any inconsistencies during its validation process.



# Lesson 4: VMware Distributed Resource Scheduler

## Lesson Objectives

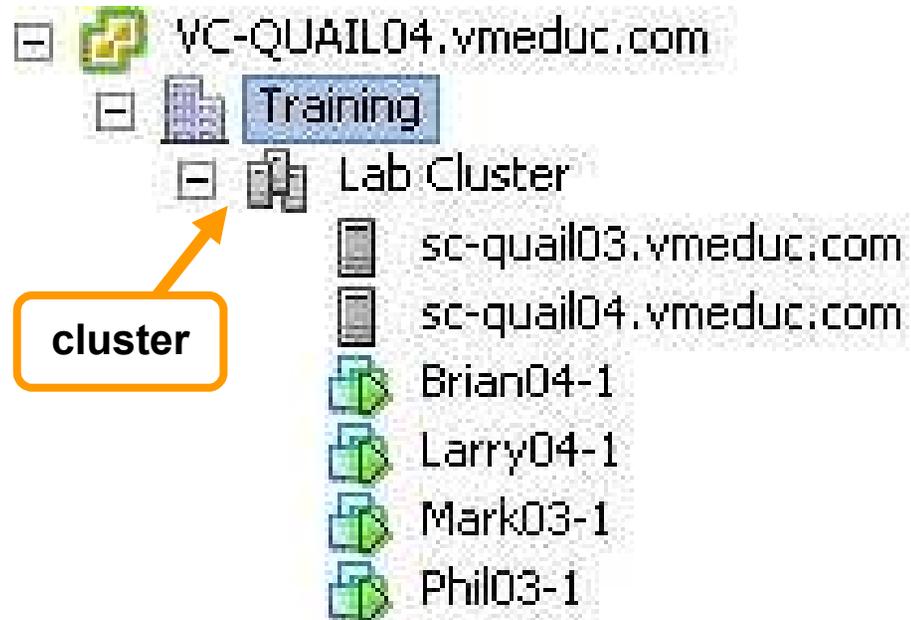
- Describe the functions of a DRS cluster
- Explain the benefits of EVC
- Create a DRS cluster
- View information about a DRS cluster
- Remove a host from a DRS cluster

## What Is a DRS Cluster?

**A cluster is a collection of ESX hosts and associated virtual machines.**

**A DRS cluster is managed by vCenter Server and has these resource management capabilities:**

- > Initial placement
- > Load balancing
- > Power management
- > Virtual machine affinity rules



## DRS Cluster Prerequisites

**DRS works best if the virtual machines meet VMotion requirements.**

**To use DRS for load balancing, the hosts in the cluster must be part of a VMotion network.**

- If not, DRS can still make initial placement recommendations.

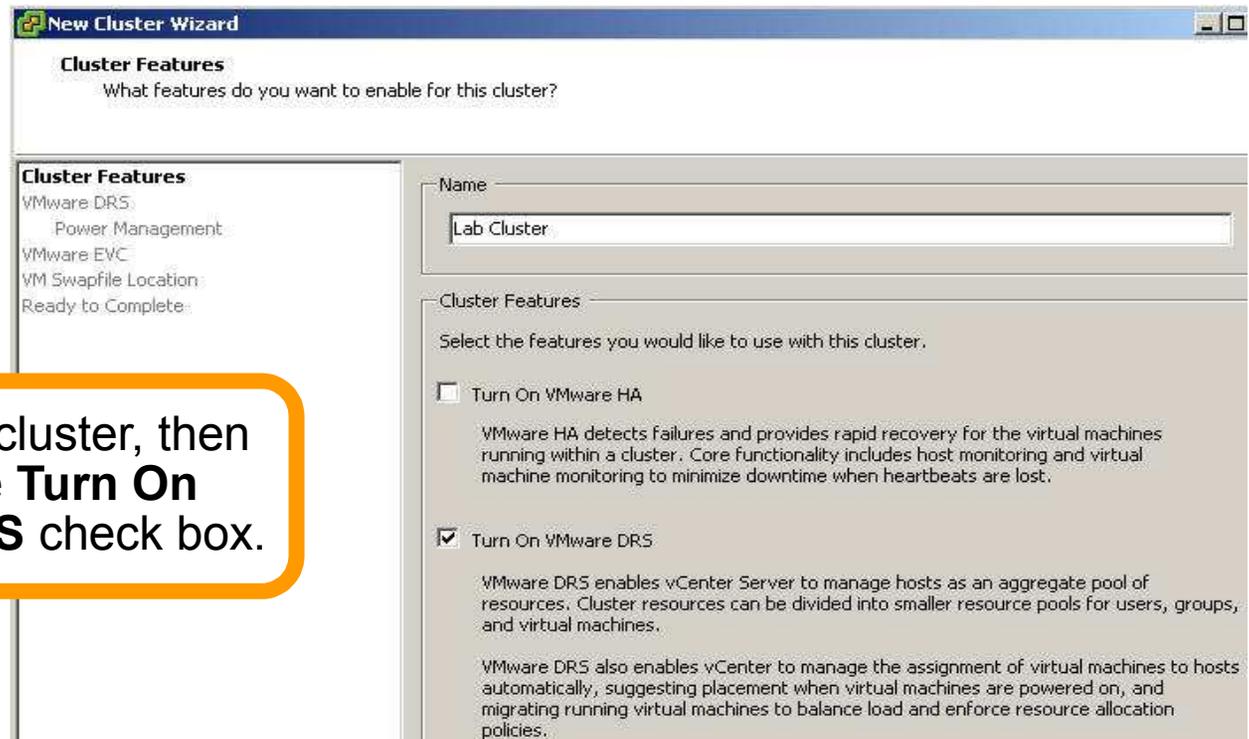
**Configure all hosts in the cluster to use shared VMware vStorage VMFS volumes.**

- Volumes must be accessible by all hosts.
- Volumes must be large enough to store all virtual disks for your virtual machine.

