



Sixty-Seven vSphere Tips

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Greg Shields
Author Evangelist
Pluralsight



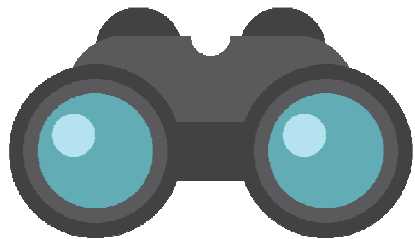
Sixty-Seven vSphere Tips

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TIP #1:

Never trust a conference session title
that advertises 67 tips.

Our Learning Path for vSphere 6



Configure and Administer Security
Configure Advanced Networking
Configure Advanced Storage
Administer and Manage Resources
Configure Availability Solutions
Deploy and Consolidate a vSphere Data Center

VMware vSphere® 6 Data C

vSphere 6 Data Center: X

+

← → ↺

app.pluralsight.com/library/courses/vsphere-6-datacenter-introduction/table-of-contents

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🔍 What do you want to learn?

Greg

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vSphere 6 Data Center: Introduction


by Greg Shields

This course is the first in a Learning Path of eleven courses that cover VMware vSphere 6 and objectives for the VCP6-DCV certification. Courses in this Learning Path follow directly after those in the vSphere 6 Foundations Learning Path. This...

▶ Resume Course

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Course author



Greg Shields

Greg Shields is Author / Evangelist with Pluralsight. Reach him on Twitter at <http://twitter.com/ConcentratdGreg>

Course info

Level	Intermediate
Rating	★★★★★ (73)
My rating	★★★★★
Duration	0h 48m
Released	20 Aug 2015

Add to playlist

Table of contents

Description


Transcript

Exercise files

Discussion

Recommended

This course is part of:

 VMware vSphere® 6 Data Center Virtualization (VCP6-DCV) Path

Expand all

VMware vSphere® 6.0.x | vSphere 6 Data Center: Intro | +

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What do you want to learn?

Greg
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This series builds upon concepts introduced in vSphere 6 Foundations and focuses on successfully deploying and managing scalable vSphere environments:

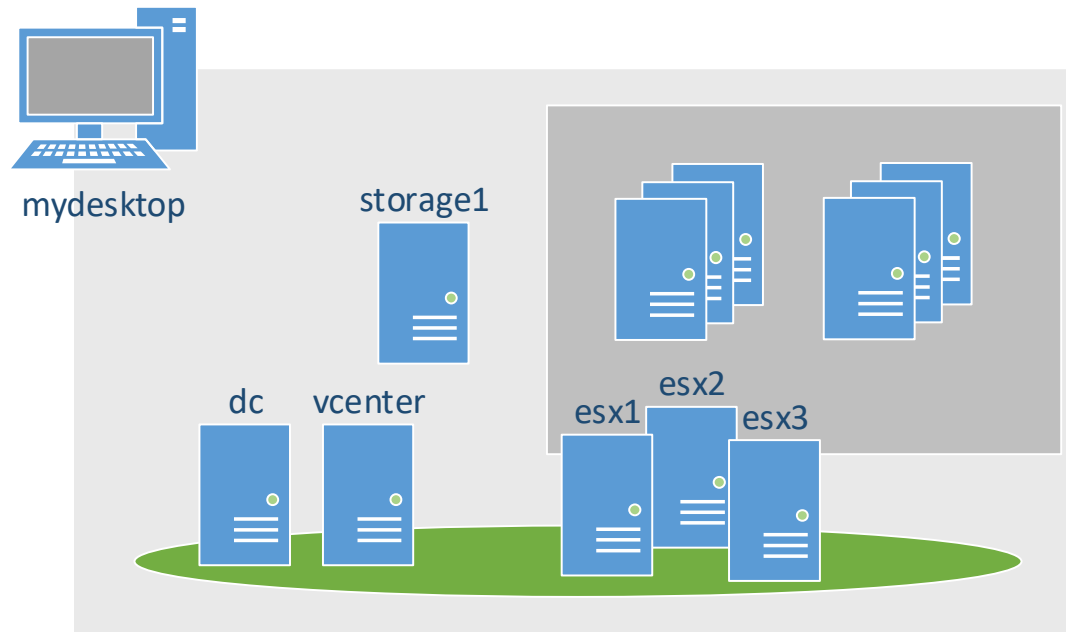
1 vSphere 6 Data Center: Introduction By Greg Shields Last viewed: Nov 21, 2016	2 vSphere 6 Data Center: Configure and Administer Security By Greg Shields Last viewed: Nov 21, 2016	3 vSphere 6 Data Center: Configure Advanced Networking By Greg Shields Last viewed: Nov 18, 2016	4 vSphere 6 Data Center: Configure Advanced Storage By Greg Shields
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<https://github.com/greggoindenvr/TechMentor>

Repository for Session Notes

Caution: These are literally my own (very raw) notes which I use for the demonstrations in this session. They're offered as-is and without warranty.

Exploring the Infrastructure





Configure and Administer Security

Configure Advanced Networking

Configure Advanced Storage

Administer and Manage Resources

Configure Availability Solutions

Deploy and Consolidate a vSphere Data Center

Grok vSphere RBAC

Tip #2

Four Types of Permissions

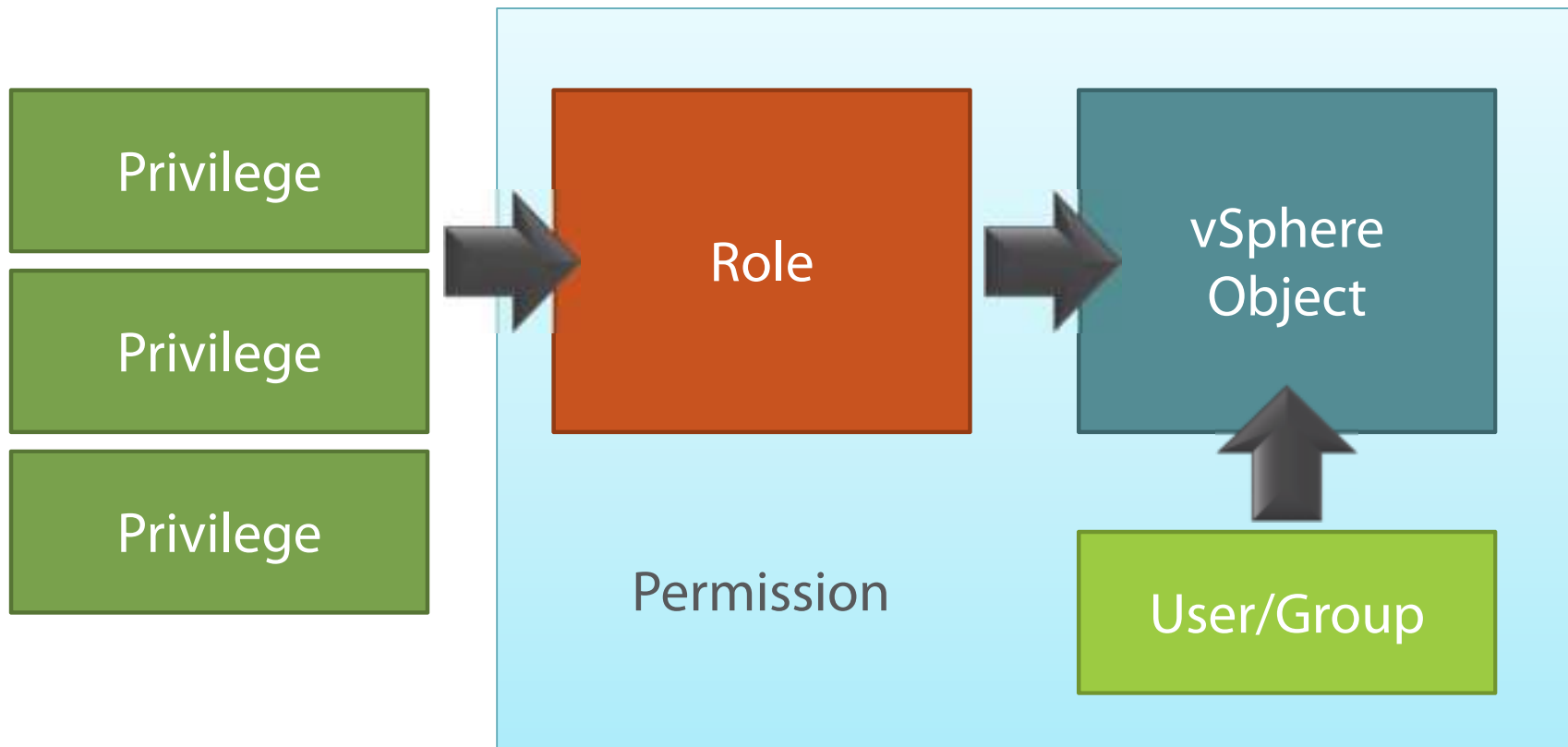
Global
Permissions

vCenter Server
Permissions

vSphere.local
Group Permissions

ESXi Local Host
Permissions

Permissions Application



Permissions Inheritance

Permissions Inheritance

- If an object inherits permissions from two parent objects, the permissions on one object are added to the permissions on the other object.

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Permissions Inheritance

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- If multiple group permissions are defined on the same object and a user belongs to two or more of those groups, two situations are possible:

Permissions Inheritance

- If an object inherits permissions from two parent objects, the permissions on one object are added to the permissions on the other object.
- Permissions applied on a child object always override permissions that are applied on a parent object.
- If multiple group permissions are defined on the same object and a user belongs to two or more of those groups, two situations are possible:
 - If no permission is defined for the user on that object, the user is assigned the set of privileges assigned to the groups for that object.
 - If a permission is defined for the user on that object, the user's permission takes precedence over all group permissions.

Customize the ESXi Firewall

Tip #3

Enable Lockdown Mode

(or don't)

Tip #4

Restrict Access to the Managed Object Browser

Tip #5

Download and Auto-trust vCenter Server Certificates

Tip #6

Harden SSO Authentication Policies

Tip #7

Respect When To Scale Out vCenter and its PSC

Tip #8

Configure Platform Services Controller

VMware vCenter Server Appliance Deployment

✓ 1 End User License Agreement
✓ 2 Connect to target server
✓ 3 Set up virtual machine
4 Select deployment type
5 Set up Single Sign-on
6 Single Sign-on Site
7 Select appliance size
8 Select datastore
9 Network Settings
10 Ready to complete

Select deployment type
Select the services to deploy onto this appliance.

vCenter Server 6.0 requires a Platform Services Controller, which contains shared services such as Single Sign-On, Licensing, and Certificate Management. An embedded Platform Services Controller is deployed on the same Appliance VM as vCenter Server. An external Platform Services Controller is deployed in a separate Appliance VM. For smaller installations, consider vCenter Server with an embedded Platform Services Controller. For larger installations with multiple vCenter Servers, consider one or more external Platform Services Controllers. Refer to the vCenter Server documentation for more information.

Note: Once you install vCenter Server, you can only change from an embedded to an external Platform Services Controller with a fresh install.

Embedded Platform Services Controller

☐ Install vCenter Server with an Embedded Platform Services Controller

External Platform Services Controller

☒ Install Platform Services Controller

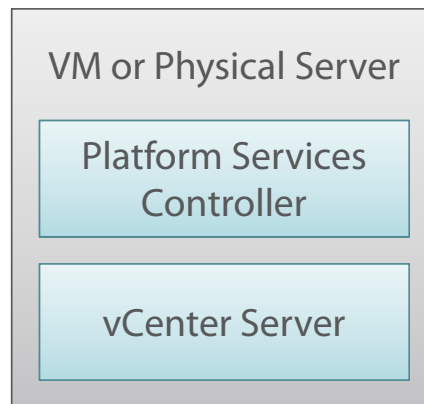
☐ Install vCenter Server (Requires External Platform Services Controller)

Back Next Finish Cancel

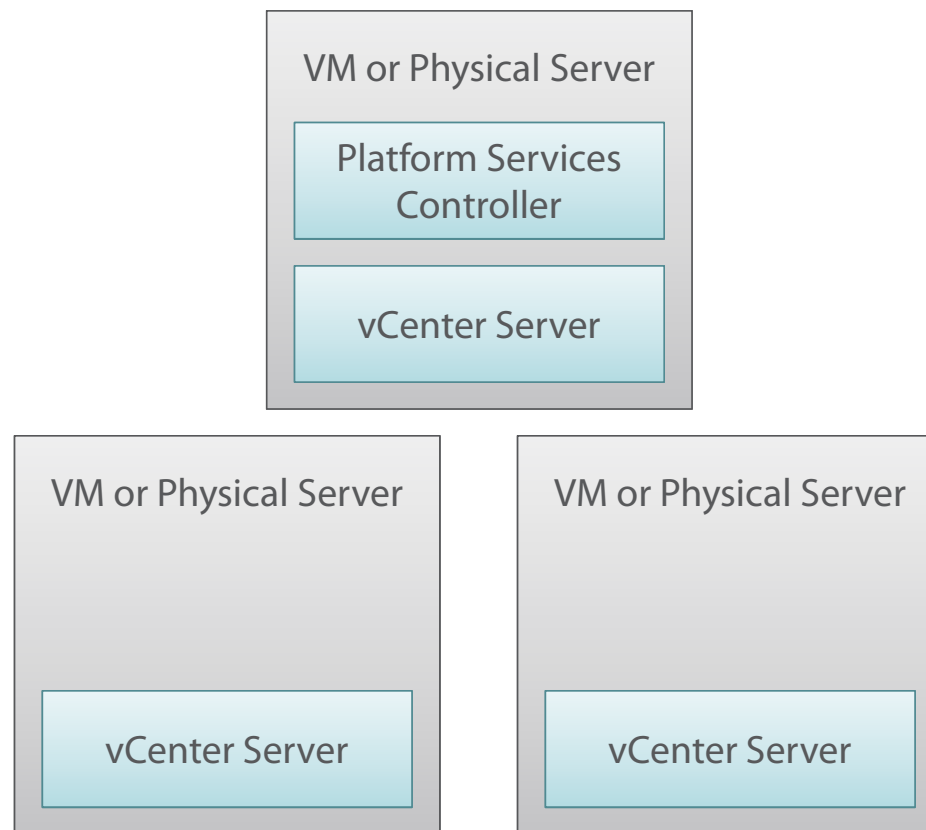
Configure Platform Services Controller

- The Platform Services Controller (PSC) facilitates:
 - Single Sign-On
 - Licensing
 - VM Certificate Authority

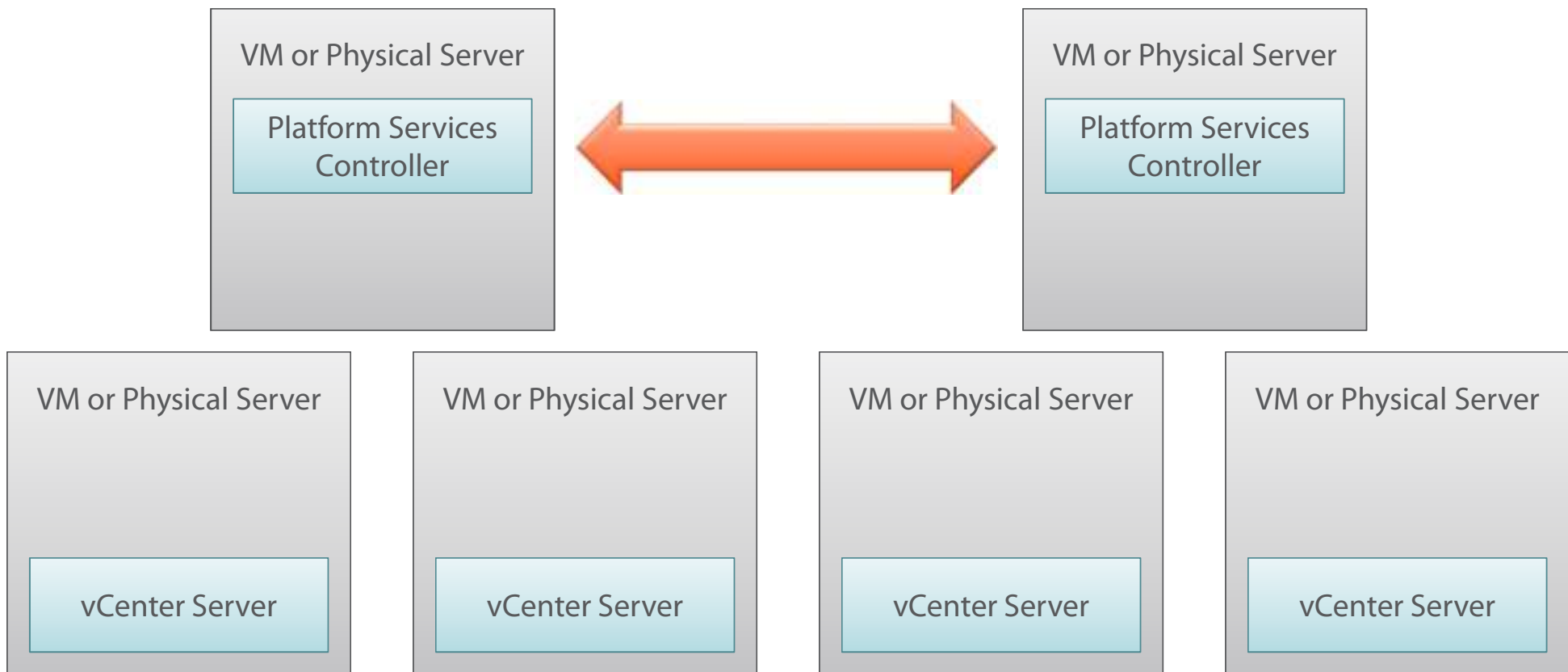
Configure Platform Services Controller



Configure Platform Services Controller



Configure Platform Services Controller








Configure Platform Services Controller

- The Platform Services Controller (PSC) facilitates:

- Single Sign-On
- Licensing
- VM Certificate Authority

- Embedded PSC





-  Sufficient for most environments. Easiest to deploy, maintain, and backup.
-  Aimed at minimizing fault domains.
-  Use in conjunction with one VMware Product or Solution.
-  Multiple standalone instances supported.
-  Replication between embedded instances not supported.

Configure Platform Services Controller

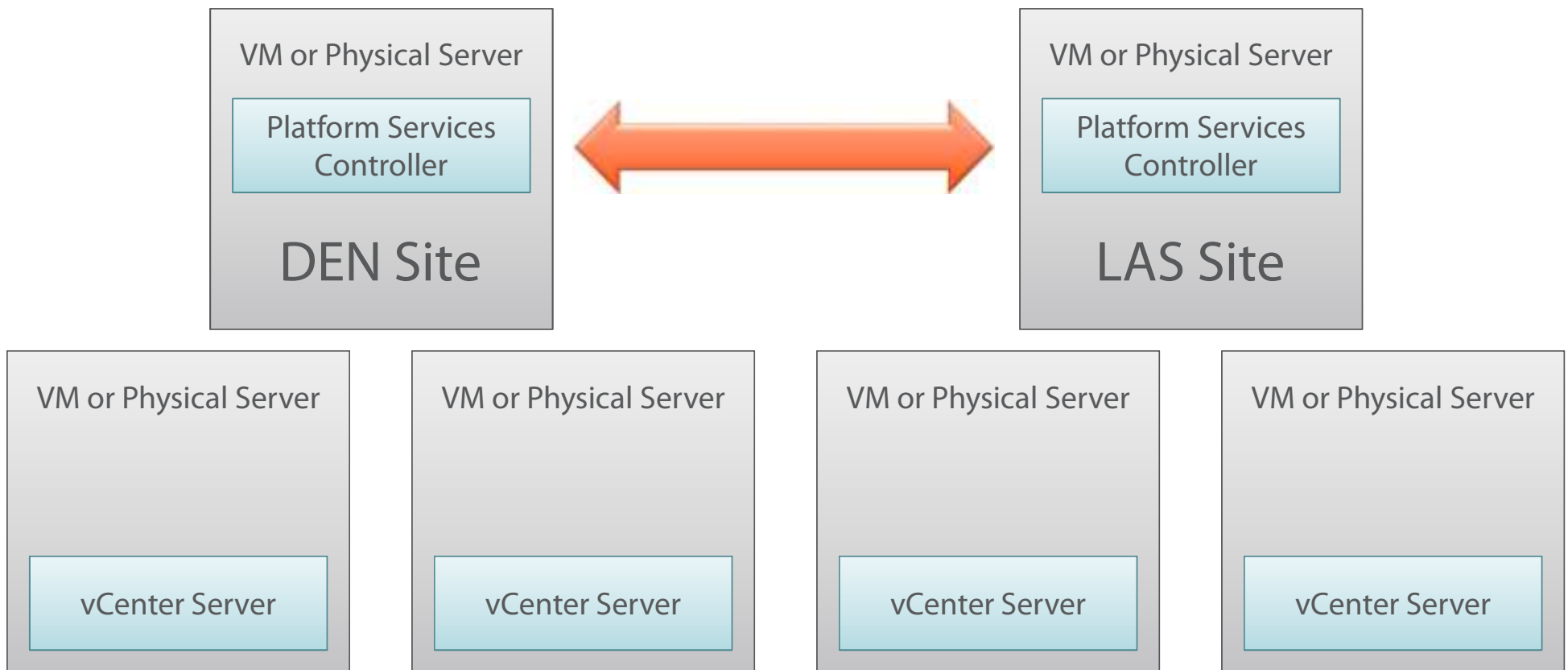
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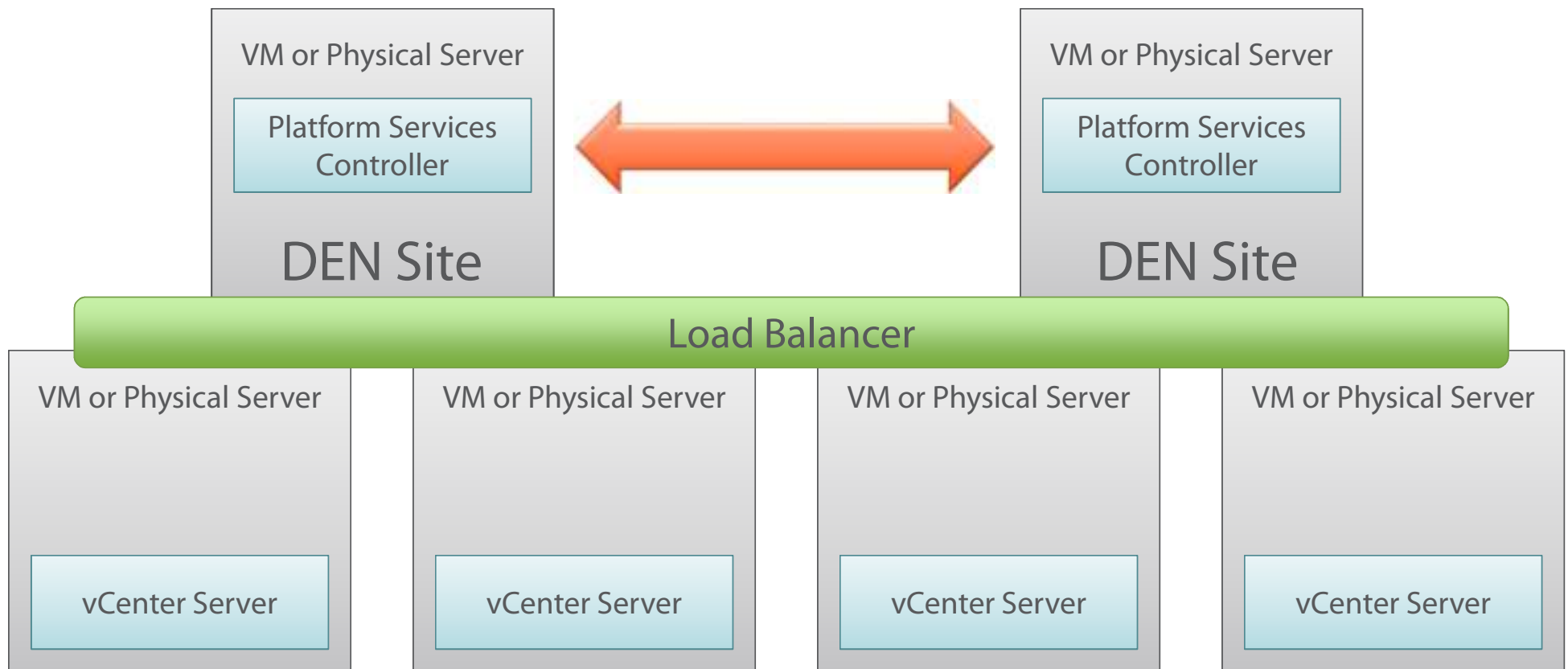
- External PSC

-  Recommended if deploying or expanding to multiple, linked vCenter Servers.
-  Enhanced Linked Mode provides a single point of management for all vCenter Servers in the same vSphere domain.
-  Reduces footprint by sharing PSC across several vCenter Servers.
-  Enhanced Linked Mode is not recommended in multi-vCenter Server environments with Embedded PSC due to potential backup data inconsistency.

Perform a Multi-site SSO Installation



Perform a Multi-site SSO Installation



Regenerate Out-of-Box vSphere Certificates with Internal PKI

Tip #9

Configure and Administer Security



Configure Advanced Networking

Configure Advanced Storage

Administer and Manage Resources

Configure Availability Solutions

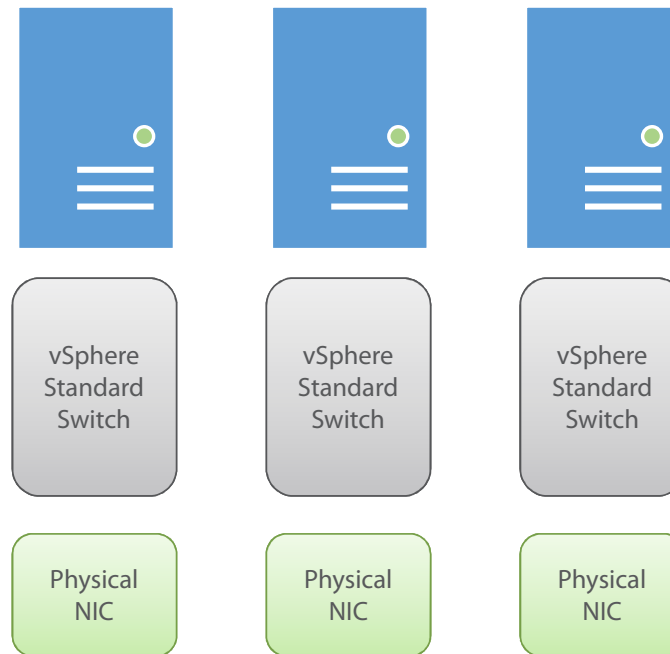
Deploy and Consolidate a vSphere Data Center

Migrate to vSphere Distributed Switches

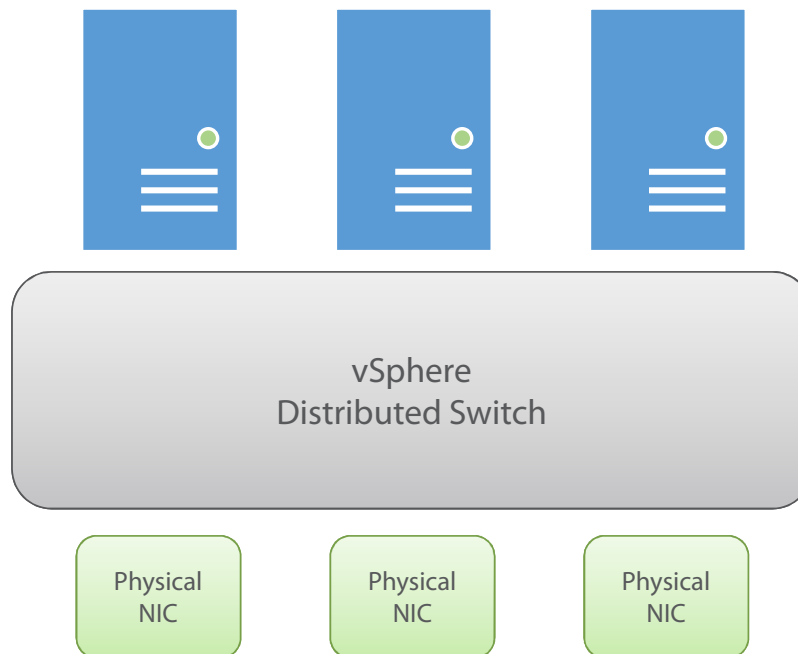
(if you can afford them)

Tip #10

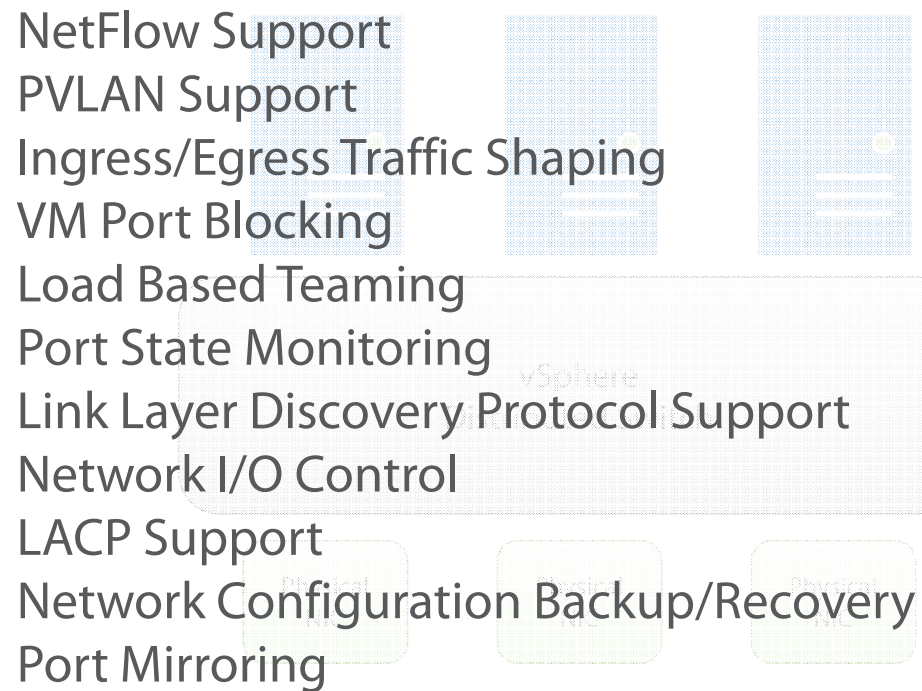
Identify vDS Capabilities



Identify vDS Capabilities



Identify vDS Capabilities



The diagram illustrates vDS capabilities across three platform categories: ESX/ESXi (blue), vSphere (grey), and Physical (green). The capabilities are listed on the left, and their support is indicated by colored boxes on the right.

- NetFlow Support
- PVLAN Support
- Ingress/Egress Traffic Shaping
- VM Port Blocking
- Load Based Teaming
- Port State Monitoring
- Link Layer Discovery Protocol Support
- Network I/O Control
- LACP Support
- Network Configuration Backup/Recovery
- Port Mirroring

ESX/ESXi

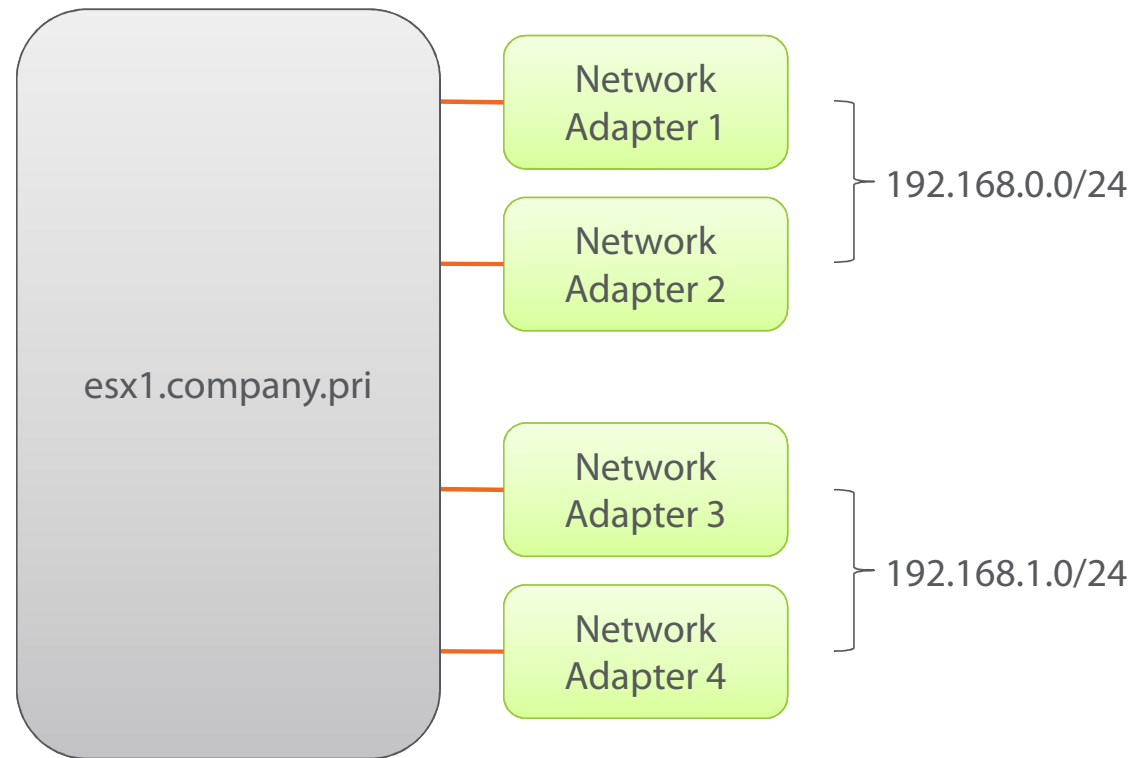
vSphere

Physical

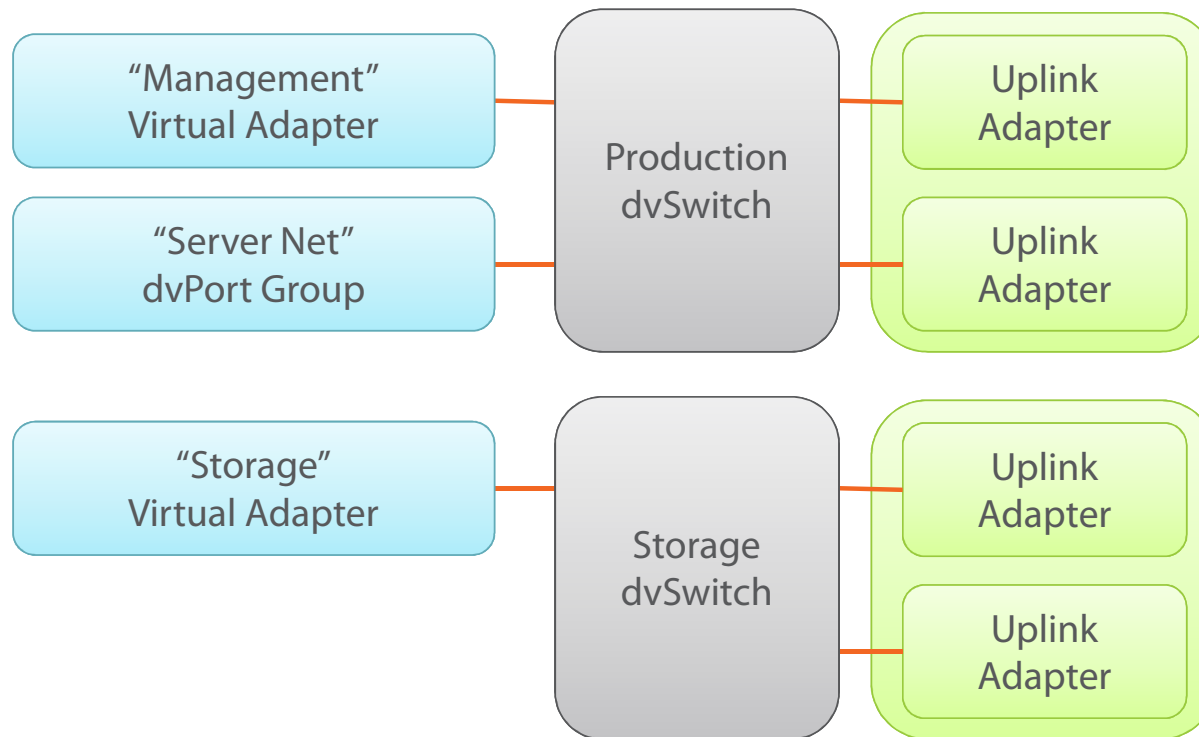
Aim Towards Full Redundancy
Aim Towards Network Convergence

Tip #11

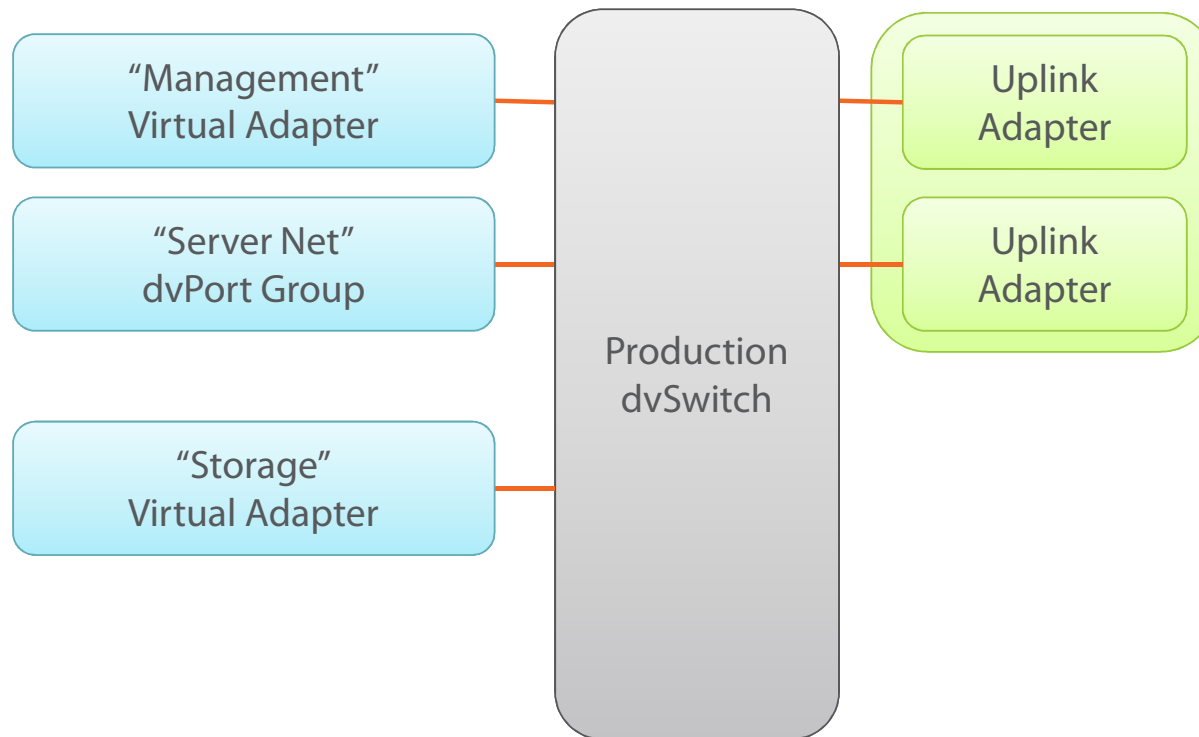
Constructing a vSphere Network



Constructing a vSphere Network



Constructing a vSphere Network



Understand the Impact of dvPortGroup Policies

Tip #12

Configure Load Balancing and Failover Policies

Policy

- Route based on originating virtual port
- Route based on source MAC hash
 - Route based on IP hash
- Route based on physical NIC load
 - Use explicit failover order

Characteristics

Configure Load Balancing and Failover Policies

Policy

Route based on originating virtual port

Route based on source MAC hash

Route based on IP hash

Route based on physical NIC load

Use explicit failover order

Characteristics

Even distribution of traffic when the number of vNICs > pNICs.

Low resource consumption. vSwitch typically calculates uplinks for VMs only once.

No changes required on pSwitches.

vSwitch is not aware of traffic load on the uplinks and does not load balance traffic to uplinks.

VM bandwidth is limited to the speed of the uplink associated with the VM's port ID, unless the VM has more than one vNIC.

Configure Load Balancing and Failover Policies

Policy

Route based on originating virtual port

Route based on source MAC hash

Route based on IP hash

Route based on physical NIC load

Use explicit failover order

Characteristics

Improved load balancing but higher resource consumption than RBOOVP as vSwitch calculates an uplink for every packet.

VMs use the same uplink as their MAC address is static.

No changes required on pSwitches.

VM bandwidth is limited to the speed of the uplink associated with the VM's port ID, unless the VM uses multiple source MAC addresses.

vSwitch is not aware of uplink load, so uplinks can become overloaded.

Configure Load Balancing and Failover Policies

Policy

Route based on originating virtual port

Route based on source MAC hash

Route based on IP hash

Route based on physical NIC load

Use explicit failover order

Characteristics

Further improved load balancing but highest resource consumption as the vSwitch calculates the uplink for every packet.

Potentially higher throughput for VMs that use multiple IP addresses.

Etherchannel configuration required on pSwitches.

vSwitch is not aware of uplink load, so uplinks can become overloaded.

Complex to troubleshoot.

Configure Load Balancing and Failover Policies

Policy

Route based on originating virtual port

Route based on source MAC hash

Route based on IP hash

Route based on physical NIC load

Use explicit failover order

Characteristics

Not supported on vSS.

Low resource consumption as the dvSwitch calculates uplinks for VMs only.

dvSwitch tests the load of uplinks every 30 seconds and rebalances if load exceeds 75% of usage.

No changes required on pSwitches.

VM bandwidth is limited to the speed of the uplinks connected to the distributed switch.

Configure Load Balancing and Failover Policies

Policy

Route based on originating virtual port

Route based on source MAC hash

Route based on IP hash

Route based on physical NIC load

Use explicit failover order

Characteristics

No actual load balancing.

vSwitch always uses the first uplink in the list of active adapters that passes failover detection criteria.

When no uplinks in the active list are available, the vSwitch then uses uplinks from the Standby list.

Recognize the Locations where VLANs are (mis)Configured

Tip #13

Determine Appropriate VLAN Configuration

VLAN Configuration

External Switch Tagging (EST)

Virtual Switch Tagging (VST)

Virtual Guest Tagging (VGT)

Characteristics

Determine Appropriate VLAN Configuration

VLAN Configuration

External Switch Tagging (EST)

Virtual Switch Tagging (VST)

Virtual Guest Tagging (VGT)

Characteristics

a.k.a, "The network people handle the VLANs."

VLAN tagging is handled by the physical network.

VLAN tagging occurs at the pSwitch.

dvPort Groups configured for VLAN Type = None.

VLAN ID not configured.

Determine Appropriate VLAN Configuration

VLAN Configuration

External Switch Tagging (EST)

Virtual Switch Tagging (VST)

Virtual Guest Tagging (VGT)

Characteristics

a.k.a, "The vSphere people handle the VLANs."

VLAN tagging is handled by vSphere.

VLAN tagging occurs at the vSwitch.

dvPort Groups configured for VLAN Type = VLAN

VLAN ID configured on dvPort Group.

Determine Appropriate VLAN Configuration

VLAN Configuration

External Switch Tagging (EST)

Virtual Switch Tagging (VST)

Virtual Guest Tagging (VGT)

Characteristics

a.k.a, "The VM people handle the VLANs."

VLAN tagging is handled by each VM.

VLAN tagging occurs in the VM.

dvPort Groups configured for VLAN Type = VLAN Trunking.

VLAN ID configured within the VM.

Configure and Administer Security

Configure Advanced Networking



Configure Advanced Storage

Administer and Manage Resources

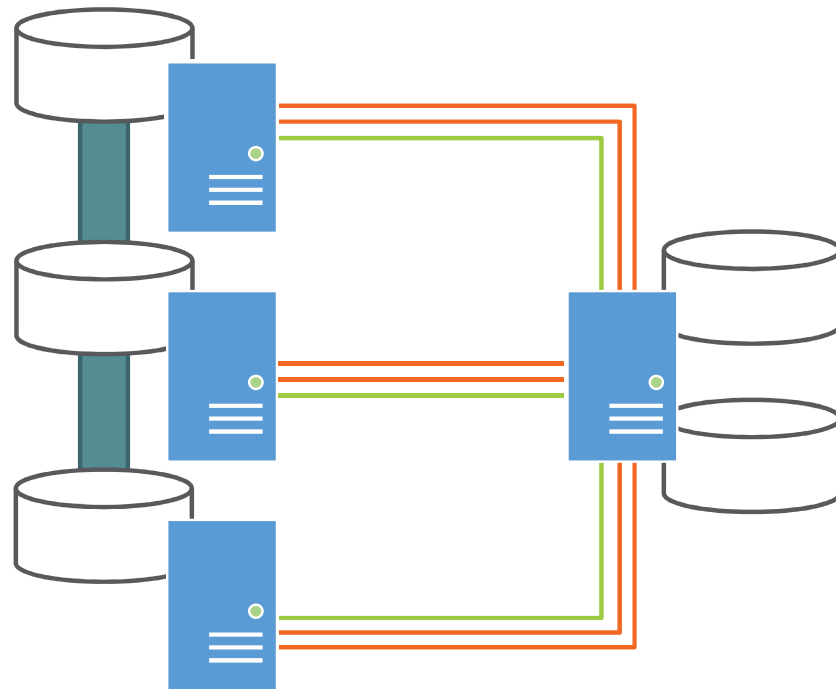
Configure Availability Solutions

Deploy and Consolidate a vSphere Data Center

Understand Storage Naming Conventions

Tip #14

Constructing vSphere Storage



Identify Storage Adapters & Devices

SCSI

iSCSI

RAID

Fibre Channel

Fibre Channel over Ethernet (FCoE)

Ethernet

Identify Storage Naming Conventions

iSCSI Qualified Name (IQN) Format

iqn.1998-01.com.vmware.iscsi:server1

Enterprise Unique Identifier (EUI) Format

eui.0123456789ABCDEF

Queried via SCSI INQUIRY

eui.<number>

naa.<number>

t10.<number>

Alternative Legacy Identifiers

vml.<number>

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Identify Storage Naming Conventions

Path-based Identifiers

`mpx.<adapter>:C<channel>:T<target>:L<LUN>`

`mpx.vmhba1:C0:T0:L0`

`<adapter>` = Physical adapter on the host

`<channel>` = Storage channel number

Used to show multiple paths to the same target.

`<target>` = Target number

Determined by the host and may change if mappings of targets visible to the host change.