## Creating a DRS Cluster



**Right-click your datacenter.  
Select New Cluster.**



Name your cluster, then  
select the **Turn On  
VMware DRS** check box.

## DRS Cluster Settings: Automation Level

Configure the automation level for initial placement of VMs and dynamic balancing while VMs are running.

**VMware DRS**  
What level of automation do you want this cluster to use?

**Cluster Features**  
VMware DRS  
Power Management  
VMware EVC  
VM Swapfile Location  
Ready to Complete

**Automation level**

- Manual**  
vCenter will suggest migration recommendations for virtual machines.
- Partially automated**  
Virtual machines will be automatically placed onto hosts at power on and vCenter will suggest migration recommendations for virtual machines.
- Fully automated**  
Virtual machines will be automatically placed onto hosts when powered on, and will be automatically migrated to attain best use of resources.

Migration threshold: Conservative  Aggressive

Apply priority 3 or higher recommendations  
vCenter will apply recommendations that promise at least good improvement to the cluster's load balance.

Automation level	Initial VM placement	Dynamic balancing
Manual	Manual	Manual
Partially automated	Automatic	Manual
Fully automated	Automatic	Automatic

## DRS Cluster Settings: Migration Threshold

The migration threshold levels determine how quickly virtual machines are migrated.

Migration threshold: Conservative  Aggressive

Apply priority 3 or higher recommendations  
vCenter will apply recommendations that promise at least good improvement to the cluster's load balance.

Priority level	Apply all recommendations
1 – Most conservative	with five stars only
2 – Moderately conservative	with four or more stars
3 – Midpoint (default)	with three or more stars
4 – Moderately aggressive	with two or more stars
5 – Aggressive	with one or more stars

# DRS Cluster Settings: Power Management

The screenshot shows the 'New Cluster Wizard' window. The title bar reads 'New Cluster Wizard'. Below the title bar, the 'Power Management' section is active, with the question: 'Do you want to enable power management for this cluster?'. On the left, a navigation pane shows 'Cluster Features' expanded, with 'VMware DRS' selected. Under 'VMware DRS', 'Power Management' is highlighted. Other options in the pane include 'VMware EVC', 'VM Swapfile Location', and 'Ready to Complete'. The main content area shows the 'Power Management' configuration. It includes a text block explaining that DPM uses Wake-on-LAN, IPMI, or iLO to power on hosts and that IPMI or iLO should be configured separately. Below this, it asks to specify the default power management for the cluster. Three radio buttons are present: 'Off' (selected), 'Manual', and 'Automatic'. Each option has a descriptive paragraph. At the bottom, there is a 'DPM Threshold' slider ranging from 'Conservative' to 'Aggressive', with a slider handle positioned in the middle. Below the slider, there is a text block explaining that vCenter will apply priority 3 or higher recommendations to meet VMware HA requirements or user-specified capacity requirements, and that power on recommendations will be applied if host resource utilization becomes higher than the target utilization range, while power off recommendations will be applied if host resource utilization becomes very low in comparison to the target utilization range.

**VMware Distributed Power Management (DPM) allows a DRS cluster to reduce its power consumption by powering off hosts that are not busy.**

## DRS Cluster Settings: VMware EVC

**New Cluster Wizard**

**VMware EVC**  
Do you want to enable Enhanced VMotion Compatibility for this cluster?

**Cluster Features**  
[VMware DRS](#)  
[VMware HA](#)  
**VMware EVC**  
VM Swapfile Location  
Ready to Complete

Enhanced VMotion Compatibility (EVC) configures a cluster and its hosts to maximize VMotion compatibility. Once enabled, EVC will also ensure that only hosts that are compatible with those in the cluster may be added to the cluster.

Disable EVC     Enable EVC for AMD Hosts     Enable EVC for Intel® Hosts

VMware EVC Mode:

Description
AMD Opteron™ Generation 1/2
AMD Opteron™ Generation 3

Applies the baseline feature set of AMD Opteron™ Generation 1/2 ("Rev. E"/"Rev. F") processors to all hosts in the cluster.