Targets that are shared by different hosts might not have the same target number.

`<LUN>` = LUN number

Shows the position of the LUN within the target.

The LUN number is provided by the storage system.

Identify Storage Naming Conventions

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The LUN number is provided by the storage system.

Respect the Differences Between Array and Virtual Disk Thin Provisioning

Tip #15

Compare/Contrast Array and Virtual Disk Thin Provisioning

- Thin provisioning offers a way to report more virtual storage space than actual physical capacity.
- MOST IMPORTANT: This can lead to storage oversubscription.
 - With thin provisioning, you must monitor actual storage usage to avoid running out of physical storage space.

Compare/Contrast Array and Virtual Disk Thin Provisioning

Array Thin Provisioning

Virtual Disk Thin Provisioning



Compare/Contrast Array and Virtual Disk Thin Provisioning

Array Thin Provisioning

Virtual Disk Thin Provisioning

“**ESXi** provisions the entire space configured for the **disk**. However, the disk only consumes as much storage space as it actually uses.”

Compare/Contrast Array and Virtual Disk Thin Provisioning

Array Thin Provisioning


“**The SAN** provisions the entire space configured for the **LUN**. However, the LUN only consumes as much storage space as it actually uses.”

Virtual Disk Thin Provisioning

“**ESXi** provisions the entire space configured for the **disk**. However, the disk only consumes as much storage space as it actually uses.”

Determine the Use Case for
and Configure Array Thin Provisioning

Determine the Use Case for and Configure Array Thin Provisioning


 “If your array supports thin provisioning, it’s generally more efficient to use array-level thin provisioning in most operational models.

- “If you thick-provision at the LUN or file system level, there will always be large amounts of unused space until you start to get it highly utilized...”
- “One other benefit of thin provisioning on the array...is the extra capacity available for nonvirtual storage. When you’re thin provisioning within vSphere only, the VMFS Datastore takes the entire datastore capacity on the array, even if the datastore itself has no VMs stored within it.”

Determine the Use Case for and Configure Array Thin Provisioning

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Ain't Nuthin' Wrong with Renaming Your iSCSI IQNs

Tip #16

Understand (but don't) Disable vCenter Server Storage Filters

Tip #17


Configure vCenter Server Storage Filters

- Storage filters assist in preventing corruption and/or performance degradation due to unsupported devices and configurations.
- Storage filters are enabled by default and generally shouldn't be disabled.


Configure vCenter Server Storage Filters

- `Config.vxpd.filter.vmfsFilter = False`
Filters out storage devices or LUNs that are already used by a VMFS datastore.
- `Config.vxpd.filter.rdmFilter = False`
Filters out LUNs that are already referenced by an RDM.
- `Config.vxpd.filter.SameHostAndTransportsFilter = False`
Filters out incompatible LUNs ineligible for use as VMFS extents.
- `Config.vxpd.filter.hostRescanFilter = False`
Automatically rescans and updates VMFS Datastores after performing management operations.


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 `Config.vxpd.filter.hostRescanFilter = False`
Automatically rescans and updates VMFS Datastores after performing management operations.

Differentiate Storage Multipathing Policies

Tip #18

Identify Available Storage Multi-pathing Policies

Policy

Behavior

Fixed

Most Recently Used

Round Robin

Identify Available Storage Multi-pathing Policies

Policy

Fixed

Most Recently Used

Round Robin

Behavior

Hosts will use a designated preferred path.

When no preferred path is designated, the host will select the first working path discovered at system boot time.

If the host selects a default preferred path and that path's status changes to Dead, a new path is selected as preferred.

If a preferred path is explicitly designated, that path remains preferred even after it becomes inaccessible.

Fixed is the default policy for most active-active storage devices.

Identify Available Storage Multi-pathing Policies

Policy

Fixed

Most Recently Used

Round Robin

Behavior

Hosts will use the path that was used most recently.

When that path becomes unavailable, the host selects an alternative path.

The host will not revert back to the original path when that path becomes available again.

Consequently, there is no preferred path setting with the MRU policy.

MRU is the default policy for most active-passive storage devices.

Identify Available Storage Multi-pathing Policies

Policy

Fixed

Most Recently Used

Round Robin

Behavior

Hosts use an automatic path selection algorithm.

This algorithm rotates through all active paths when connecting to active-passive arrays, or all available paths when connecting to active-active arrays.

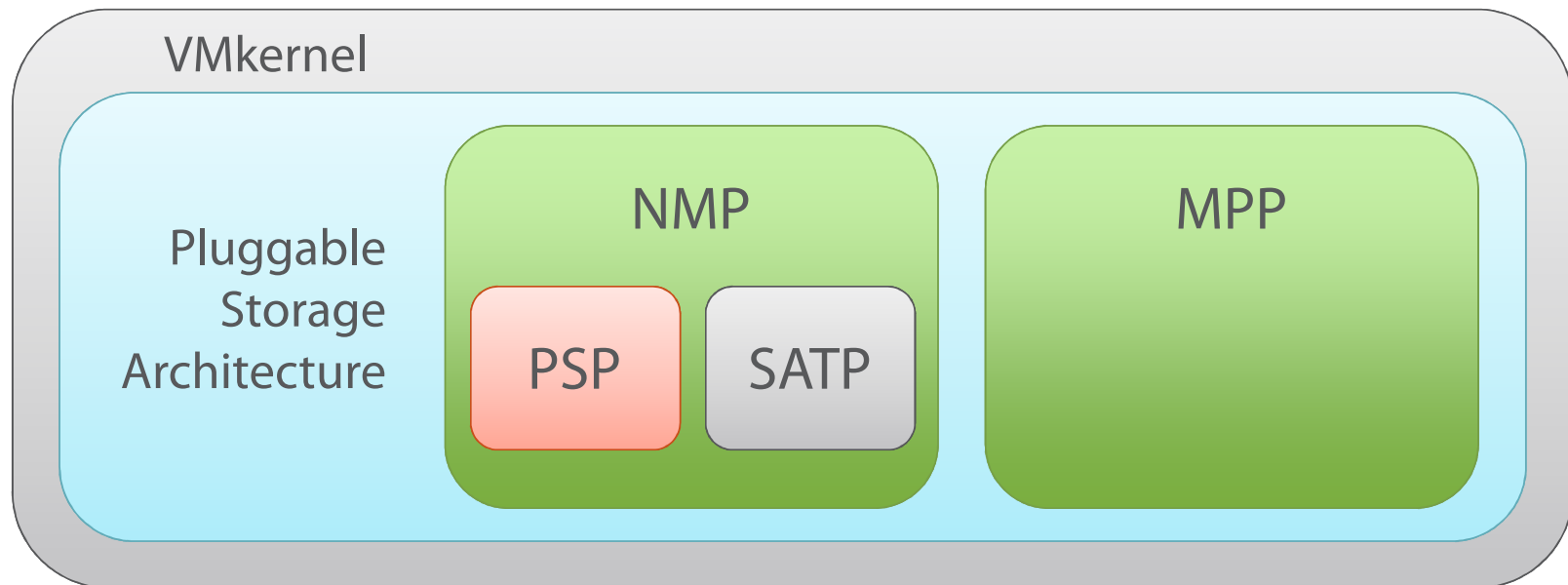
RR policy by default sends 1000 IOPS per path before switching to the next available path.

RR can be used with both active-active and active-passive arrays to implement load balancing across paths for different LUNs.

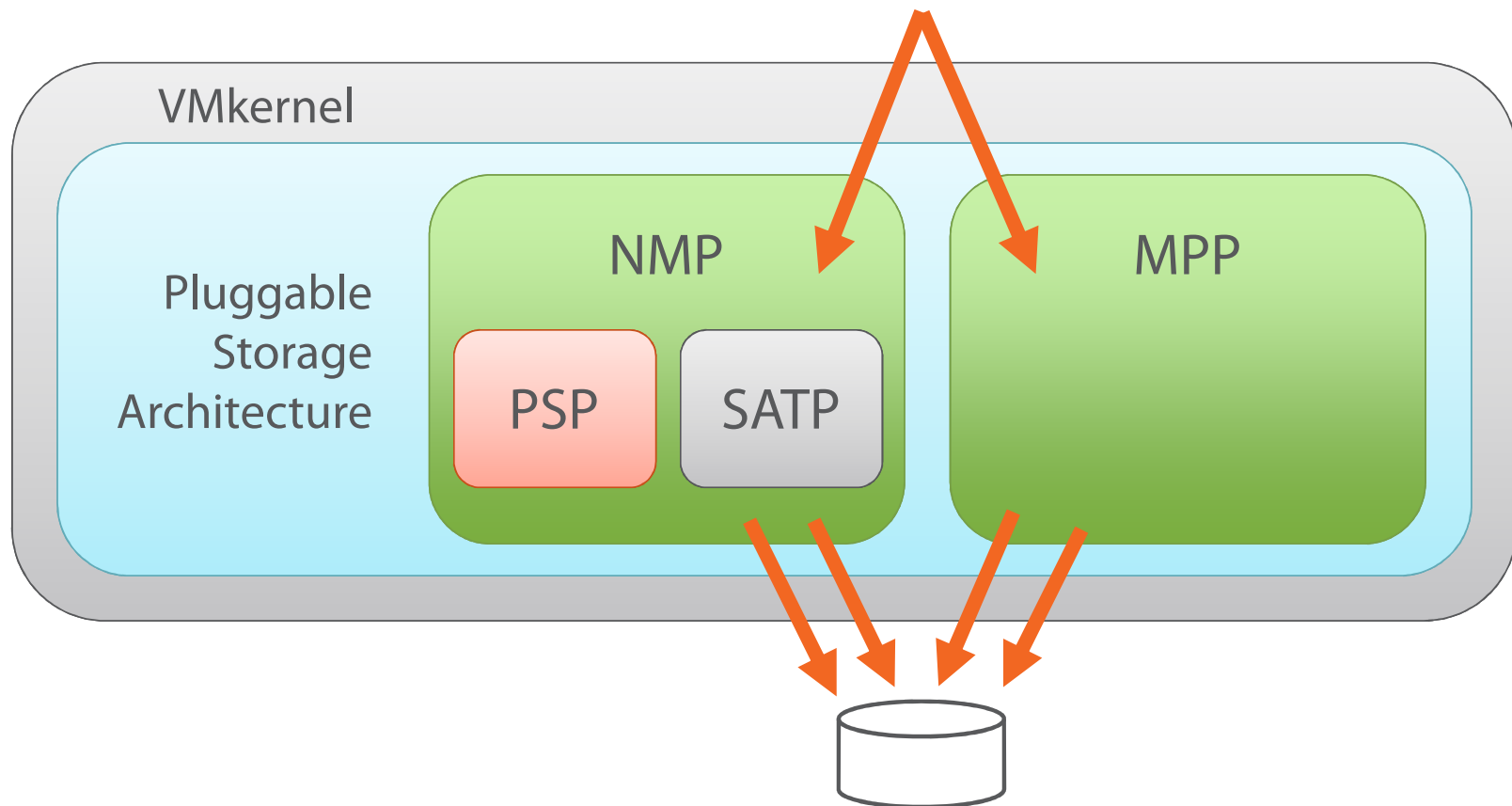
Grok vSphere's Pluggable Storage Architecture

Tip #19

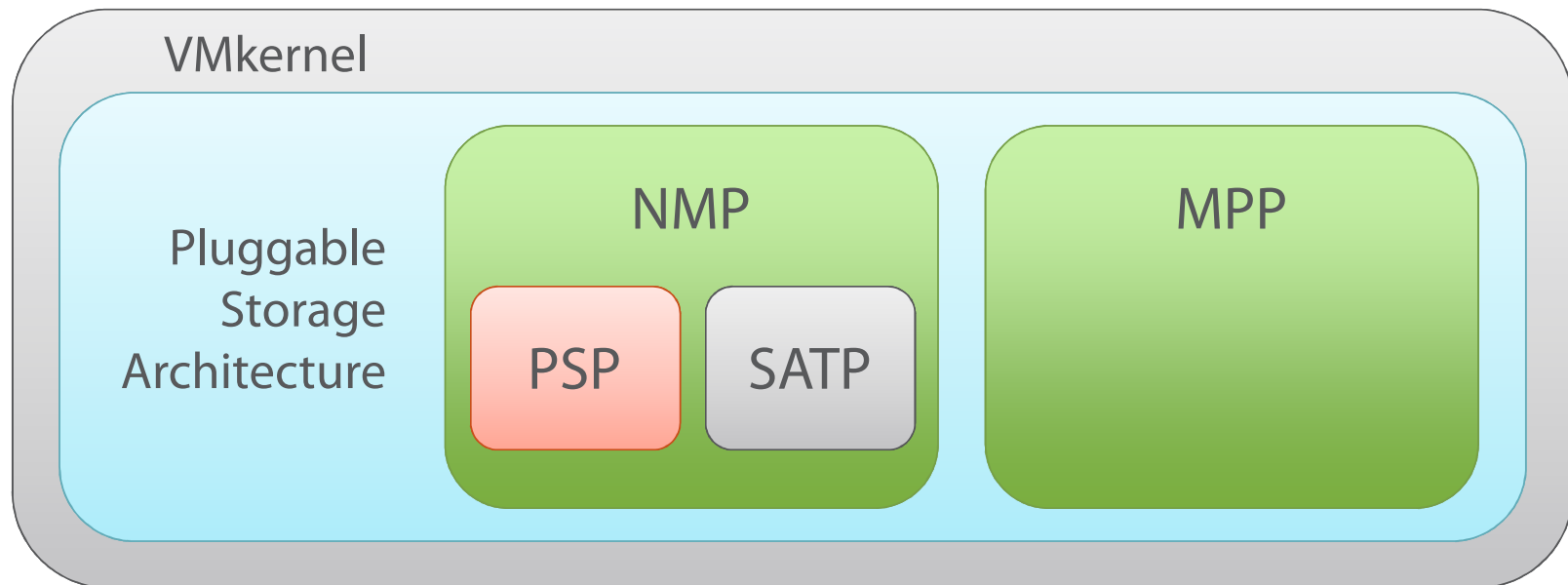
Identify Features of Pluggable Storage Architecture



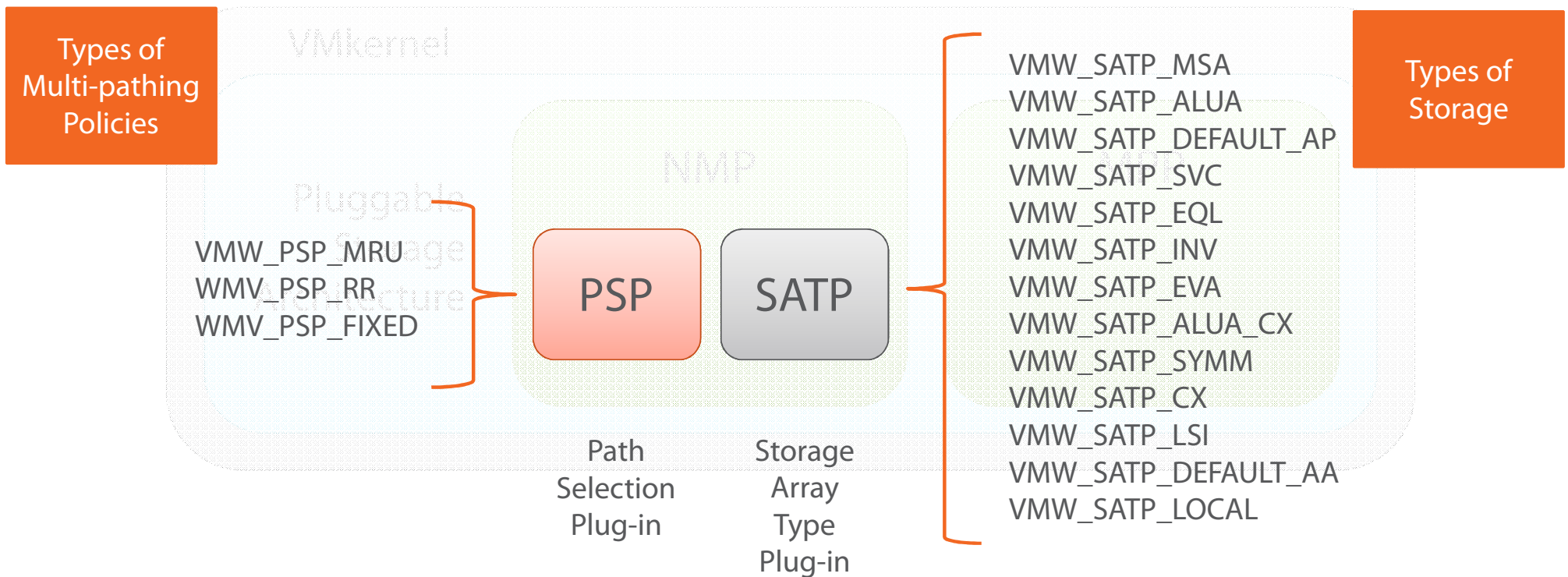
Identify Features of Pluggable Storage Architecture



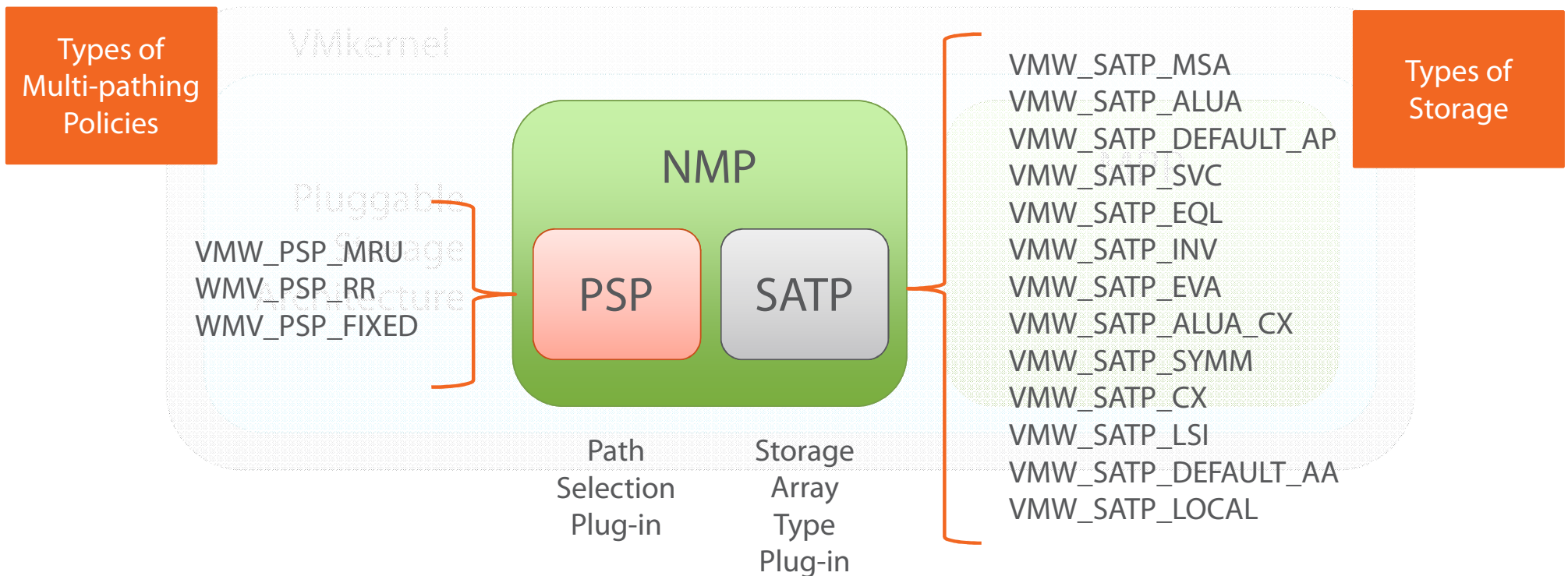
Determine the Effect of Changing the PSP and SATP



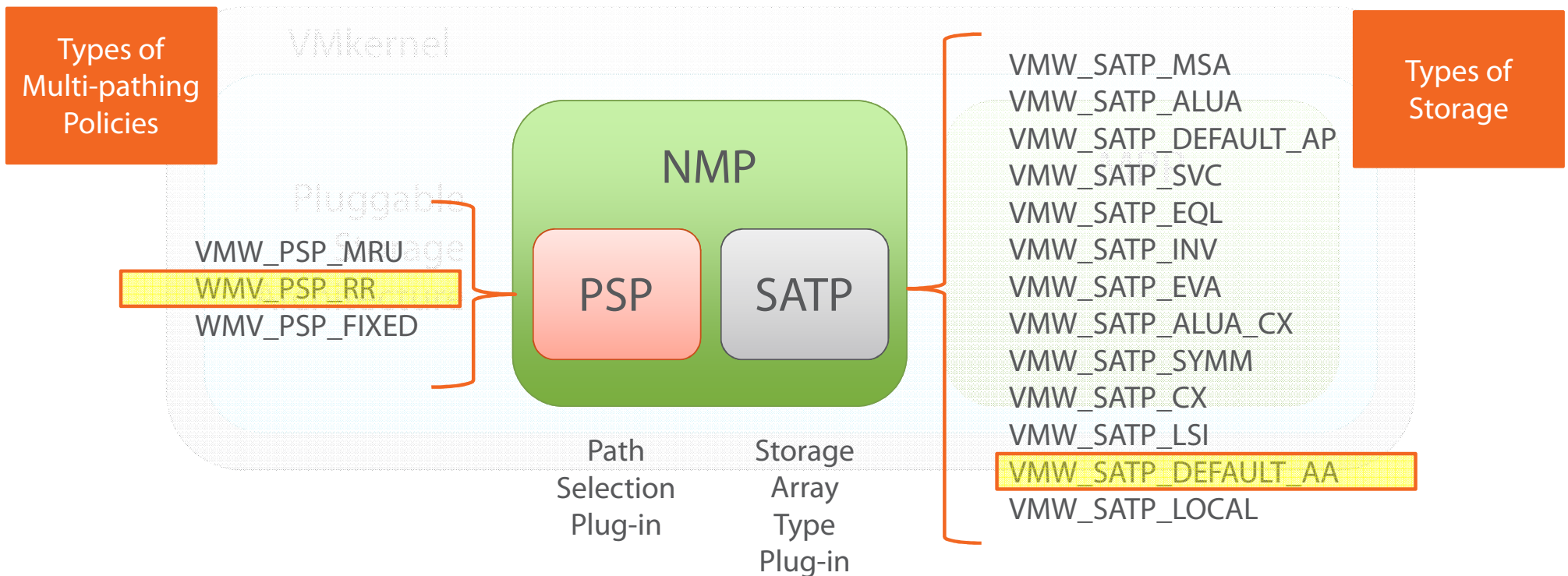
Determine the Effect of Changing the PSP and SATP



Determine the Effect of Changing the PSP and SATP



Determine the Effect of Changing the PSP and SATP



Respect What Changes When You Change PSPs and SATPs

Tip #20

Customize Storage Claim Rules

Tip #21

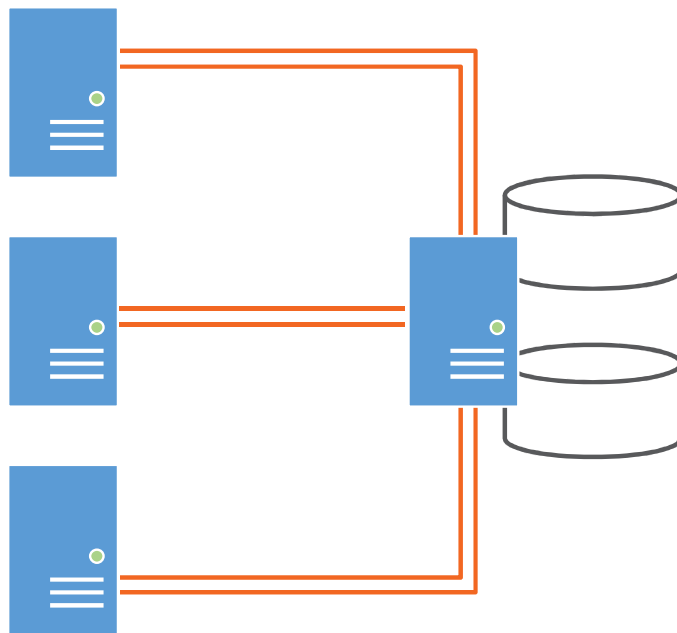
Extend the Windows Timeout for Delayed Write Operations

Tip #22

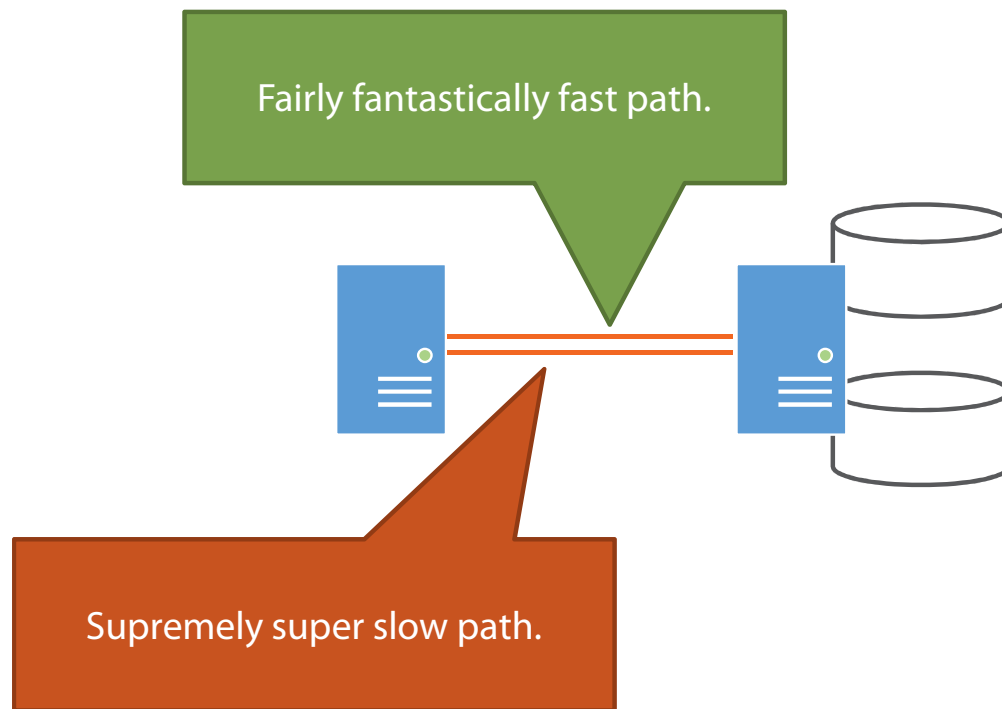
Understand the Use Case and Behavior of Non-Optimized Storage Paths

Tip #23

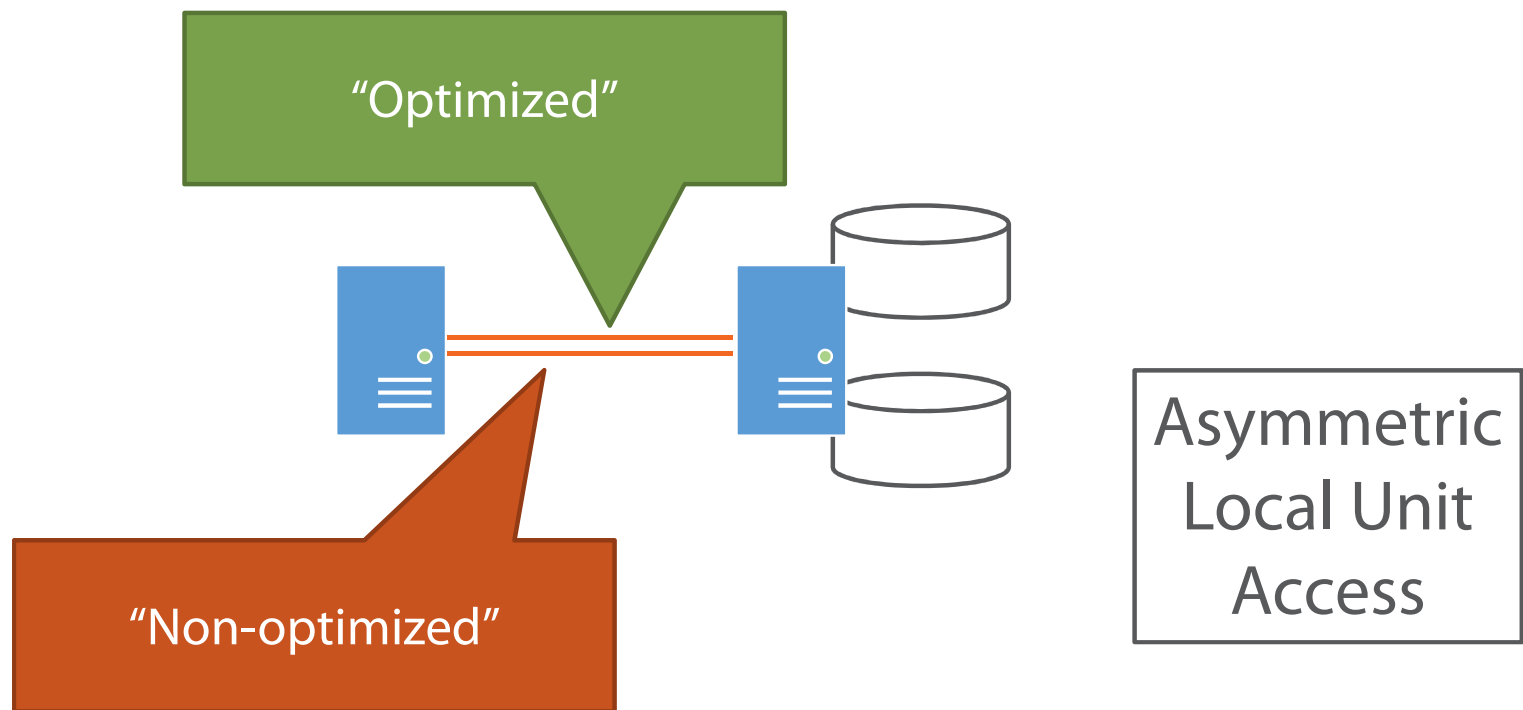
Compare Active Optimized vs. Active Non-optimized Port Group States



Compare Active Optimized vs. Active Non-optimized Port Group States



Compare Active Optimized vs. Active Non-optimized Port Group States



“The default PSP for all devices claimed by VMW_SATP_ALUA is VMW_PSP_MRU. The VMW_PSP_MRU selects an active/optimized path as reported by the VMW_SATP_ALUA, or an active/unoptimized path if there is no active/optimized path. This path is used until a better path is available. For example, if the VMW_PSP_MRU is currently using an active/unoptimized path and an active/optimized path becomes available, the VMW_PSP_MRU will switch the current path to the active/optimized one. While VMW_PSP_MRU is typically selected for ALUA arrays by default, certain ALUA storage arrays need to use VMW_PSP_FIXED.”

— vSphere Command-Line Guide

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— vSphere Command-Line Guide

Avoid the NFS3 Gotcha

Tip #24

Compare and contrast VMFS and NFS Datastore Properties

Datastores deployed on block storage devices use vSphere VMFS. VMFS is a special high-performance file system that is optimized for storing virtual machines.

NFS volumes are not formatted with a VMFS file system. NFS volumes are mounted directly on ESXi hosts and used to store and boot virtual machines in the same way as VMFS datastores.

“

NFS 3 uses only one TCP connection for I/O. As a result, ESXi supports I/O on only one IP address or hostname for the NFS server, and does not support multiple paths. Depending on your network infrastructure and configuration, you can use the network stack to configure multiple connections to the storage targets. In this case, you must have multiple datastores, with each datastore using separate network connections between the host and the storage.

— vSphere Storage Guide

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Differentiate NFS 3.x and 4.1 capabilities

NFS 3.x

NFS 3 uses only a single TCP connection for I/O and does not support multiple paths.

NFS 3 supports hardware acceleration and the use of thick-provisioned disks.

NFS 3 does not support access to NFS volumes via non-root credentials. You must provide each host root access to the volume.

NFS 3 locking does not use the Network Lock Manager (NLM) protocol. VMware provides its own locking protocol which creates and manages lock files on the NFS server.

NFS 4.1

NFS 4.1 provides multipathing for servers that support session trunking.

NFS 4.1 does not support hardware acceleration nor the use of thick-provisioned disks.

NFS 4.1 supports the Kerberos authentication protocol and the use of non-root users to access files when used with Kerberos.

NFS 4.1 uses share reservations as a locking mechanism and inbuilt file locking.

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Differentiate NFS 3.x and 4.1 capabilities

NFS 3.x

Full support for vSphere features.

NFS 4.1

Does not support...

- Storage DRS
- Storage I/O Control
- Site Recovery Manager
- Virtual Volumes
- Pre-v6 Fault Tolerance

Avoid the “Upgraded VMFS5 Volume” Gotcha

Tip #25

Identify VMFS5 Capabilities

- VMFS-5 uses GPT instead of MBR.
- VMFS-5 supports volumes up to 64TB, including pass-through RDMs.
- VMFS-5 uses a non-configurable 1MB block size.
- VMFS-5 uses a smaller 8KB sub-block size.
- VMFS-5 has support for 1KB “small” files.
- Files smaller than 1KB are stored in the metadata file descriptor location rather than using file blocks.
- Support for ATS locking on supported devices.

Compare Functionality of Newly-created vs. Upgraded VMFS5 Datastores

	Upgraded VMFS5	Newly-created VMFS5
Max datastore size	64TB	64TB
Max size of physical RDM	64TB	64TB
Max size of virtual RDM	2TB minus 512 bytes	2TB minus 512 bytes
Max size of file	2TB minus 512 bytes	2TB minus 512 bytes
Block size	Previous size (1/2/4/8 MB)	1MB
Sub-block size	64KB	8KB
File limit	30,000	100,000
Partition style	MBR	GPT
Partition sector	Starting on sector 128	Starting on sector 2048

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Know Your RDMs and their Sharing

Tip #26

Identify Available Raw Device Mapping Solutions

Identify Available Raw Device Mapping Solutions

- RDMs provide direct access to physical LUNs for VMs.
 - The “Raw Device Mapping” is a file in a separate VMFS volume that acts as a proxy to the physical storage device.

Identify Available Raw Device Mapping Solutions

- RDMs provide direct access to physical LUNs for VMs.
 - The “Raw Device Mapping” is a file in a separate VMFS volume that acts as a proxy to the physical storage device.
- RDMs are used in special circumstances, all of which are becoming less prevalent in today’s datacenters.
 - SAN snapshots for non-application aware backup solutions
 - Windows Failover Clustering
 - Direct access to LUNs which were previously or may later be redirected to a physical machine.

Identify Available Raw Device Mapping Solutions

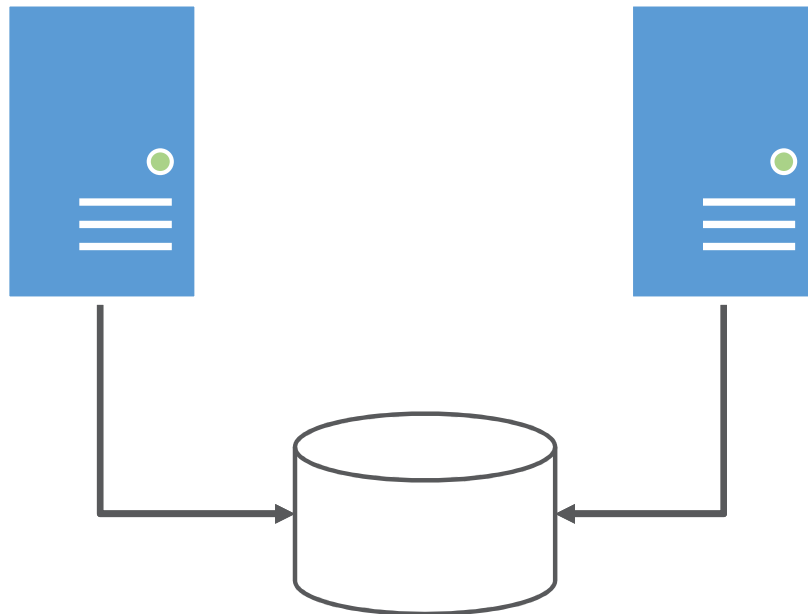
Physical Compatibility Mode

- All physical characteristics of the underlying hardware are exposed to the VM.
- Allows the guest OS to access the physical device directly.
- VMs with these RDMs cannot be cloned, converted to a template, or migrated if the operation involves a disk copy.

Virtual Compatibility Mode

- Underlying hardware appears to the guest OS similar to a virtual disk.
- Actual physical characteristics are hidden.
- Supports snapshots, cloning, and conversion to templates. LUN contents during the operation are copied into a VMDK.

Configure Bus Sharing



Configure Bus Sharing

Component	Single-Host Clustering	Multi-host Clustering
Clustered VMDK	SCSI bus sharing = Virtual	Not supported
Clustered RDM in Virtual Compatibility Mode	SCSI bus sharing = Virtual	SCSI bus sharing = Physical
Clustered RDM in Physical Compatibility Mode	Not supported	SCSI bus sharing = Physical

Configure Storage Policies Using Tags

Tip #27

Configure Storage Policies Using VASA

Tip #28

Use VSAN Fault Domains!

Tip #29

VSAN Requirements Recap

Minimum of three hosts

Minimum of one SSD + one HDD per host

HDDs, SSDs, I/O Controllers on VSAN HCL

VSAN 6 licensing

Dedicated 1Gbps/10Gbps uplink

VMkernel port dedicated for VSAN

Layer 2 multicasting on physical network

Enable Virtual SAN Fault Domains

Used to group together VSAN hosts that could potentially fail together.

Failure of all hosts within a single fault domain is treated as a single failure.

When fault domains are specified, VSAN will never put more than one replica of the same object in the same fault domain.

A fault domain appears as a single host to VSAN.

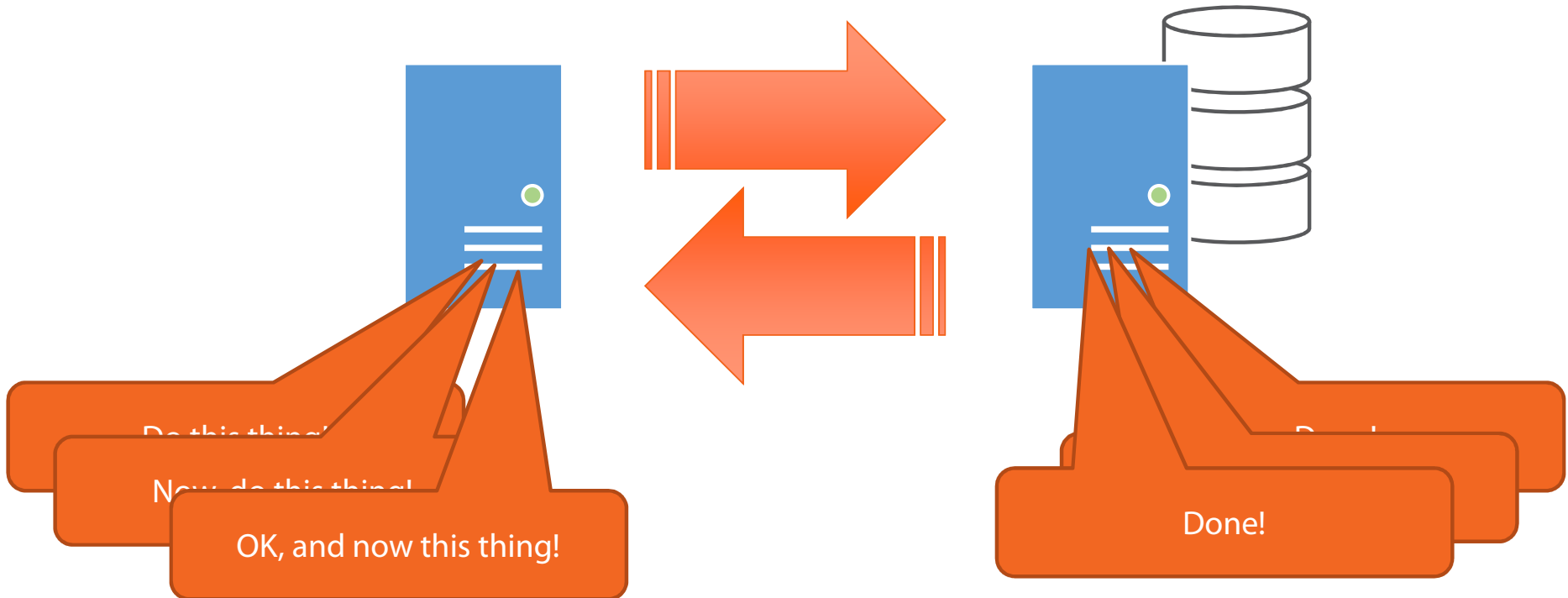
Hosts not added to any fault domain are considered to be in their own single-host fault domain.

Recommended to configure fault domains with a uniform number of hosts each.

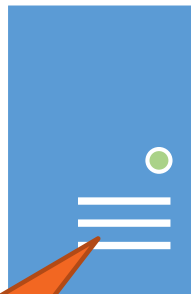
Prepare for (but maybe don't [yet] use) VMware VVOLs

Tip #30

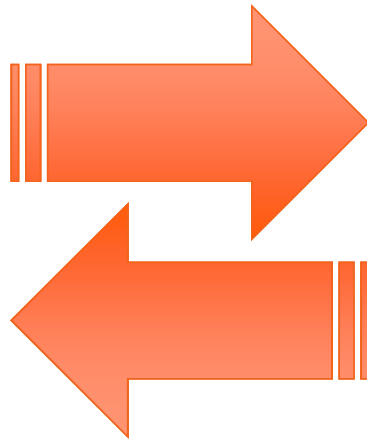
Understand vStorage API for Array Integration (VAAI)



Understand vStorage API for Array Integration (VAAI)

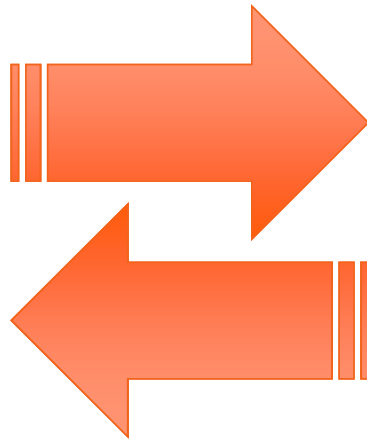
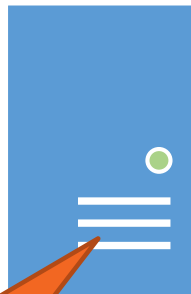


So, what can you
do on your own?



I can do all these things!

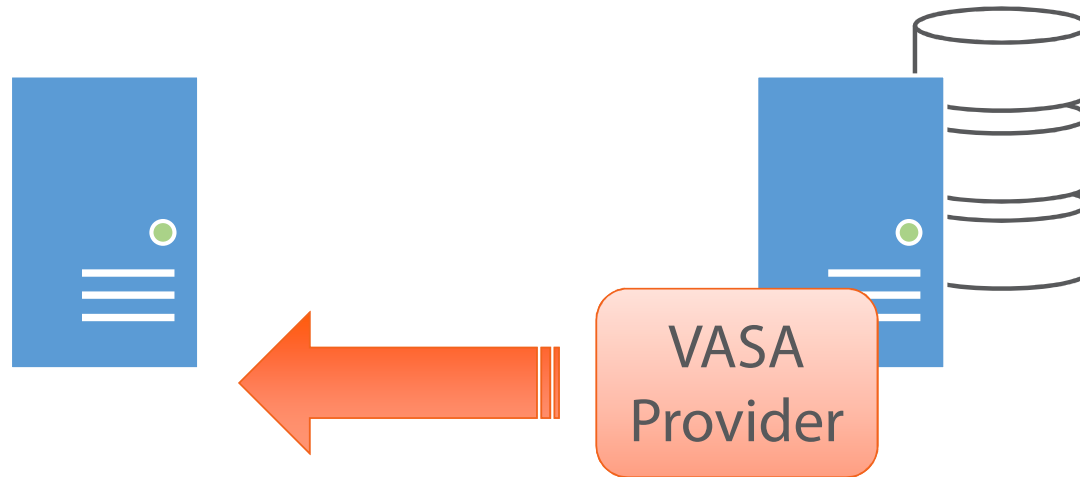
Understand vStorage API for Array Integration (VAAI)



Do ALL OF THESE things!

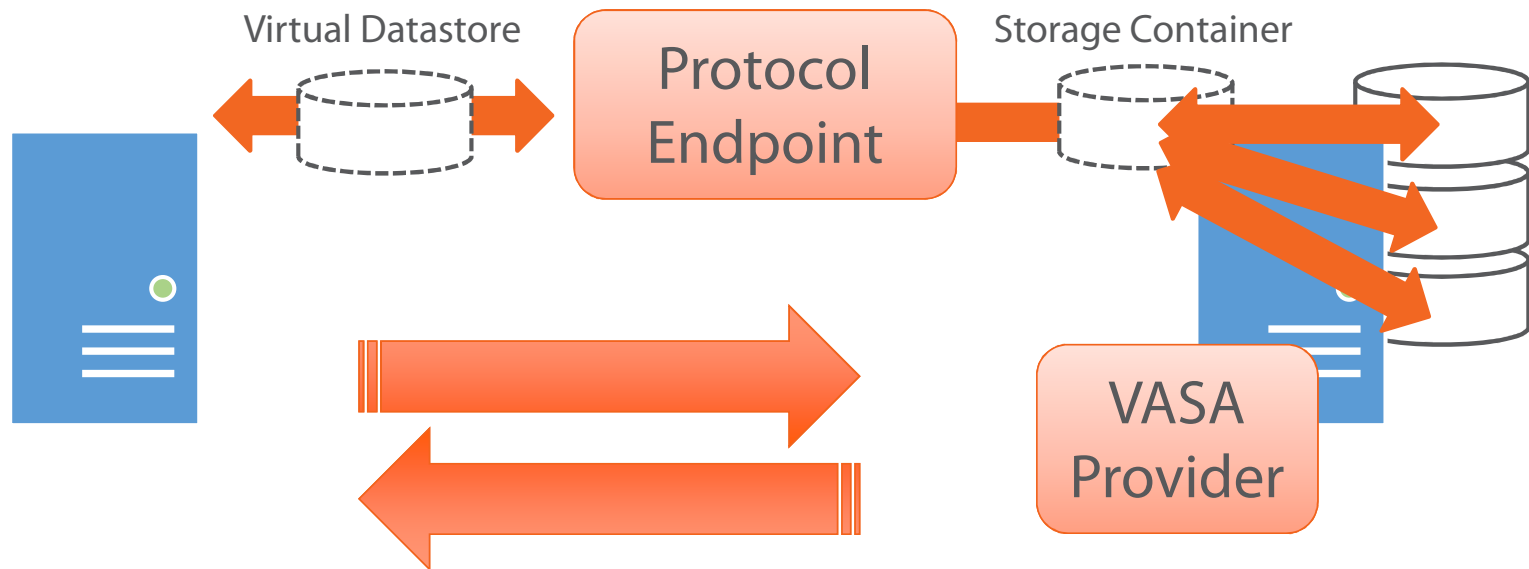
Done!