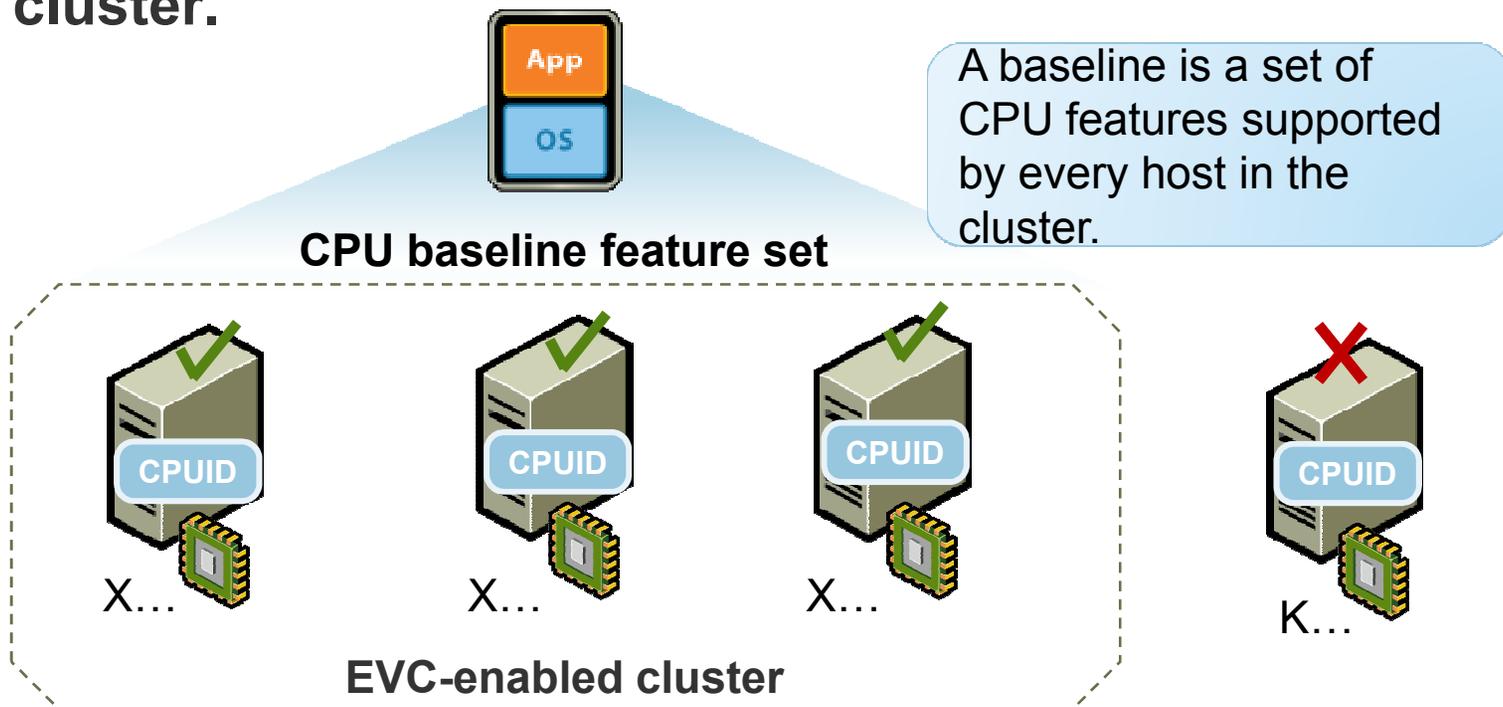
Hosts with the following processor types will be permitted to enter the cluster:  
AMD Opteron™ Generation 1/2 ("Rev. E"/"Rev. F")  
AMD Opteron™ Generation 3 ("Greyhound")

For more information, see Knowledge Base article 1003212.

**EVC is a cluster feature that prevents VMotion migrations from failing due to incompatible CPUs.**

## CPU Baselines for an EVC Cluster

**EVC works at the cluster level using CPU baselines to configure all processors included in the EVC-enabled cluster.**



## EVC Cluster Requirements

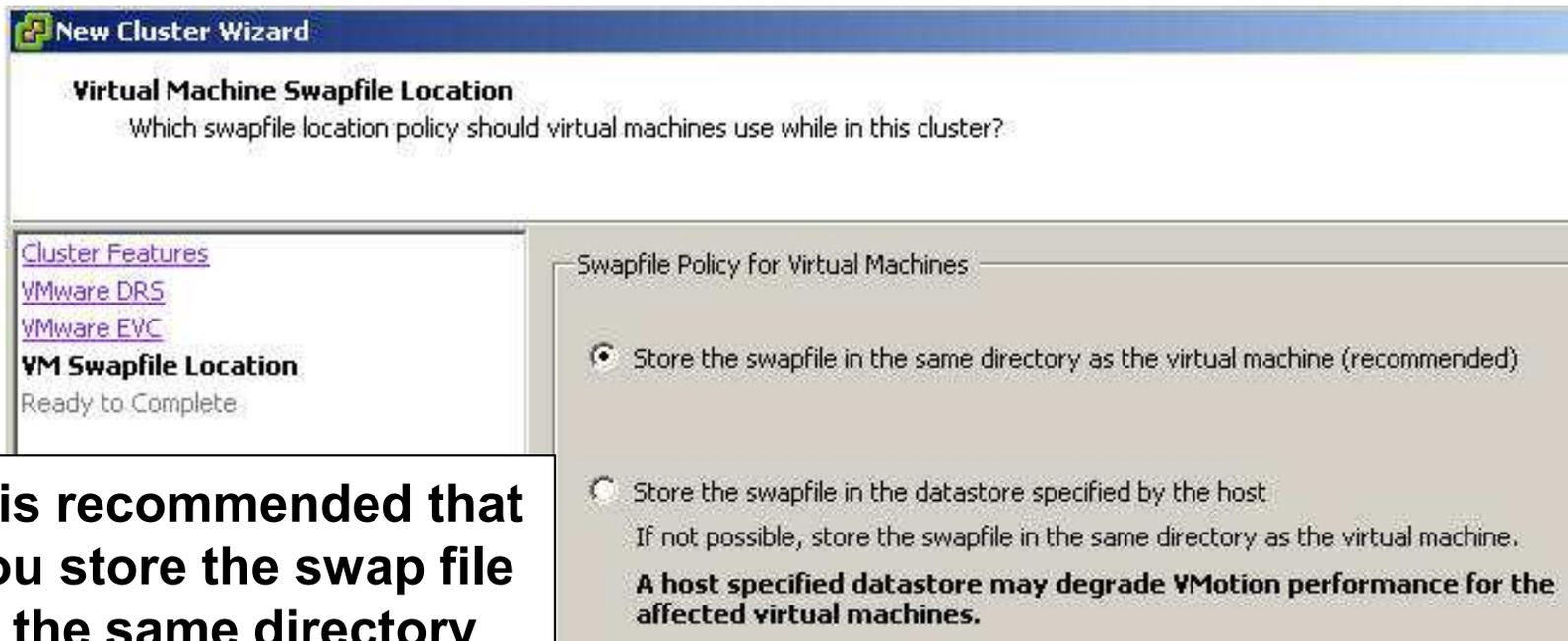
**All hosts in the cluster must meet the following requirements:**