Understand vSphere API for Storage Awareness (VASA)



If VAAI is about doing,
then VASA is about seeing.

Understand VMware Virtual Volumes (VVOLs)



Lotsa' vSphere Stuff isn't yet Compatible

vROPS 6.0.x to 6.1.0

Site Recovery Manager 5.x to 6.1.0

vSphere Data Protection 5.x to 6.1.0

VMware vCloud Director 5.x

Fault Tolerance

IPv6

Microsoft Failover Clustering

NFS version 4.1

Raw Device Mapping

SMP-FT

Storage Distributed Resource Scheduler

Storage I/O Control

Configure and Administer Security

Configure Advanced Networking

Configure Advanced Storage



Administer and Manage Resources

Configure Availability Solutions

Deploy and Consolidate a vSphere Data Center

Get Really (Really, Really) Familiar with Reservations, Shares, and Limits

Tip #31 | Tip #32 | Tip #33

“

“There’s no such thing
as a free lunch.”

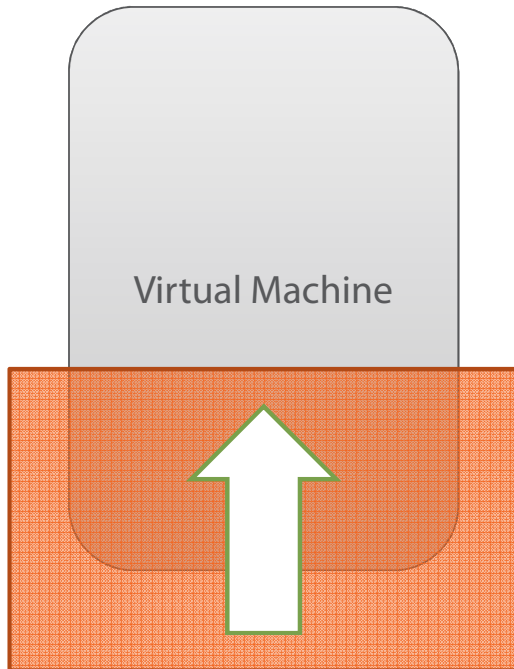
— Life ”

Understanding Reservations, Limits, and Shares



Virtual Machine

Understanding Reservations, Limits, and Shares

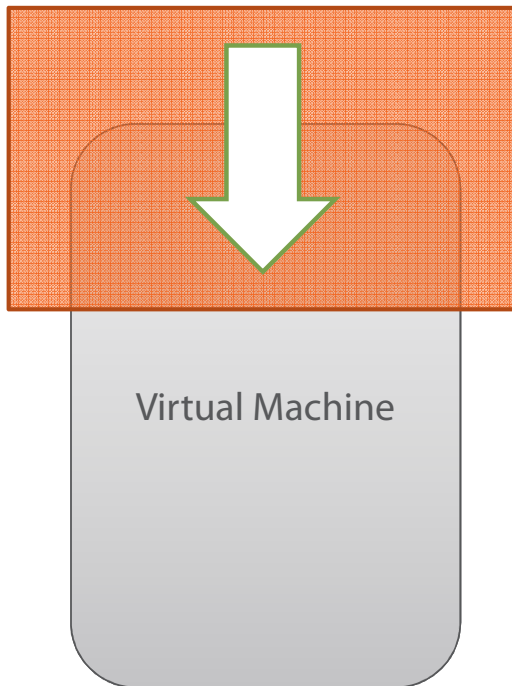


Reservations

Act as a guarantee of a particular resource.

Ensure that a VM is absolutely assured a configured quantity of a given resource.

Understanding Reservations, Limits, and Shares



Limits

Restrict the quantity of a given resource that a VM can use.

Offer additional control beyond the natural “limit” defined in each VM’s configuration.

Understanding Reservations, Limits, and Shares

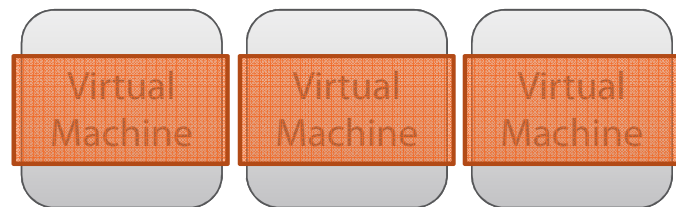
Shares

Establish a priority for resources during periods of contention.

Only affects the allocation of resources that exists between reservations and limits.

VMs with comparatively more shares assigned are given higher priority to resources.

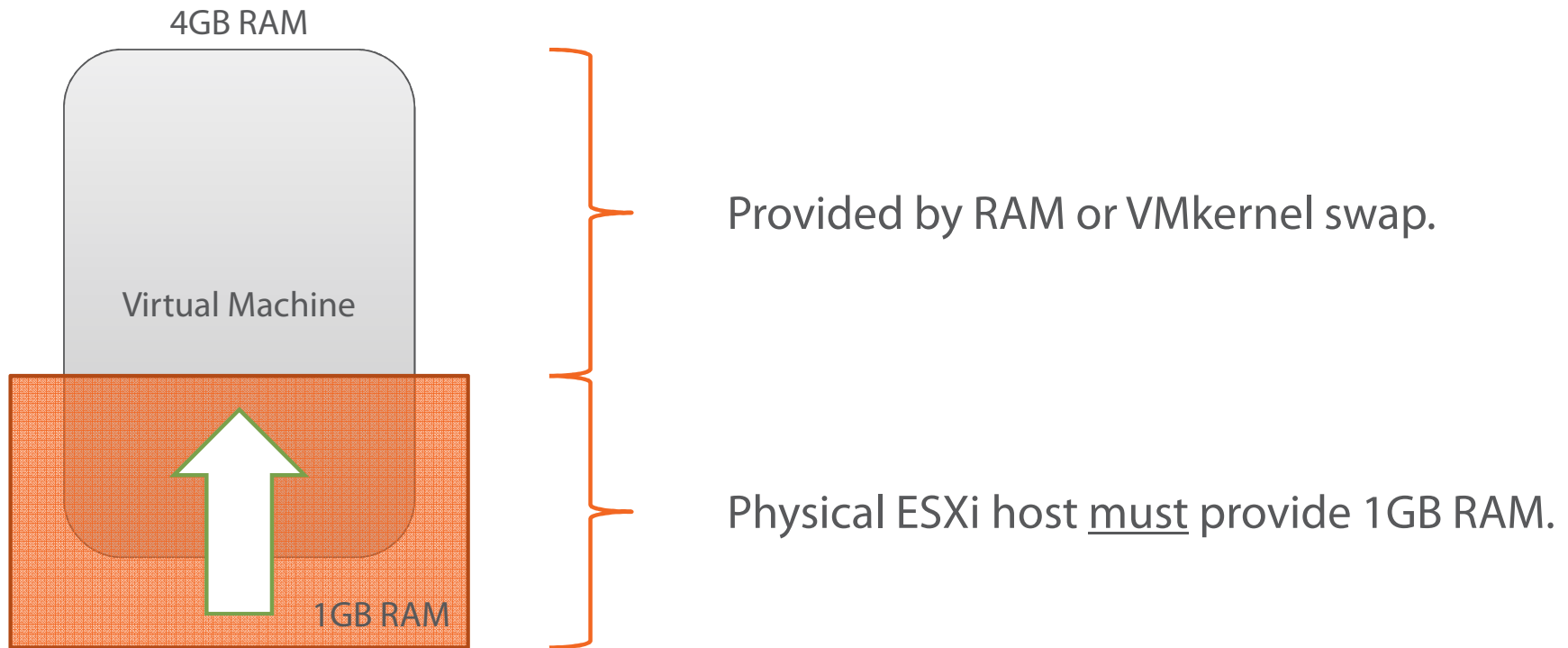
IMPORTANT: Shares are only evaluated during periods of contention.



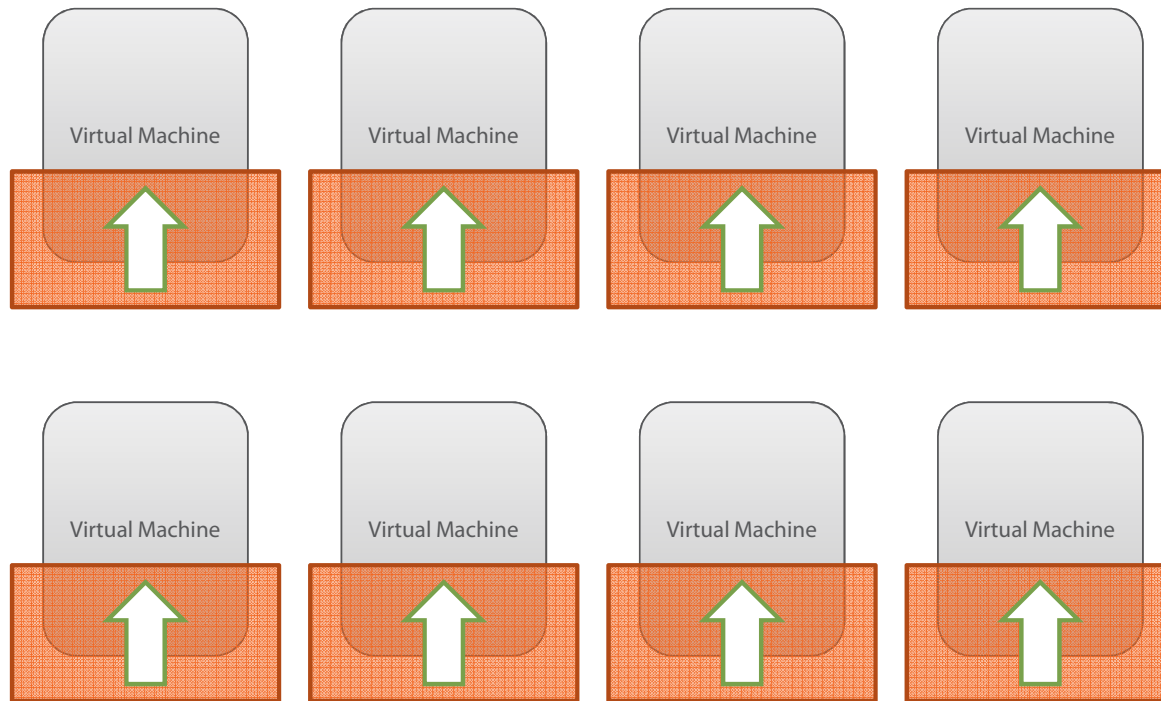
Avoid the Memory Reservations Gotcha

Tip #34

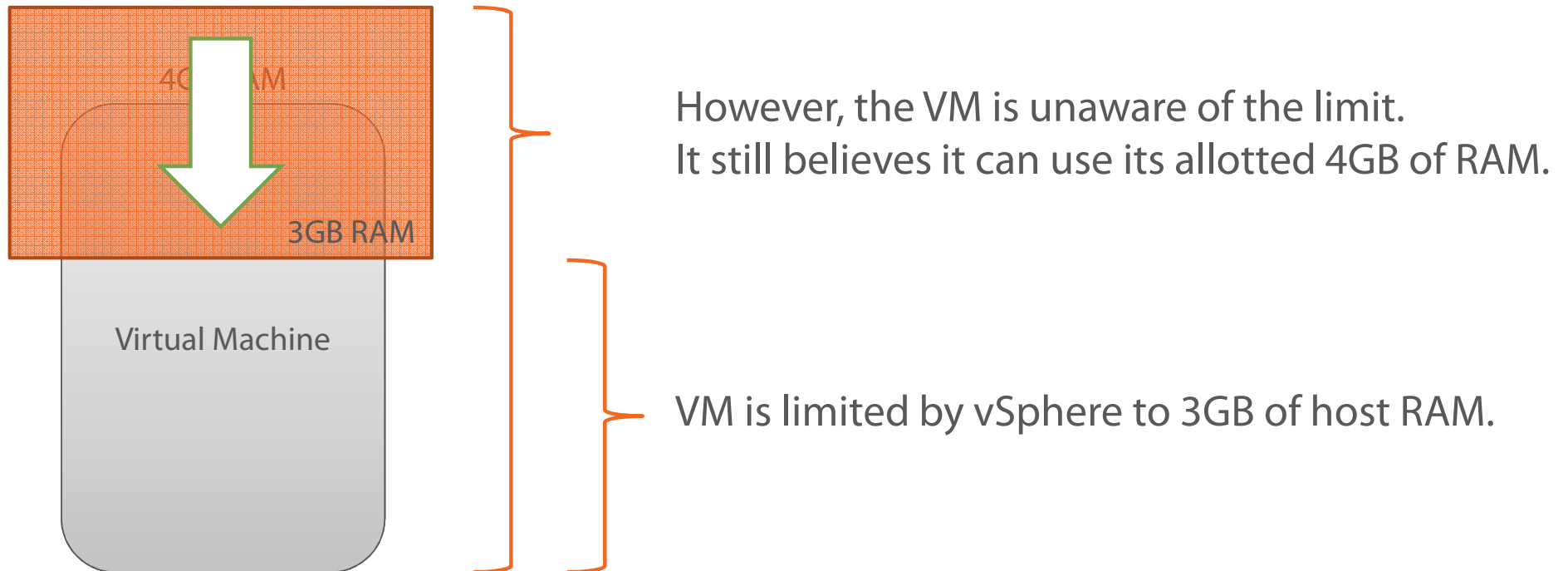
Working with Memory Reservations



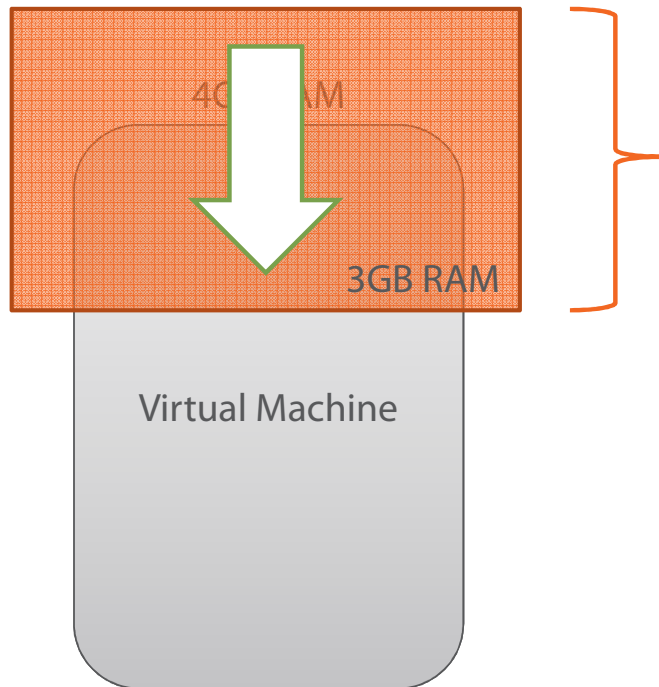
Working with Memory Reservations



Working with Memory Limits

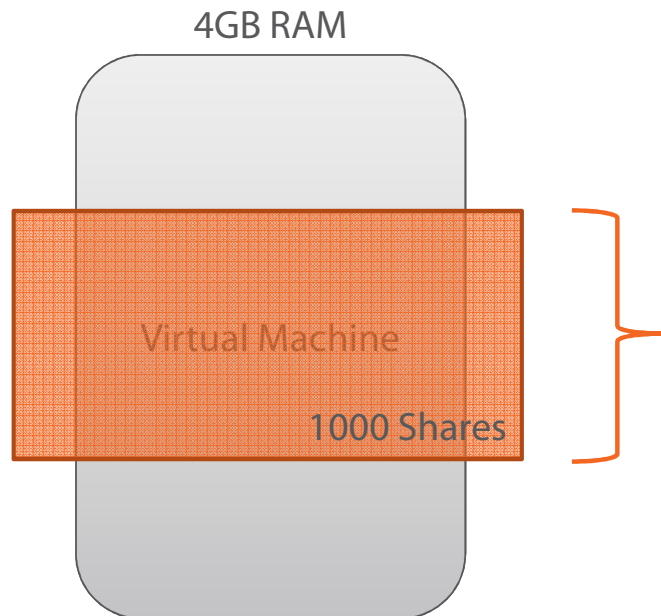


Working with Memory Limits



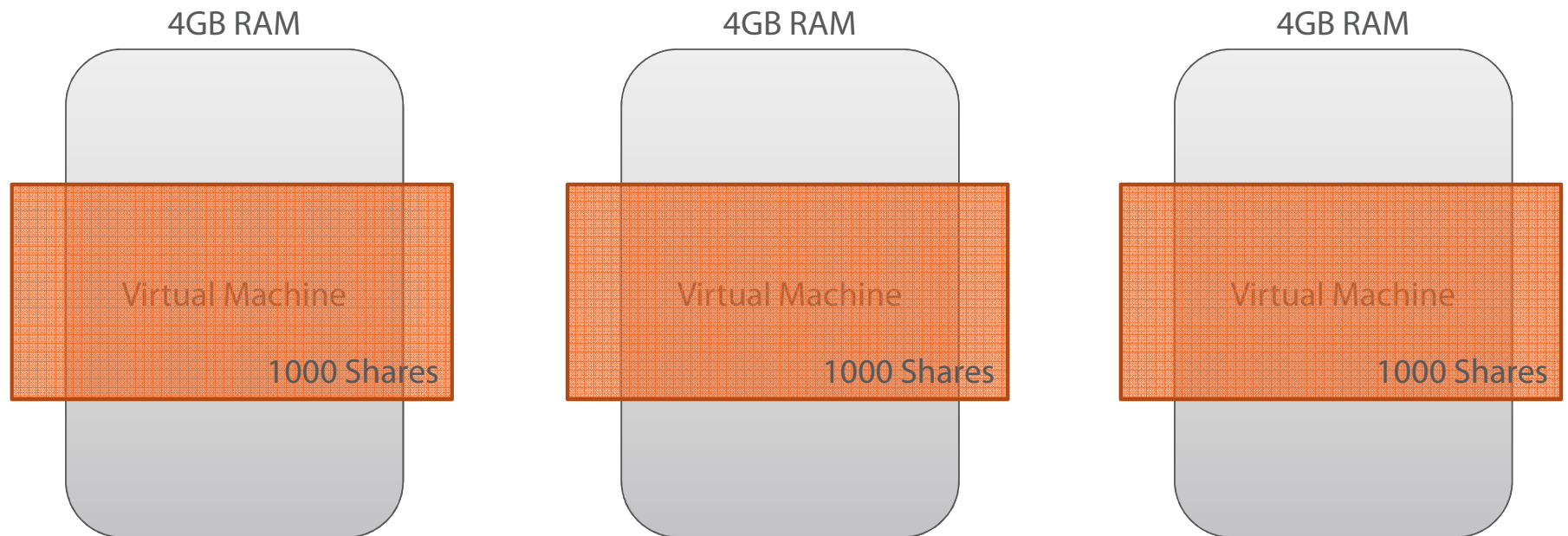
All RAM usage above 3GB must come from swap.

Working with Memory Shares

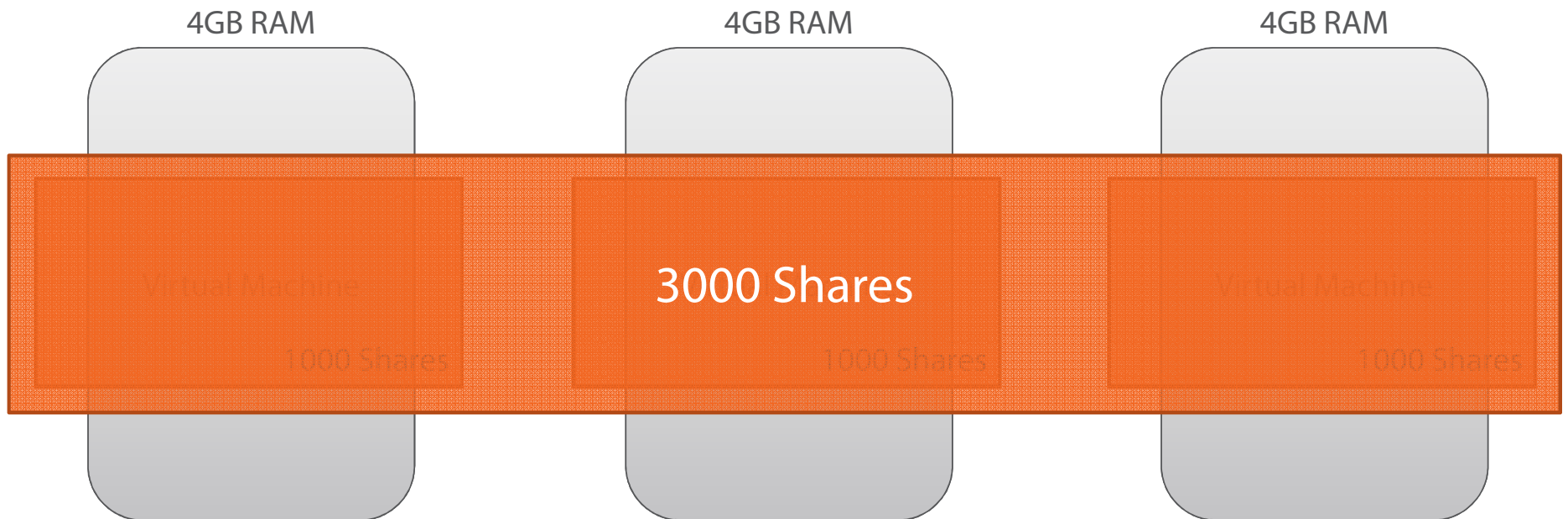


Shares are an arbitrary number whose absolute value is meaningless.

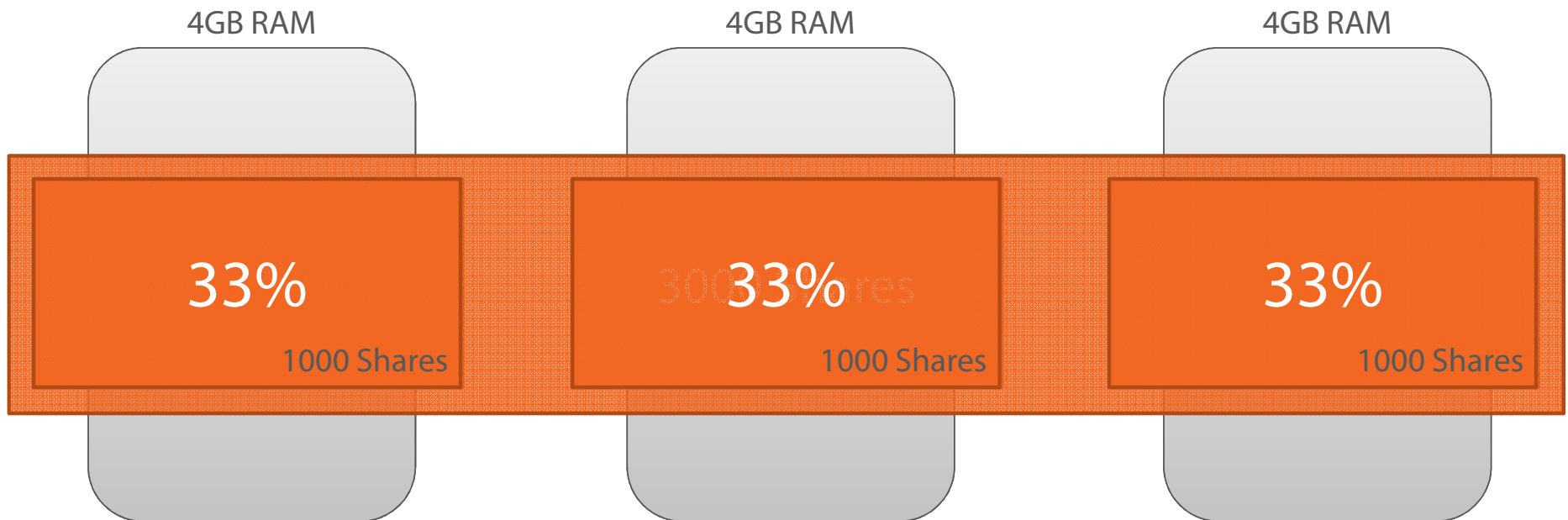
Working with Memory Shares



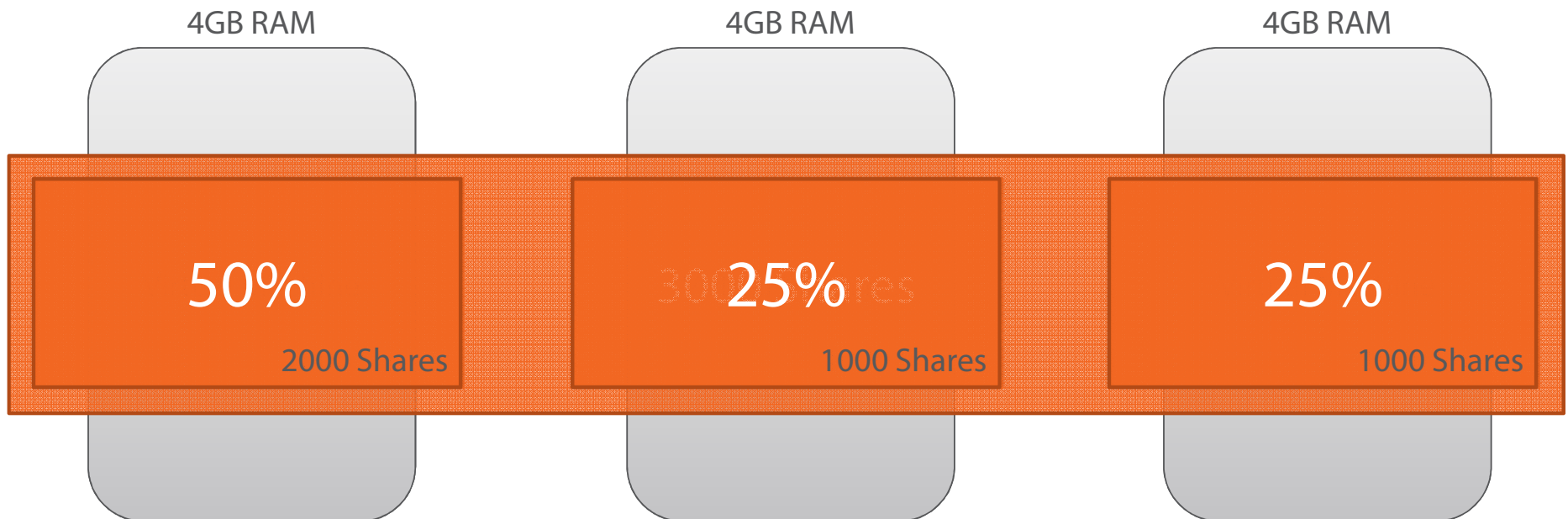
Working with Memory Shares



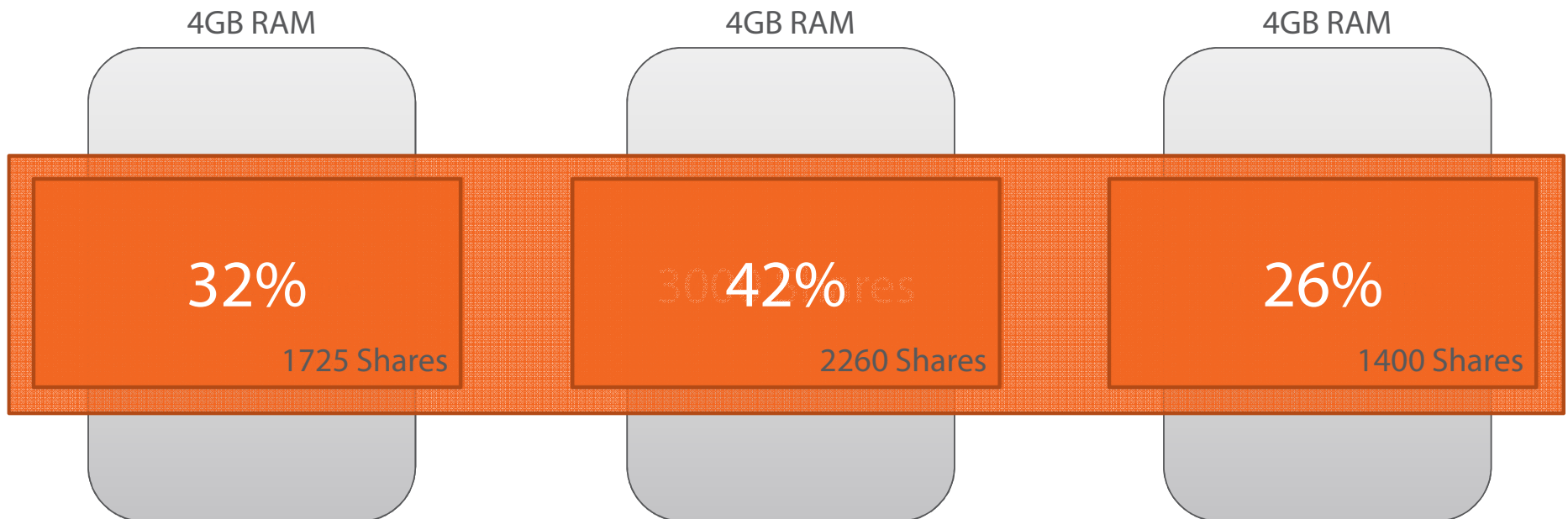
Working with Memory Shares



Working with Memory Shares



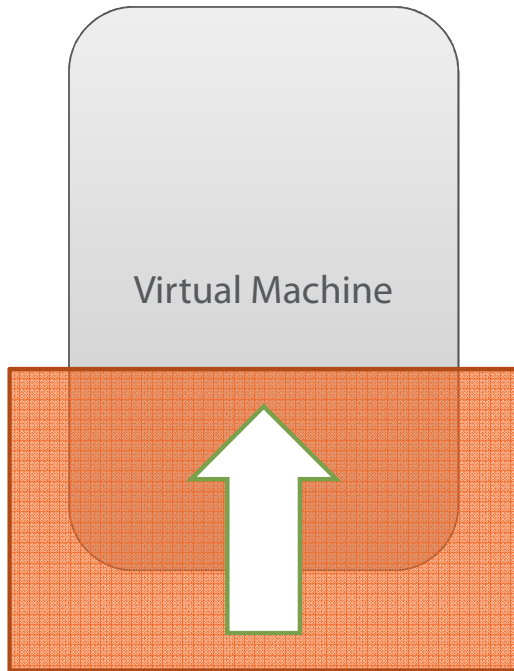
Working with Memory Shares



Avoid the CPU Shares Gotcha

Tip #35

Working with CPU Reservations



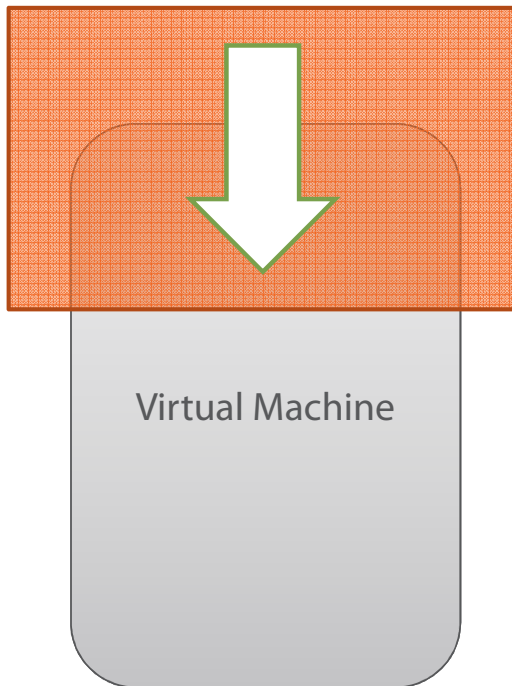
Reservations

Act as a guarantee for CPU processing power.

Unlike with RAM, unused reserved CPU cycles will be used to service other VMs when needed.

Like with RAM, the host must have enough CPU cycles to satisfy a reservation to power on a VM.

Working with CPU Limits



Limits

Prevent a VM from accessing CPU processing power, even if CPU cycles are available for use.
Can impact system and/or application performance.

Working with CPU Shares

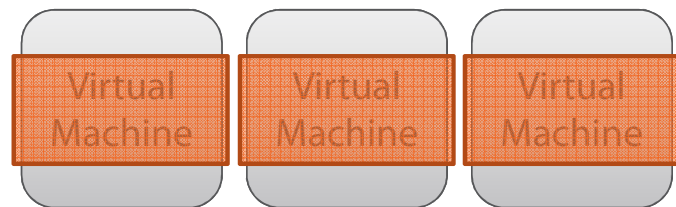
Shares

Establish a priority for CPU consumption during periods of contention.

Only affects the CPU allocation that exists between reservations and limits.

VMs with comparatively more shares assigned are given higher priority to CPU processing power.

IMPORTANT: Shares are only evaluated during periods of contention.



Resource Pools are not Folders!
Folders are not Resource Pools!

Tip #36

Describe the Resource Pool Hierarchy

➤ Rather than configuring reservations, limits, or shares on individual VMs, Resource Pools set these values on a group of VMs at one.

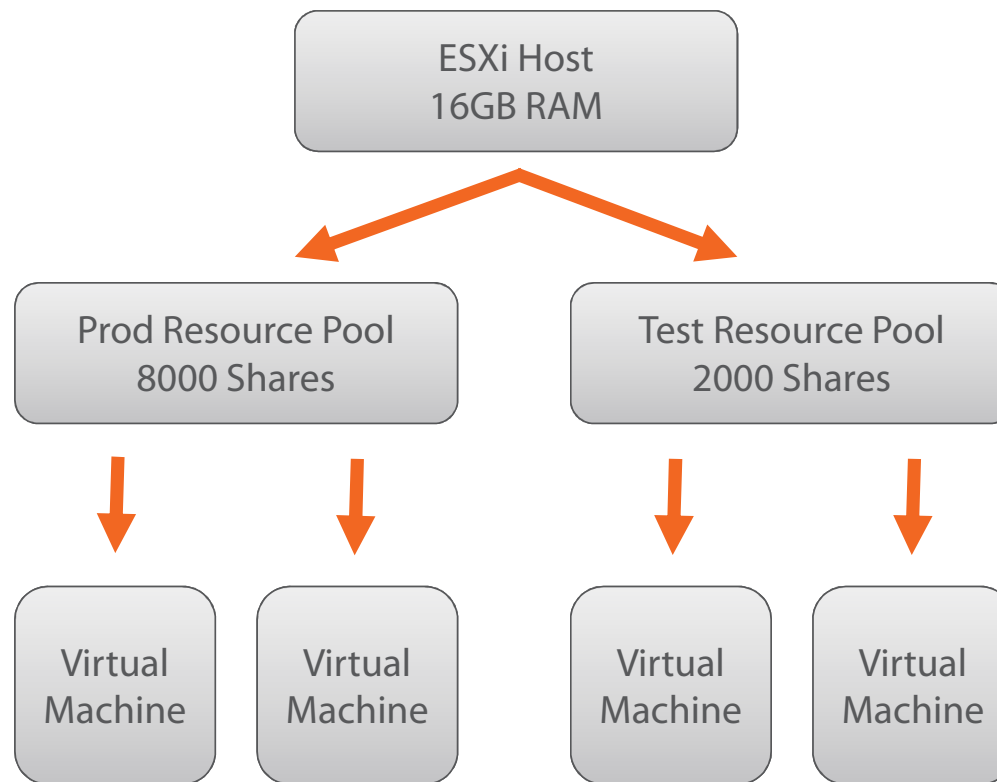
➤ Resource Pools are configured on...

- Individual stand-alone hosts
- DRS-enabled clusters

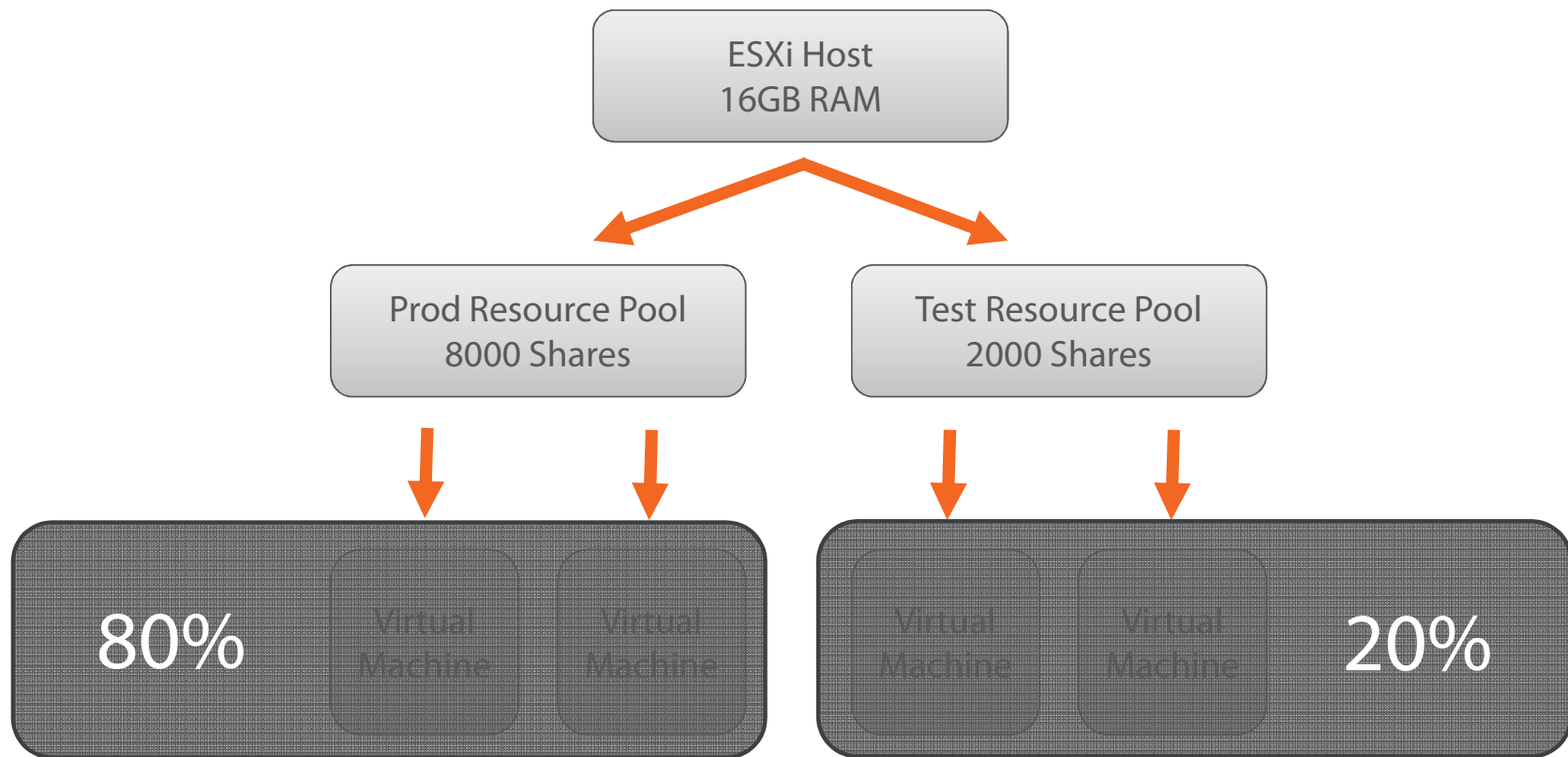
➤ IMPORTANT:

Resource Pools are not folders!
Folders are not Resource Pools!