- Use CPUs from a single vendor (either Intel or AMD)
  - Use Intel CPUs with Core 2 micro architecture and newer
  - Use AMD second-generation Opteron CPUs and newer
- Run ESX 3.5 Update 2 or later
- Be connected to vCenter Server
- Be enabled for hardware virtualization (AMD-V or Intel VT)
- Be enabled for execution-disable technology (AMD No eXecute (NX) or Intel eXecute Disable (XD))

**Applications in virtual machines must be well-behaved.**

## DRS Cluster Settings: Swap File Location

Store virtual machine's swap file with virtual machine or in a specified datastore.

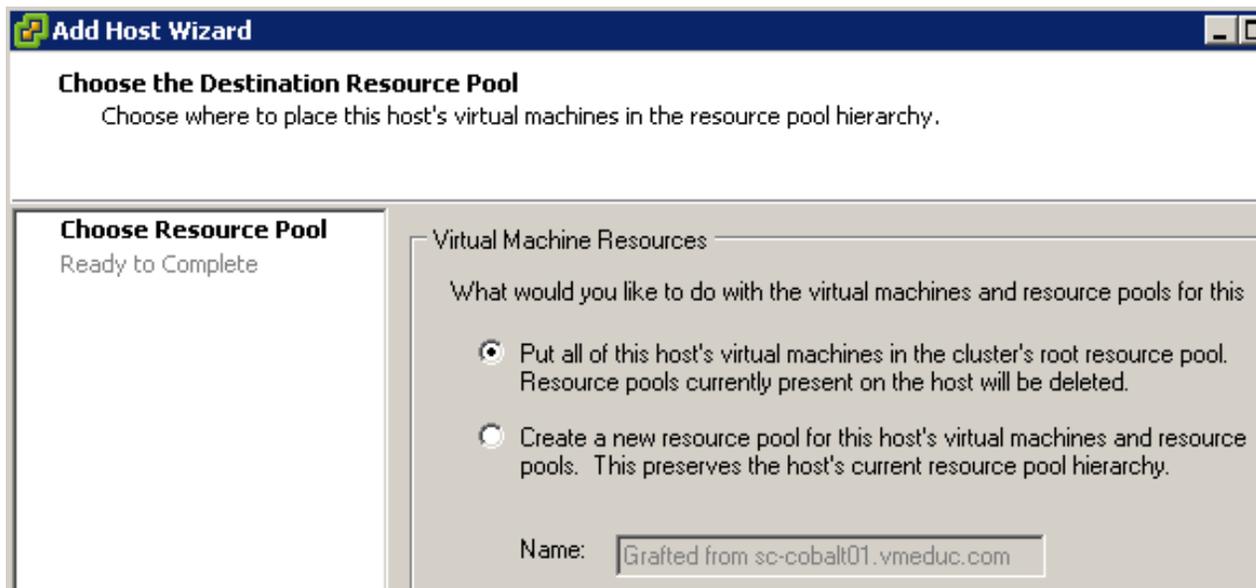


**It is recommended that you store the swap file in the same directory as the virtual machine.**

## Adding Host to Cluster



**Drag ESX  
host into  
cluster.**

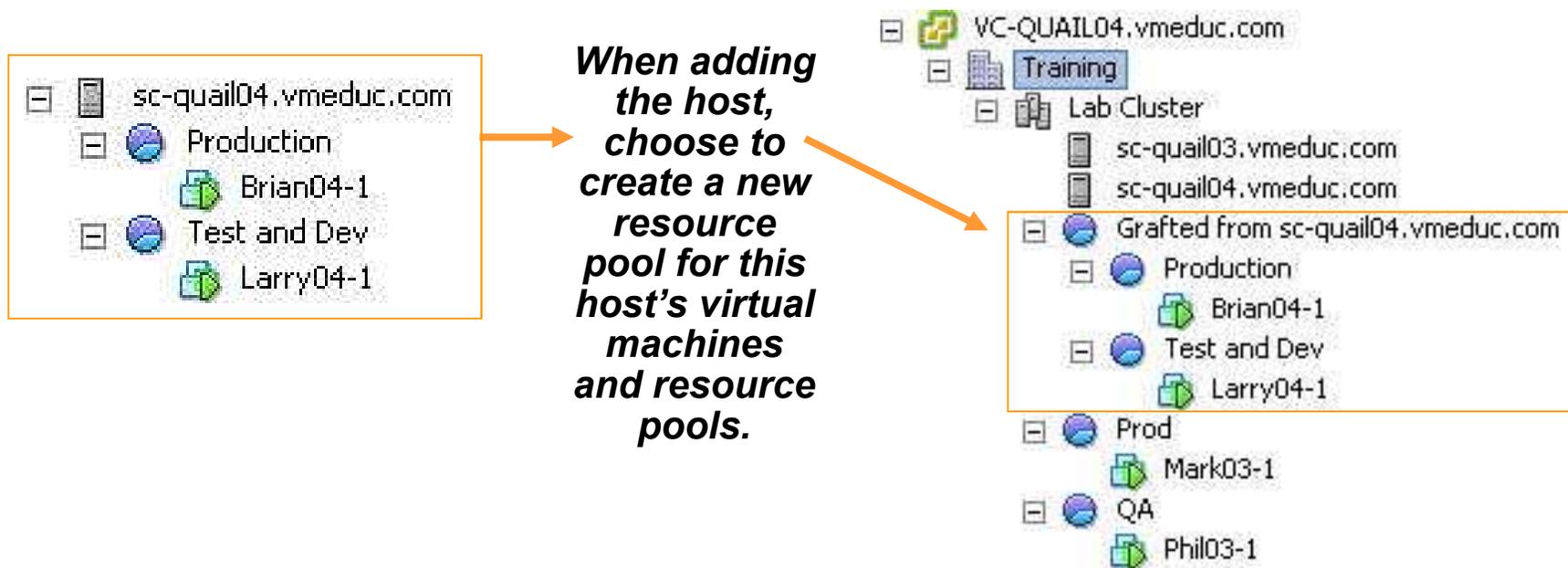


**Use the Add  
Host wizard  
to complete  
the process.**

## Adding Host to Cluster: Resource Pool Hierarchy

When adding a new host or moving an existing host into the cluster, you can keep the resource pool hierarchy of the existing host.

For example, add sc-quail04 to Lab Cluster.



## DRS Cluster Settings: Affinity Rules

Virtual Machine Rule

Give the new rule a name and choose its type from the menu below. Then, select the virtual machines to which this rule will apply.

Name  
BalanceDatabases

Type  
Separate Virtual Machines

Virtual Machines  
Database03-1  
Database03-2

Add... Remove

OK Cancel

**DRS affinity rules specify that either selected virtual machines should be placed on the same host or on different hosts (anti-affinity rule).**

### Affinity rules

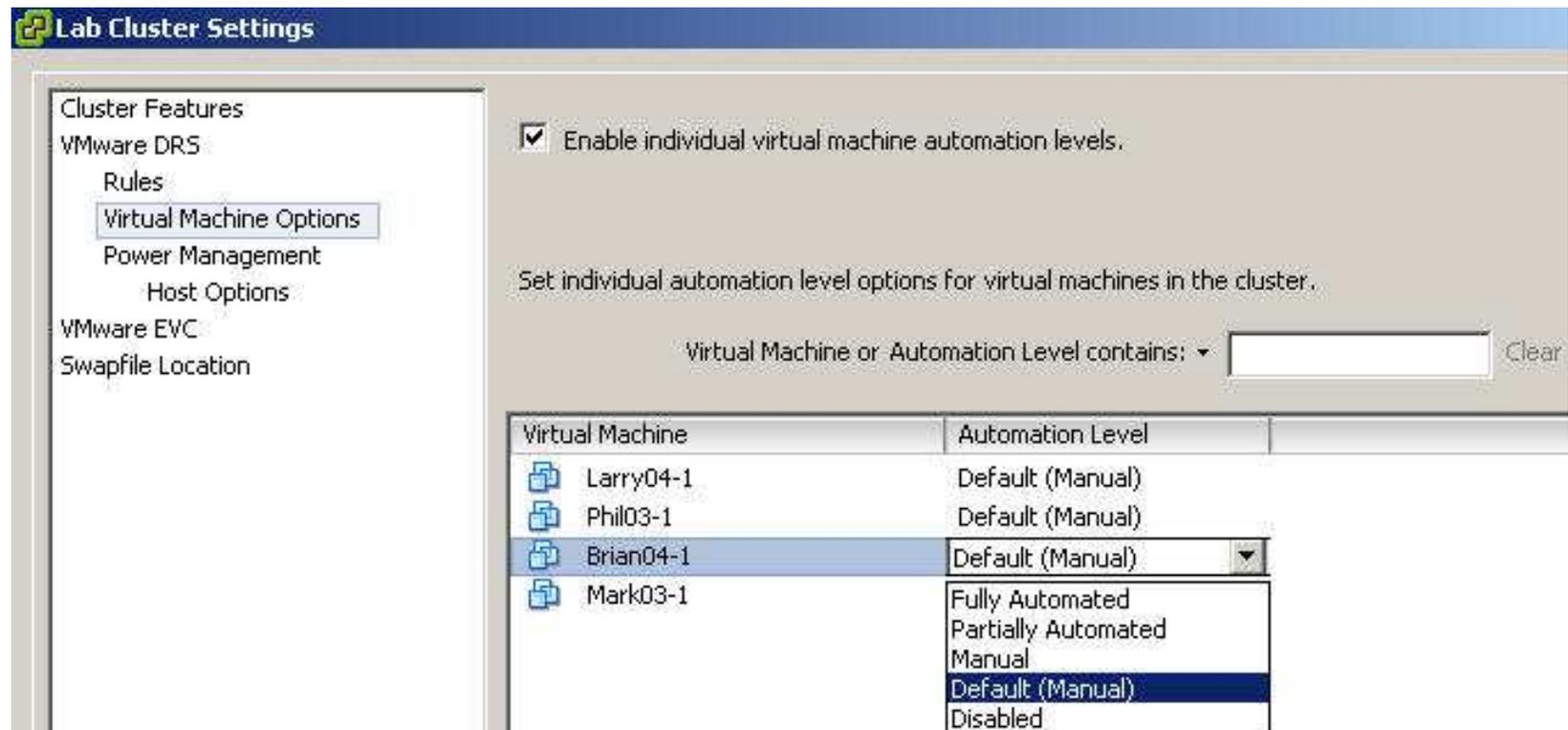
- > Use for multi-VM systems where performance benefits.