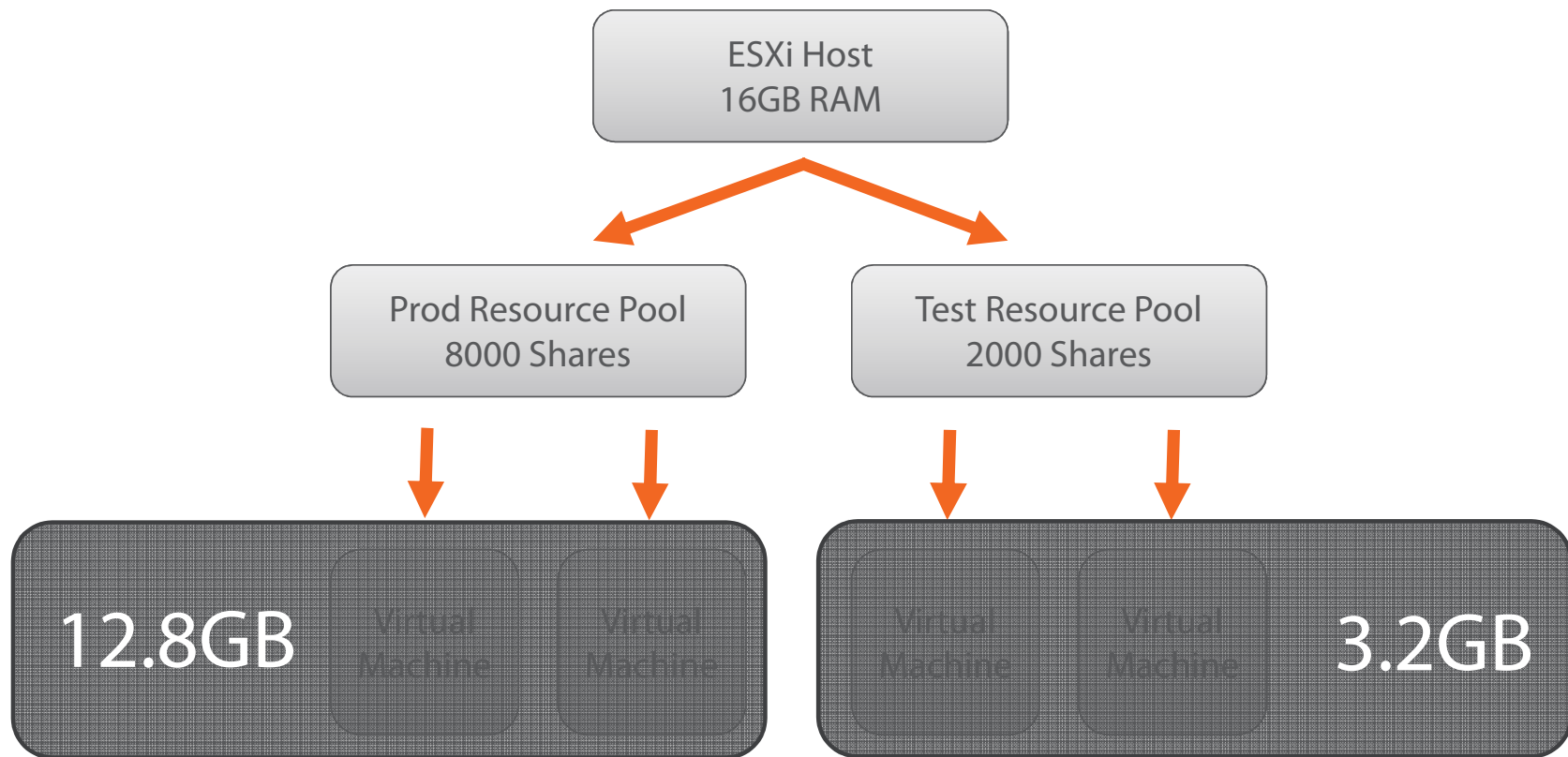
Describe the Resource Pool Hierarchy



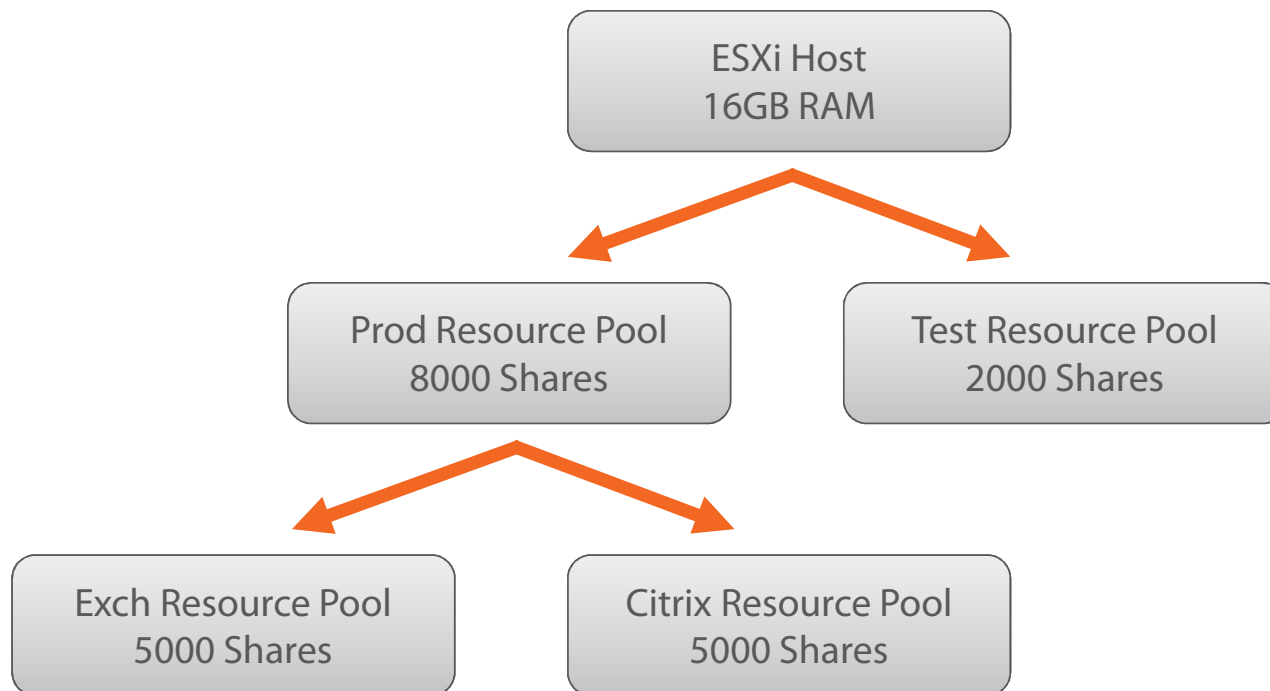
Describe the Resource Pool Hierarchy



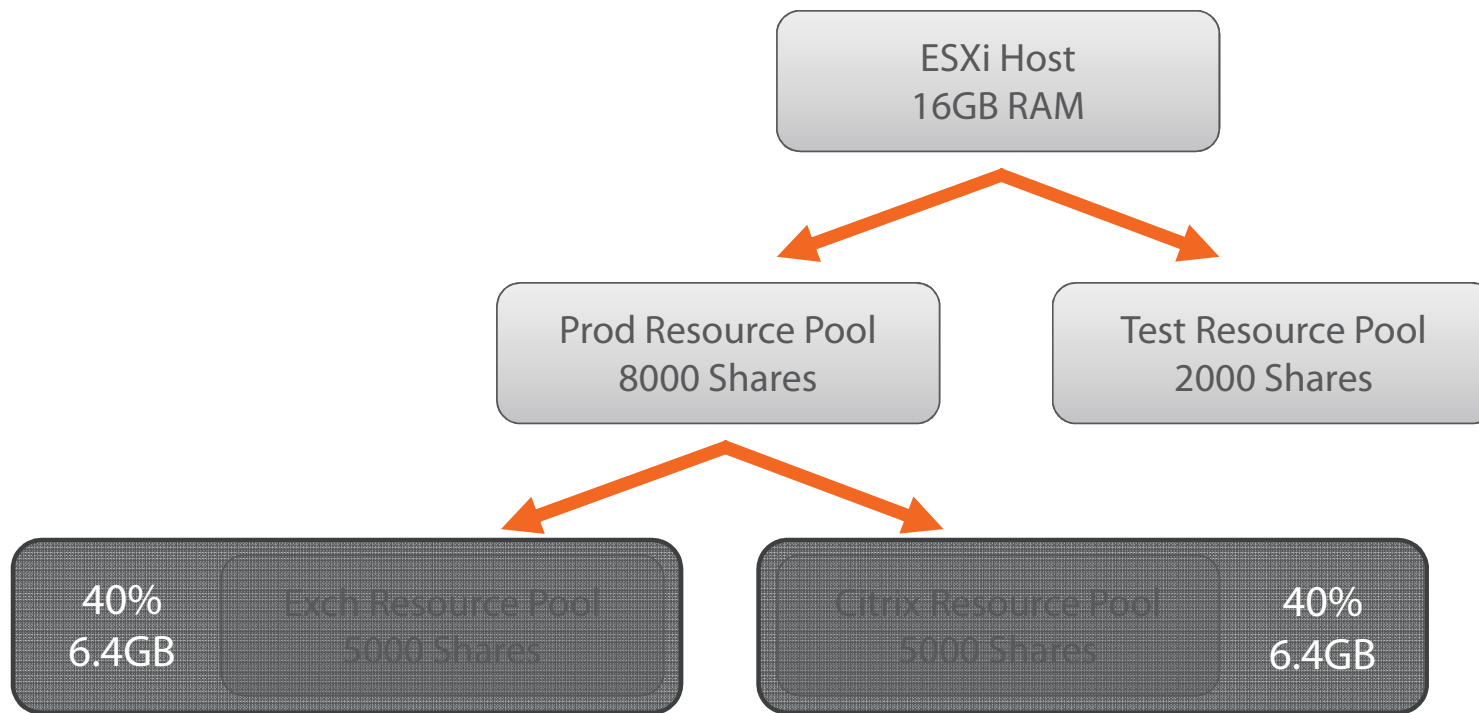
Describe the Resource Pool Hierarchy



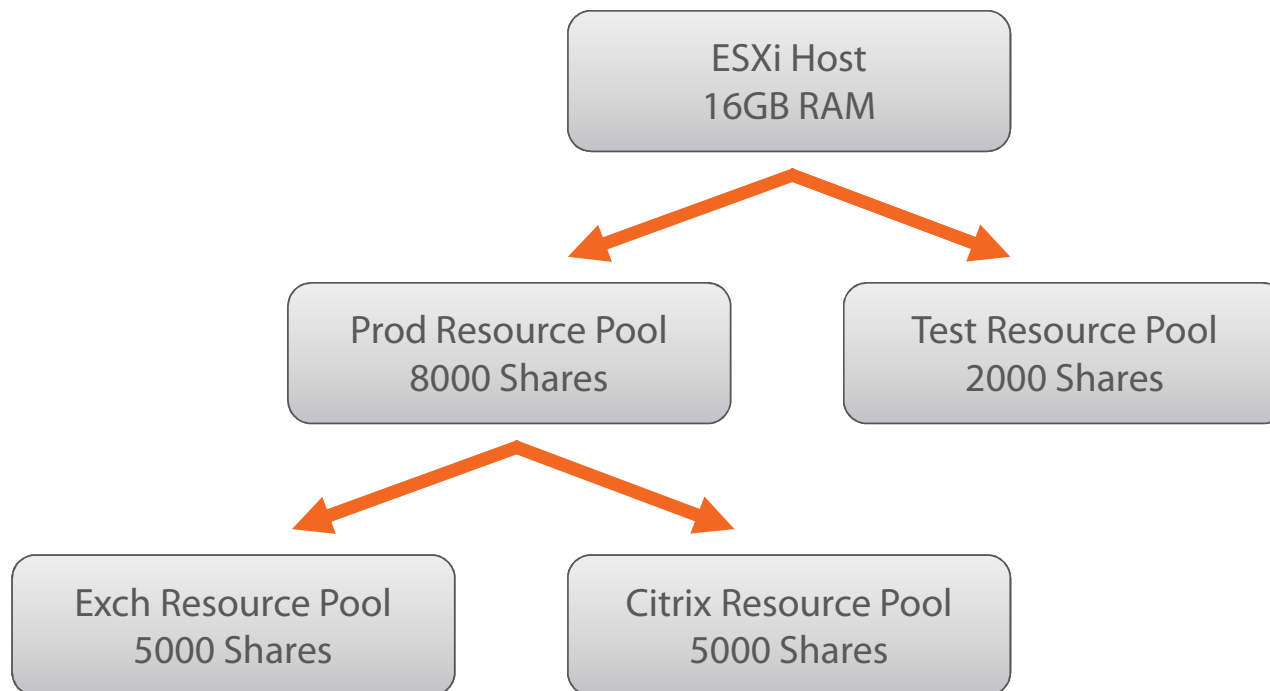
Describe the Resource Pool Hierarchy



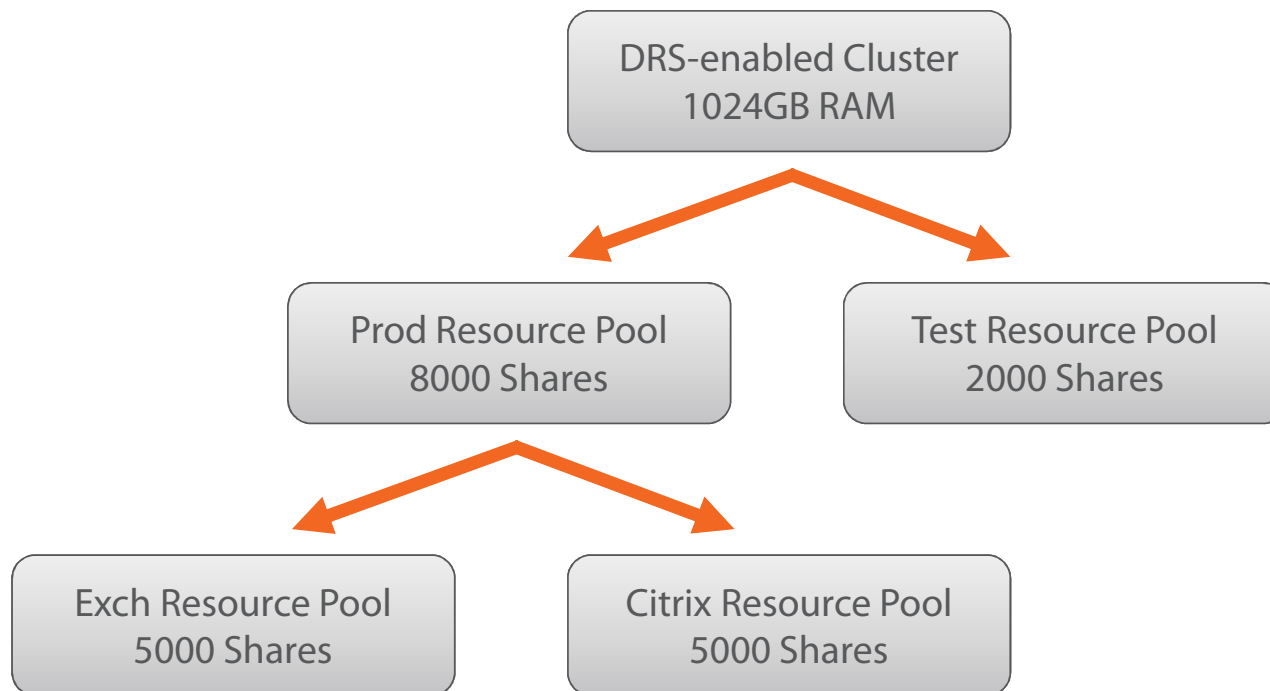
Describe the Resource Pool Hierarchy



Describe the Resource Pool Hierarchy



Describe the Resource Pool Hierarchy



Avoid the Resource Pools Gotcha

Tip #37

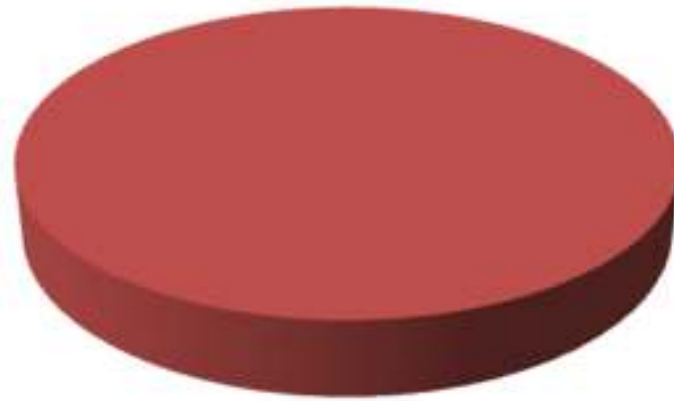
Describe the Resource Pool Hierarchy

- When you assign shares to a VM, you always specify its priority relative to other powered-on VMs.
- Sibling Resource Pools share resources according to their relative share values.
- Resources are divided at the Resource Pool first.

Describe the Resource Pool Hierarchy



Prod Resource Pool
8000 Shares
50 VMs

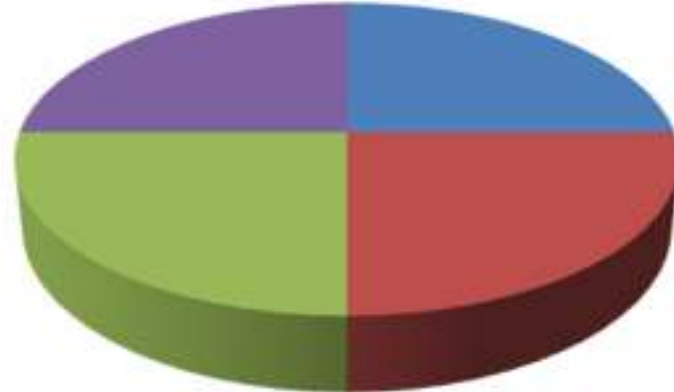


Test Resource Pool
2000 Shares
4 VMs

Describe the Resource Pool Hierarchy



Prod Resource Pool
8000 Shares
50 VMs



Test Resource Pool
2000 Shares
4 VMs

Avoid the Flexible Reservations Gotcha

(The Gotchas! The Horror!)

Tip #38

“

The Expandable Reservation parameter instructs vSphere to consider the resources available in the selected resource pool and its direct parent resource pool. If the parent resource pool also has the Expandable Reservation option selected, it can borrow resources from its parent resource pool. Leaving this option selected offers more flexibility, but at the same time provides less protection. A child resource pool owner might reserve more resources than [the parent pool] anticipates.

— vSphere Resource Management Guide

”

“

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— vSphere Resource Management Guide

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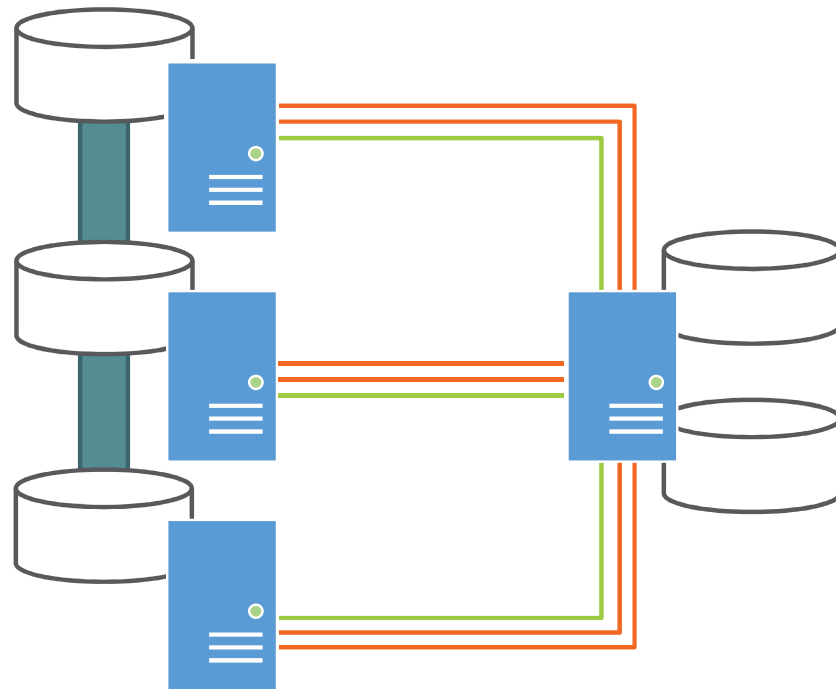
”

Implement a vFlash Resource Pool

(or don't)

Tip #39

Describe vFlash Architecture



(Don't)

Implement a vFlash Host Swap Cache

Tip #40

Understand Why and Where to Implement Network I/O Control

Tip #41

Identify Network I/O Control Requirements

- Enterprise Plus licensing required.
- NIOC can only be enabled on dvSwitches.
- Enabled by default on dvSwitches > v5.5.
- NIOC v3 available only on vSphere 6.
- Incompatible with SR-IOV.

Identify Network I/O Control Capabilities

- Extends concept of Resource Pools to networking.
- Facilitates the assignment of reservations, limits, and shares to network resources.
- Upon enabling, nine predetermined Resource Pools are created for common vSphere traffic.
- Reservation quotas can then be configured on user-defined Resource Pools.

Understand Why and Where to Implement Storage I/O Control

Tip #42

Identify Storage I/O Control Requirements

- SIOC-managed datastores must be managed under a single vCenter Server instance.
- VMFS datastores must be backed by Fibre Channel, FCoE, iSCSI, or NFS storage.
- RDMs are not supported.
- Datastores with multiple extents are unsupported.
- SIOC can interfere with array auto-tiering.
- Disabled by default.

Configure and Administer Security

Configure Advanced Networking

Configure Advanced Storage

Administer and Manage Resources

▶ Configure Availability Solutions

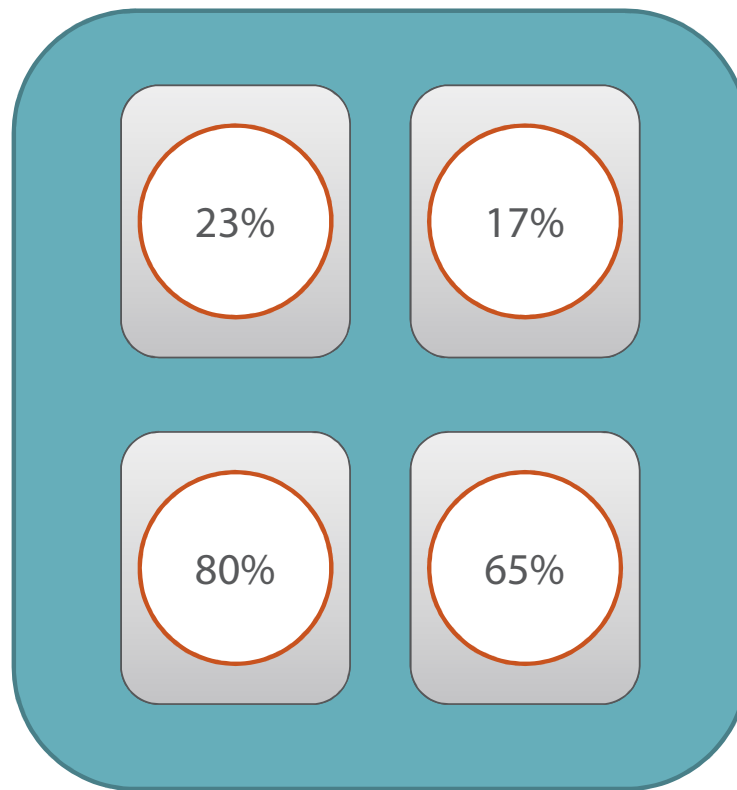
Deploy and Consolidate a vSphere Data Center

Avoid Inadvertently Exploding Yourself with vSphere HA Admission Control

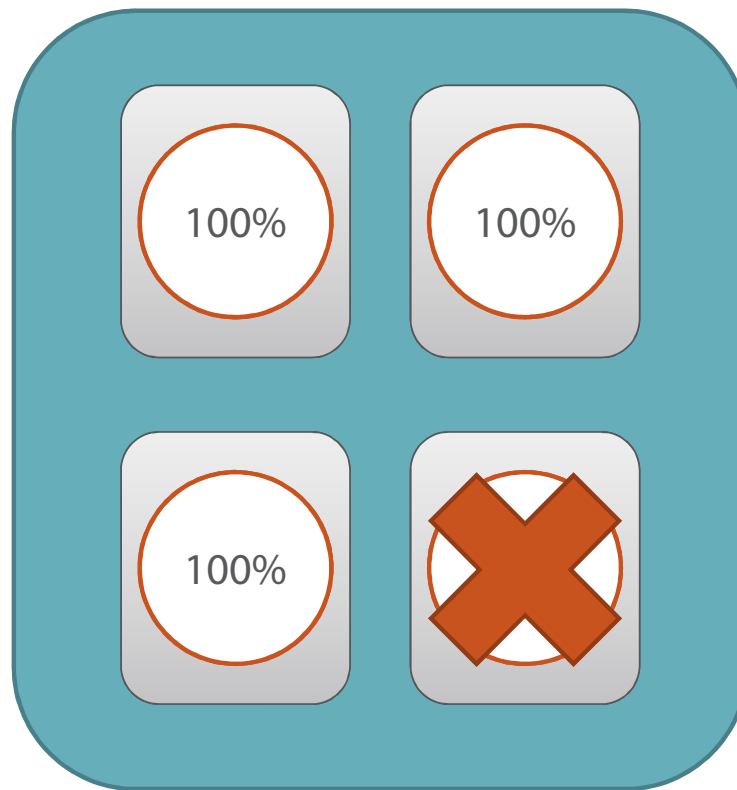
(Caution: Lots of slides)

Tip #43

Apply an Admission Control Policy for HA



Apply an Admission Control Policy for HA



Apply an Admission Control Policy for HA



Apply an Admission Control Policy for HA

☒ Use dedicated failover hosts:

+ ✕

Failover Hosts

esx1.company.pri

☐ Do not reserve failover capacity.
Allow virtual machine power-ons that violate availability constraints.



Apply an Admission Control Policy for HA

- Define failover capacity by static number of hosts.

Reserved failover capacity: 1 Hosts

Slot size policy:

- Cover all powered-on virtual machines

Calculate slot size based on the maximum CPU/Memory reservation and overhead of all powered-on virtual machines.

- Fixed slot size

Specify the slot size explicitly.

CPU slot size: 32 MHz

Memory slot size: 100 MB

VMs requiring multiple slots: 0/0 View

Calculate



Apply an Admission Control Policy for HA

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Calculate

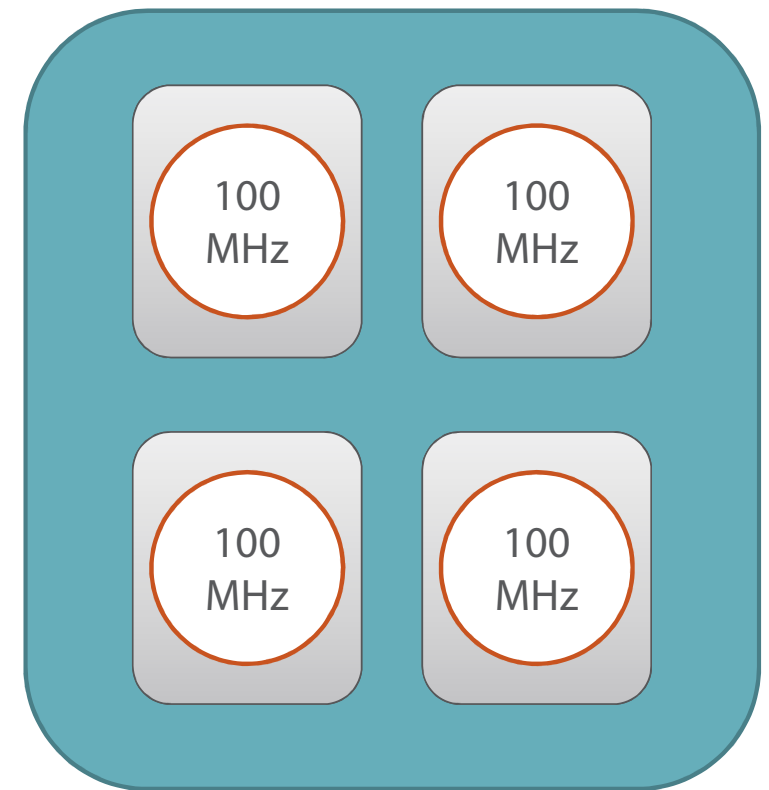


Apply an Admission Control Policy for HA

- Define failover capacity by reserving a percentage of the cluster resources.

Reserved failover CPU capacity: % CPU

Reserved failover Memory capacity: % Memory

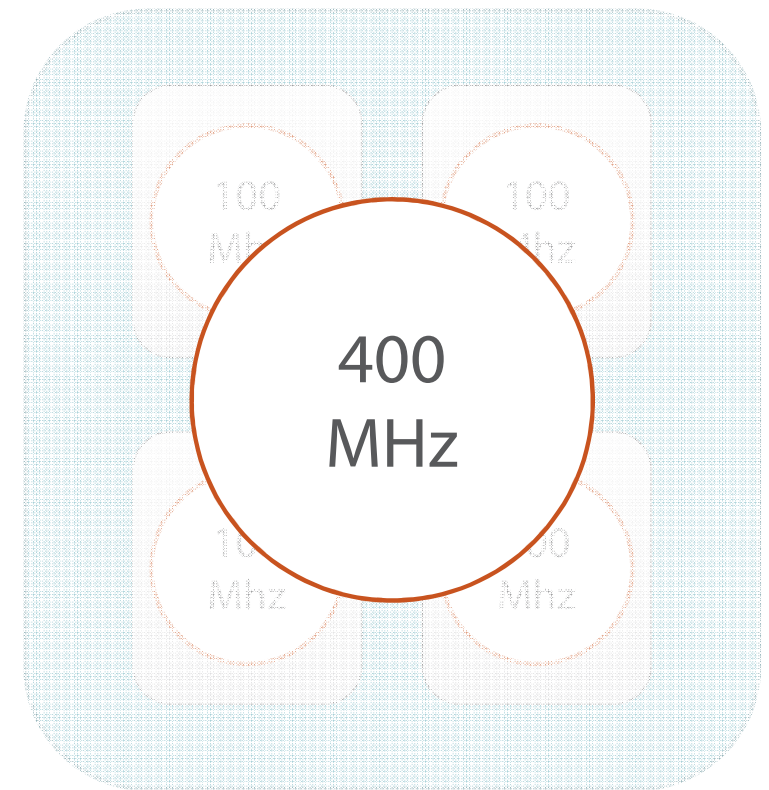


Apply an Admission Control Policy for HA

- Define failover capacity by reserving a percentage of the cluster resources.