### Anti-affinity rules

- > Use for multi-VM systems that load-balance or require high availability.

## DRS Cluster Settings: VM-Level Automation

Optionally, set automation level per virtual machine.



The screenshot shows the 'Lab Cluster Settings' window in VMware vSphere. The left sidebar contains a tree view with 'Virtual Machine Options' selected. The main area has a checked checkbox for 'Enable individual virtual machine automation levels.' Below this is a text box for 'Set individual automation level options for virtual machines in the cluster.' and a search field labeled 'Virtual Machine or Automation Level contains:'. A table lists four VMs: Larry04-1, Phil03-1, Brian04-1, and Mark03-1. The 'Automation Level' for Brian04-1 is currently set to 'Default (Manual)', and its dropdown menu is open, showing options: Fully Automated, Partially Automated, Manual, Default (Manual), and Disabled.

Virtual Machine	Automation Level
Larry04-1	Default (Manual)
Phil03-1	Default (Manual)
Brian04-1	Default (Manual)
Mark03-1	Fully Automated Partially Automated Manual Default (Manual) Disabled

## Viewing General Cluster Information



**The cluster Summary tab provides useful information about the configuration and operation of your cluster.**

The screenshot shows the 'Lab Cluster' Summary tab in vSphere. The 'General' section displays the following information:

VMware DRS:	Enabled
VMware HA:	Disabled
VMware EVC Mode:	Disabled
Total CPU Resources:	24 GHz
Total Memory:	8.00 GB
Number of Hosts:	2
Total Processors:	8
Virtual Machines and Templates:	4
Total Migrations using vMotion:	0

## Viewing DRS Cluster Information

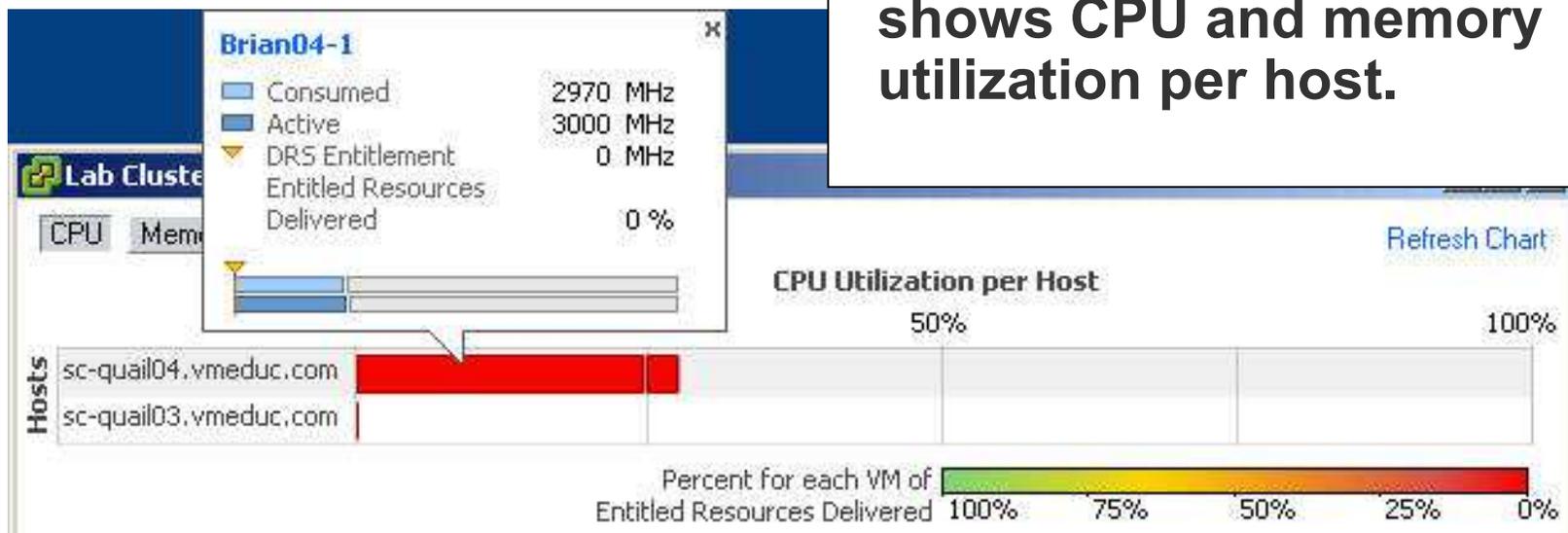
**VMware DRS**

Migration Automation Level:	Manual
Power Management Automation Level:	Off
DRS Recommendations:	0
DRS Faults:	0
Migration Threshold:	Apply all recommendations
Target host load standard deviation:	$\leq 0.05$
Current host load standard deviation:	0.001 (  Load balanced)

[View Resource Distribution Chart](#)

**The cluster Summary tab also provides information specific to DRS.**

**The View Resource Distribution Chart link shows CPU and memory utilization per host.**



## Viewing DRS Resource Allocation

The cluster Resource Allocation tab displays information about the CPU and memory resources in the cluster.

The screenshot shows the VMware vSphere interface for a cluster named 'Lab Cluster'. The 'Resource Allocation' tab is selected, displaying CPU and Memory resource allocation details. The CPU section shows a total capacity of 22800 MHz, reserved capacity of 0 MHz, and available capacity of 22800 MHz. The Memory section shows a total capacity of 6108 MB, reserved capacity of 359 MB, overhead reservation of 359 MB, and available capacity of 5749 MB. Below this, a table lists the resource allocation for four virtual machines: Brian04-1, Larry04-1, Mark03-1, and Phil03-1. Each VM has a reservation of 0 MHz, an unlimited limit, and 1000 shares. The table also shows the percentage of shares, worst-case allocation, and type for each VM.

Name	Reservation - MHz	Limit - MHz	Shares	Shares Value	% Shares	Worst Case Allocati...	Type
Brian04-1	0	Unlimited	Normal	1000	25	3000	N/A
Larry04-1	0	Unlimited	Normal	1000	25	3000	N/A
Mark03-1	0	Unlimited	Normal	1000	25	3000	N/A
Phil03-1	0	Unlimited	Normal	1000	25	3000	N/A

# Viewing DRS Recommendations

The screenshot shows the VMware vSphere interface for a cluster named "Lab Cluster". The navigation tabs include Getting Started, Summary, Virtual Machines, Hosts, DRS, Resource Allocation, Performance, Tasks & Events, Alarms, Permissions, Maps, and Profile Compliance. The "View" dropdown is set to "Recommendations". The "Cluster properties" section shows Migration Automation Level: Manual, Power Management Automation Level: Off, Migration Threshold: Apply all recommendations, and Power Management Threshold: N/A. The "DRS Recommendations" table has one entry: "Migrate Larry04-1 from sc-quail04.vmeduc.com to sc-". The reason is "Balance average CPU loads". There are callouts: "Edit cluster properties." pointing to the "Edit..." link, "Refresh recommendations." pointing to the "Run DRS" button, "Apply a subset of recommendations." pointing to the checkbox in the table, and "Apply all recommendations." pointing to the "Apply Recommendations" button. There is also an "Override DRS recommendations" checkbox at the bottom left.

**Lab Cluster**

Getting Started Summary Virtual Machines Hosts **DRS** Resource Allocation Performance Tasks & Events Alarms Permissions Maps Profile Compliance

View: Recommendations Faults History Last updated: 5/1/2009 5:02:33 AM Run DRS

**Cluster properties** Edit...

Migration Automation Level: **Manual**  
Power Management Automation Level: **Off**  
Migration Threshold: **Apply all recommendations**  
Power Management Threshold: **N/A**

**DRS Recommendations**

Apply	Priority	Recommendation	Reason
<input checked="" type="checkbox"/>	4	Migrate Larry04-1 from sc-quail04.vmeduc.com to sc-	Balance average CPU loads

Override DRS recommendations

Apply Recommendations

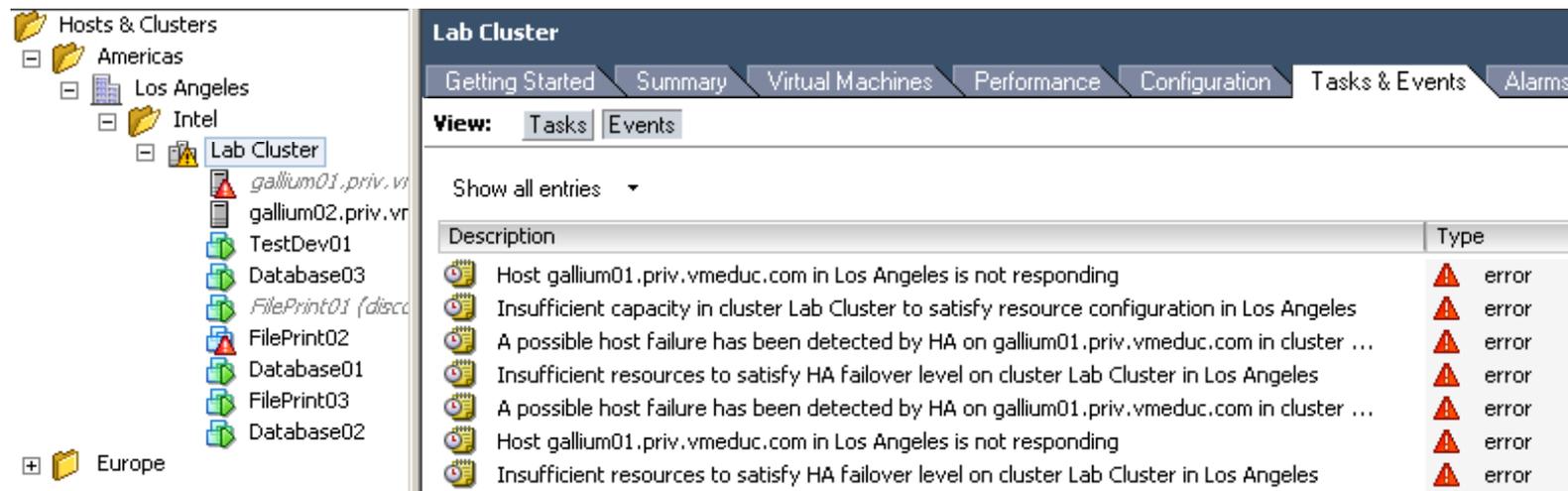
Callouts:

- Edit cluster properties.
- Refresh recommendations.
- Apply a subset of recommendations.
- Apply all recommendations.

## Monitoring Cluster Status

View the inventory hierarchy for the cluster state.

View the cluster's Tasks & Events tab for further information.



The screenshot displays the VMware vSphere interface. On the left, the inventory hierarchy is shown under 'Hosts & Clusters', with 'Americas' > 'Los Angeles' > 'Intel' > 'Lab Cluster' selected. The 'Lab Cluster' contains several hosts and virtual machines, including 'gallium01.priv.vr', 'gallium02.priv.vr', 'TestDev01', 'Database03', 'FilePrint01 (disc)', 'FilePrint02', 'Database01', 'FilePrint03', and 'Database02'. On the right, the 'Lab Cluster' view is shown with the 'Tasks & Events' tab selected. The 'View' dropdown is set to 'Events'. A list of events is displayed, all of which are errors. The events include host unresponsiveness, insufficient capacity, and HA failover level issues.

Description	Type
Host gallium01.priv.vmeduc.com in Los Angeles is not responding	error
Insufficient capacity in cluster Lab Cluster to satisfy resource configuration in Los Angeles	error
A possible host failure has been detected by HA on gallium01.priv.vmeduc.com in cluster ...	error
Insufficient resources to satisfy HA failover level on cluster Lab Cluster in Los Angeles	error
A possible host failure has been detected by HA on gallium01.priv.vmeduc.com in cluster ...	error
Host gallium01.priv.vmeduc.com in Los Angeles is not responding	error
Insufficient resources to satisfy HA failover level on cluster Lab Cluster in Los Angeles	error

## Maintenance Mode and Standby Mode

**To service a host in a cluster (for example, to install more memory) or remove a host from a cluster, you must place it in maintenance mode.**

- Virtual machines on the host should be migrated to another host or shut down.
- You cannot power on virtual machines or migrate virtual machines to a host entering maintenance mode.
- While in maintenance mode, the host does not allow you to deploy or power on a virtual machine.

**When a host is placed in standby mode, it is powered off.**

- This mode is used by DPM to optimize power usage.

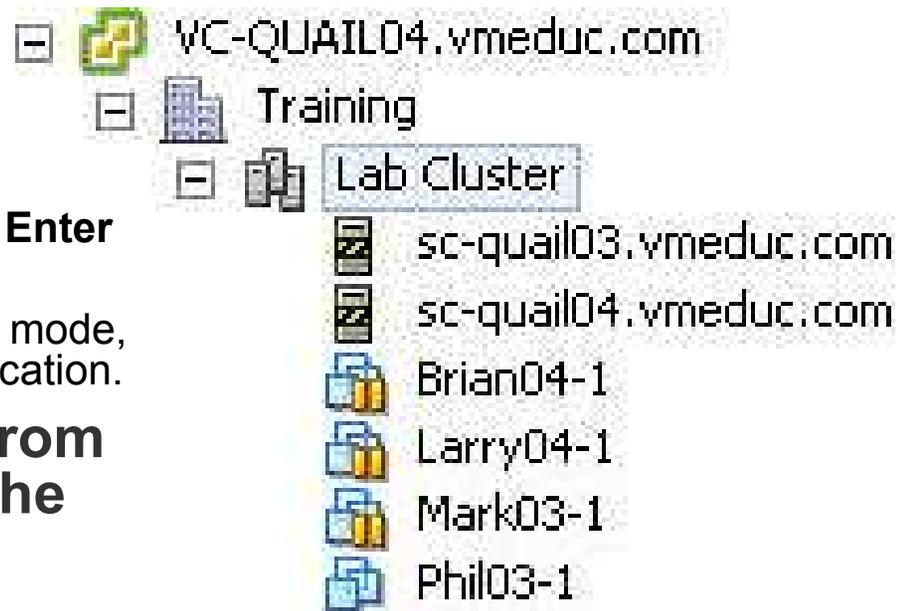
## Removing a Host from the DRS Cluster

### To remove a host from a cluster:

1. Right-click the host and choose **Enter Maintenance Mode**.
2. After the host is in maintenance mode, drag it to a different inventory location.

### Before removing a host from a DRS cluster, consider the following issues:

- > The resource pool hierarchy remains with the cluster.
- > Because a host must be in maintenance mode, all virtual machines running on that host are powered off.
- > The resources available for the cluster decrease.



## Lab 19 and eLearning Activity

**In this lab, you will implement a DRS cluster.**

1. Create a DRS cluster.
2. Populate the DRS cluster.
3. Verify DRS cluster functionality.

**In this eLearning activity, you will view a self-paced demonstration on how to configure and use Enhanced VMotion Compatibility.**

- Ask your instructor for access to the eLearning module.

## Lesson Summary

- A DRS cluster manages CPU and memory resources by initially placing virtual machines on hosts and balancing virtual machines across hosts.
- DPM allows a DRS cluster to reduce its power consumption by comparing per-host capacity versus demand and then taking, or recommending, the appropriate actions.
- EVC prevents VMotion migrations from failing due to incompatible CPUs.

## Key Points

- Shares, limits, reservations, and resource pools are mechanisms for managing CPU and memory resource allocations.
- Storage multipathing and NIC teaming are mechanisms for scaling storage and network management.
- DRS clusters provide automated resource management for multiple ESX/ESXi hosts.