Reserved failover CPU capacity: % CPU

Reserved failover Memory capacity: % Memory



Apply an Admission Control Policy for HA

- Define failover capacity by reserving a percentage of the cluster resources.

Reserved failover CPU capacity: 25 % CPU

Reserved failover Memory capacity: 25 % Memory



100 MHz set aside as failover CPU capacity.

The diagram illustrates a resource pool represented by a large light blue rounded rectangle. Inside this rectangle are four smaller white circles, each labeled '100 Mhz'. A large orange circle is overlaid on the bottom-left circle, representing a reserved portion of the resources. A blue callout box points to this orange circle with the text '100 MHz set aside as failover CPU capacity.'.

Apply an Admission Control Policy for HA

Static number of hosts

- Sets aside an amount of resources needed to protect any host, which means your “biggest” host.
 - Buy similarly-sized hosts.
- Always protects every VM, even those you don’t care about.
 - Set it and forget it.

Reserving a % of cluster resources

- Sets aside a fixed percent of resources, which does not automatically scale as you do.
 - Revisit your settings as you grow.
- Lower percent value wastes less, but also protects fewer VMs.
 - Configure VM restart policy.

Grok VM Component Protection and VM Monitoring Settings (for HA)

Tip #44 | Tip #45

Configure a Separate Network for vSphere HA Heartbeats

Tip #46

Networking for HA Heartbeats

Nodes in a vSphere HA cluster communicate via VMkernel networks.

A VMkernel network is chosen by vCenter Server.

To designate a network, enable the checkbox for Management traffic on the VMkernel port.

Limit vSphere HA traffic onto specified networks by configuring VMkernel NICs for vSphere HA onto a separate subnet.

Networking for HA Heartbeats

Network path redundancy between cluster nodes is important for vSphere HA reliability.

Configure NIC teaming for Management traffic VMkernel port.

Set load balancing policy to Route based on originating port ID and configure Failback to No.

(Optionally) Consider adding a second management network connection using a separate virtual switch.

Implement HA on a VSAN Cluster

VSAN uses its own logical network.

When VSAN and vSphere HA are enabled for the same cluster, HA traffic flows over this storage network rather than the management network.

vSphere HA uses the management network only when VSAN is disabled.

Virtual SAN can be enabled only when vSphere HA is disabled.

Configure Another vSphere HA Isolation Address

Tip #47

Avoid the Heartbeat Datastore Configuration Oops

Tip #48

Respect the Delicate Interplay Between HA, DRS, and DPM

Tip #49

HA with DRS and DPM

HA with DRS combines automatic failover with resource load balancing.

This combination can result in a more balanced cluster after a failure event.

HA's first priority is the immediate availability of all virtual machines. After a failure and VMs are restarted, hosts might be unevenly loaded.

HA with DRS and DPM

Some scenarios prevent a vSphere HA failover...

DPM enabled with HA admission control disabled.

VM-Host affinity rules set to Required.

Resource fragmentation.

(Really, Really, Really)

Understand vSphere DRS' Automation Levels

(Caution: Even more lots of slides)

Tip #50

Configure the Proper DRS Automation Level

- DRS is like a one-legged table.
 - Each side of that table represents a host in your cluster.
 - That leg can only support the table when all sides are balanced.
 - DRS' job is to relocate VMs to ensure the table stays balanced.
- Every five minutes a DRS interval is invoked.
 - During that interval DRS analyses resource utilization counters on every host.
 - It plugs those counters into this equation:

$$\frac{\sum VM \text{ Entitlements}}{Host \text{ Capacity}}$$

Configure the Proper DRS Automation Level

- VM entitlements
 - CPU resource demand and memory working set.
 - CPU and memory reservations or limits.
- Host Capacity
 - Summation of CPU and memory resources, minus...
 - VMKernel and Service Console overhead
 - Reservations for HA Admission Control
 - A small-percentage “extra” reservation



$$\frac{\sum VM \text{ Entitlements}}{Host \text{ Capacity}}$$

Configure the Proper DRS Automation Level

- A statistical mean and standard deviation can then be calculated.
 - Mean = Average load
 - Standard deviation = Average deviation from that load

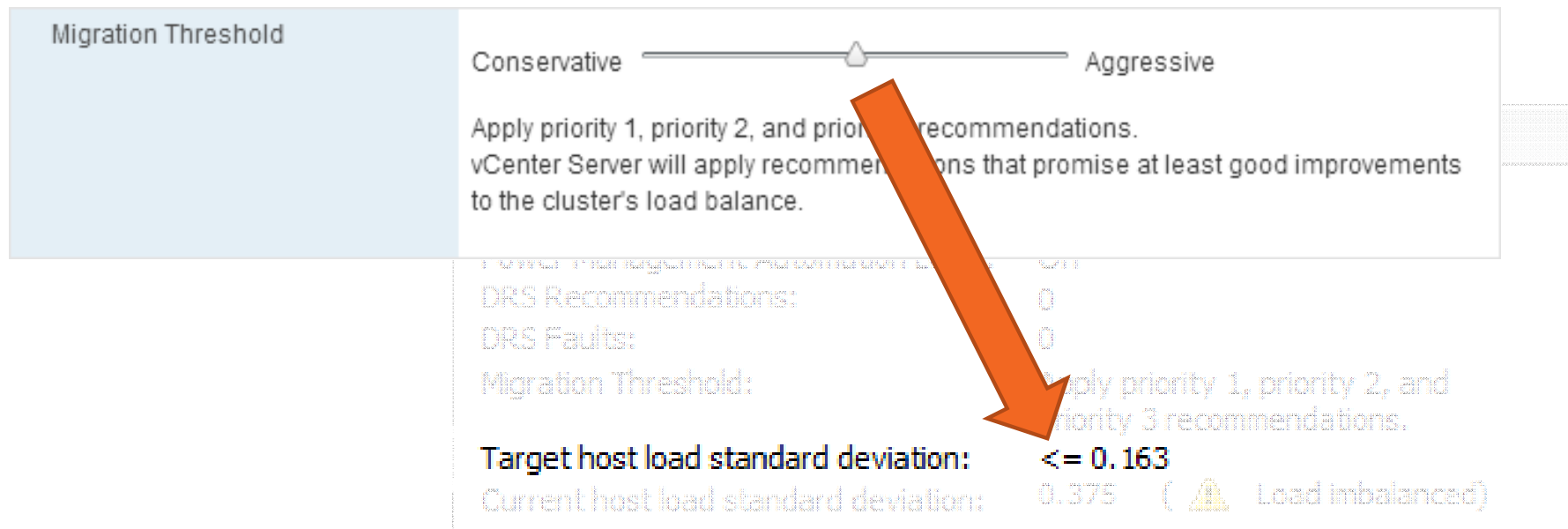
Configure the Proper DRS Automation Level

- A statistical mean and standard deviation can then be calculated.
 - Mean = Average load
 - Standard deviation = Average deviation from that load
- These define the Current host load standard deviation.

vSphere DRS	
Migration Automation Level:	Fully Automated
Power Management Automation Level:	Off
DRS Recommendations:	0
DRS Faults:	0
Migration Threshold:	Apply priority 1, priority 2, and priority 3 recommendations.
Target host load standard deviation:	<= 0.163
Current host load standard deviation:	0.375 ( Load imbalanced)

Configure the Proper DRS Automation Level

- Your migration threshold slider value determines the Target host load standard deviation.



The screenshot displays the vSphere DRS Migration Threshold configuration. A slider is positioned between 'Conservative' and 'Aggressive', with a triangle marker indicating the current setting. Below the slider, a description states: 'Apply priority 1, priority 2, and priority 3 recommendations. vCenter Server will apply recommendations that promise at least good improvements to the cluster's load balance.' A large orange arrow points from the slider to the 'Target host load standard deviation' field, which shows a value of ≤ 0.163 . Other fields include 'DRS Recommendations: 0', 'DRS Faults: 0', 'Migration Threshold: Apply priority 1, priority 2, and priority 3 recommendations.', and 'Current host load standard deviation: 0.375 (Load imbalanced)'.

Field	Value
DRS Recommendations:	0
DRS Faults:	0
Migration Threshold:	Apply priority 1, priority 2, and priority 3 recommendations.
Target host load standard deviation:	≤ 0.163
Current host load standard deviation:	0.375 (Load imbalanced)

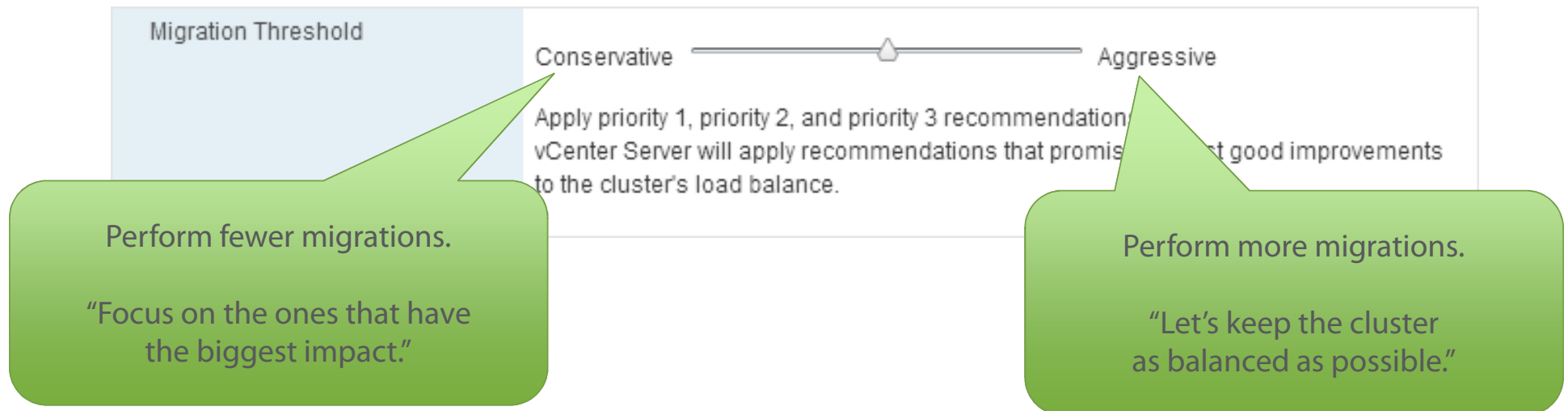
Configure the Proper DRS Automation Level

- DRS then runs a series of migration simulations to see which VM moves could have the greatest impact on rebalancing.
 - For each simulated move, it calculates a resulting CHLSD.
 - Which it then plugs into this equation...

$$6 - \left[\frac{\text{Current Host Load Standard Deviation}}{.1} * \sqrt{\# \text{ Hosts in Cluster}} \right]$$

Configure the Proper DRS Automation Level

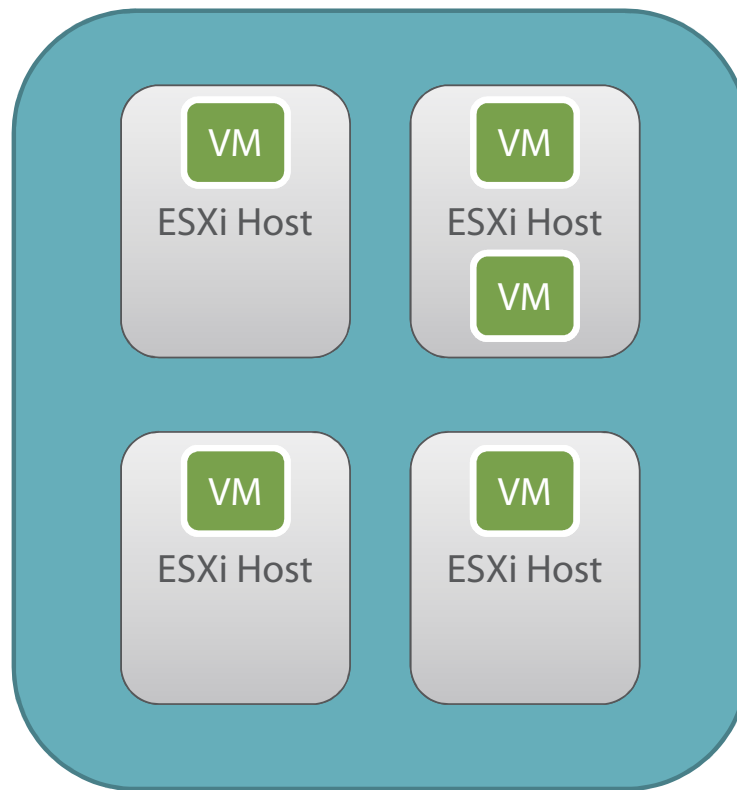
- The result is a priority number from 1 to 5.
 - Higher priority migrations have a greater impact on rebalancing.
 - Your migration threshold determines which migrations are done.



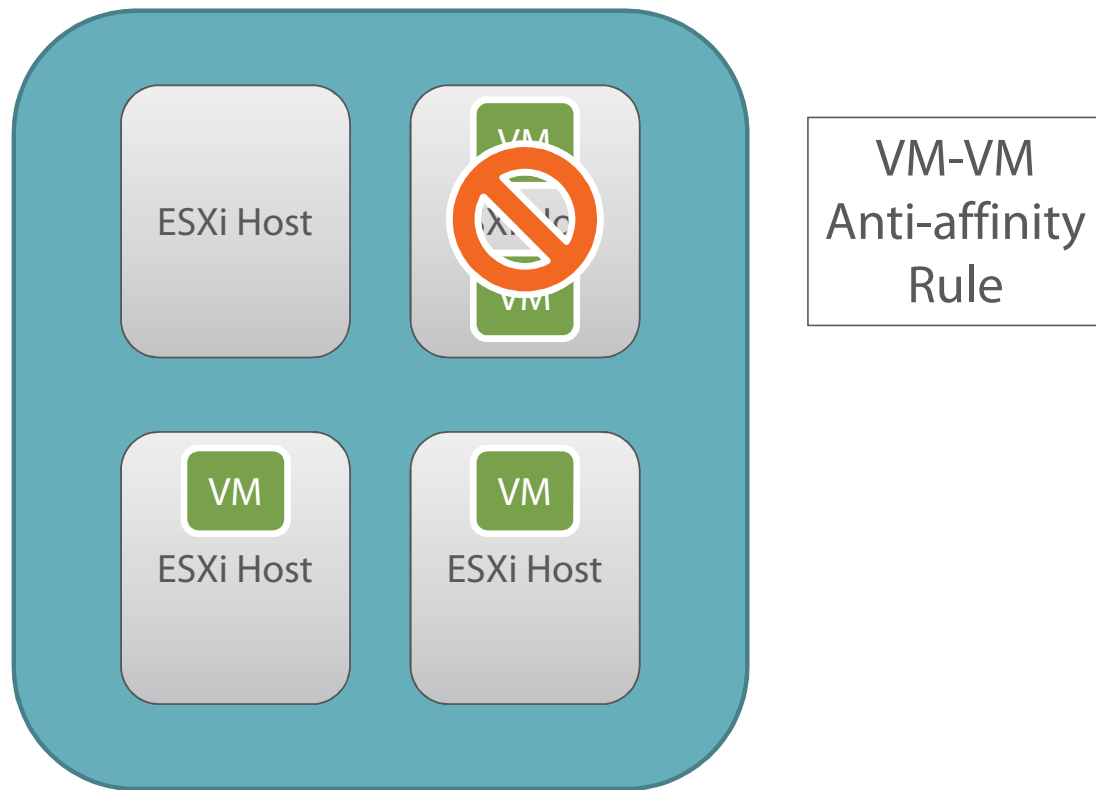
Don't (or do)
Configure vSphere DRS Affinity Rules

Tip #51

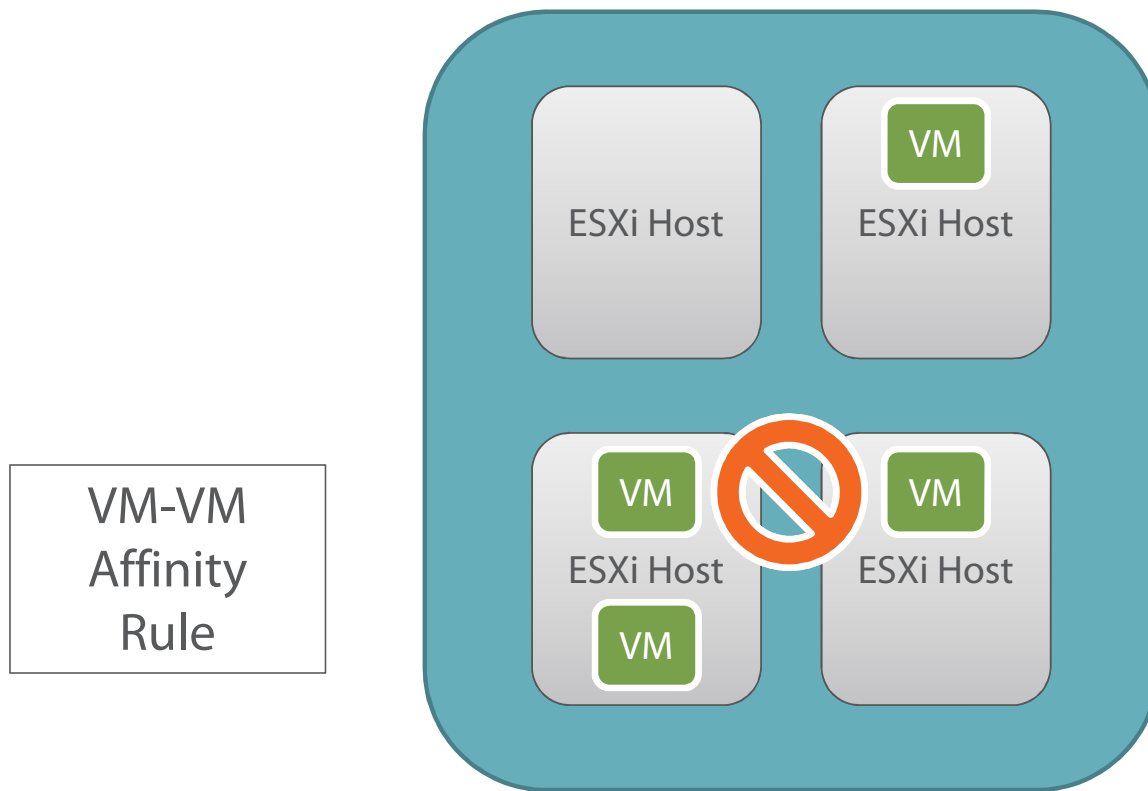
Explain how DRS Affinity Rules Affect VM Placement



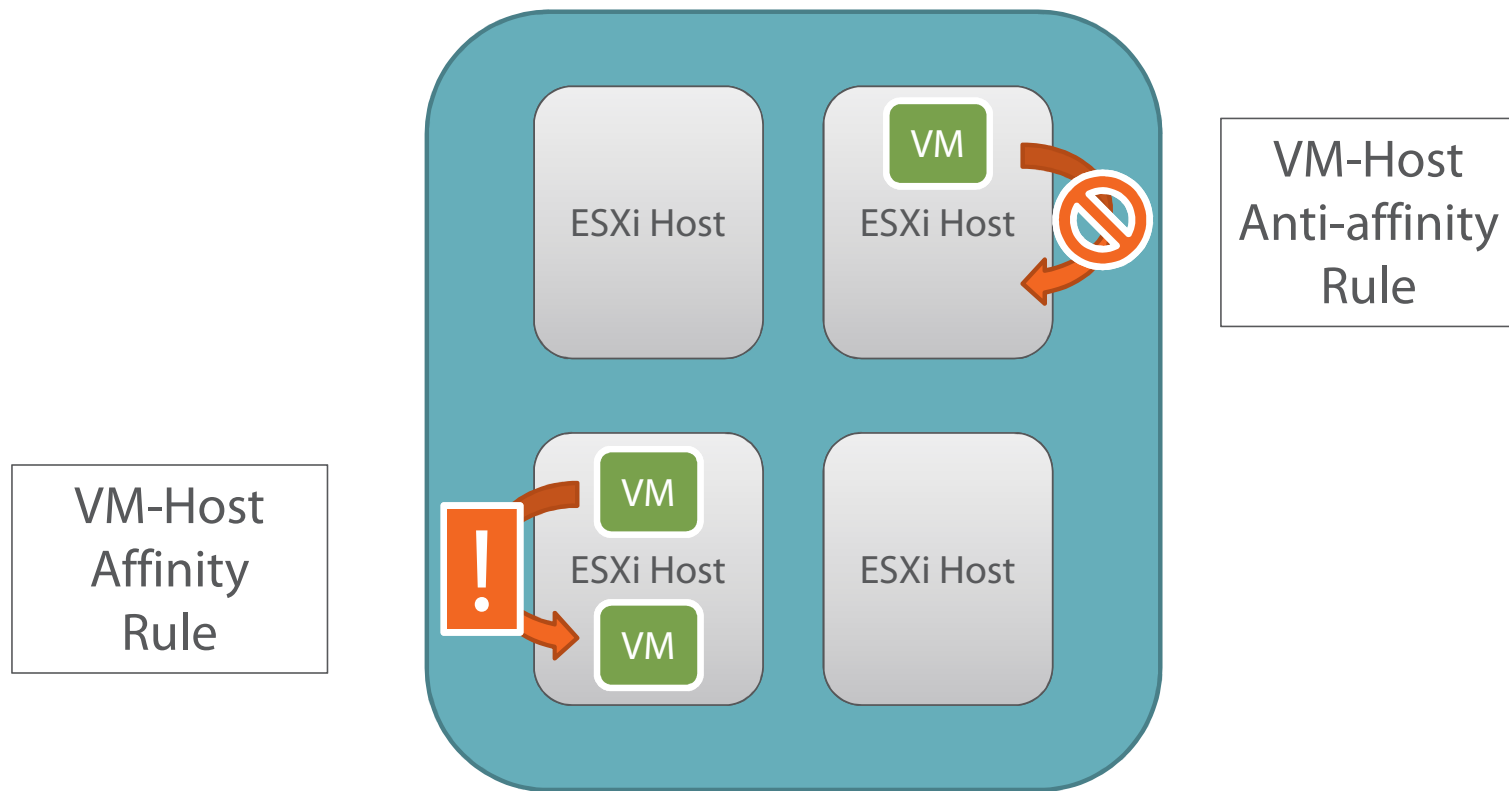
Explain how DRS Affinity Rules Affect VM Placement



Explain how DRS Affinity Rules Affect VM Placement



Explain how DRS Affinity Rules Affect VM Placement



Configure for Multi-NIC vMotion

Tip #52

Reasons for Multi-NIC vMotion

(as if you needed any)

VMs with
Exceptionally
Large vRAM

Large svMotion
Jobs w/o Shared
Storage

Long Distance
vMotion

Configure and Administer Security

Configure Advanced Networking

Configure Advanced Storage

Administer and Manage Resources

Configure Availability Solutions



Deploy and Consolidate a vSphere Data Center

Create, Customize, Attach, and Scan a vSphere Host Profile

Tip #53 | Tip #54 | Tip #55 | Tip #56

Modify Network Configurations with a Host Profile

Tip #57

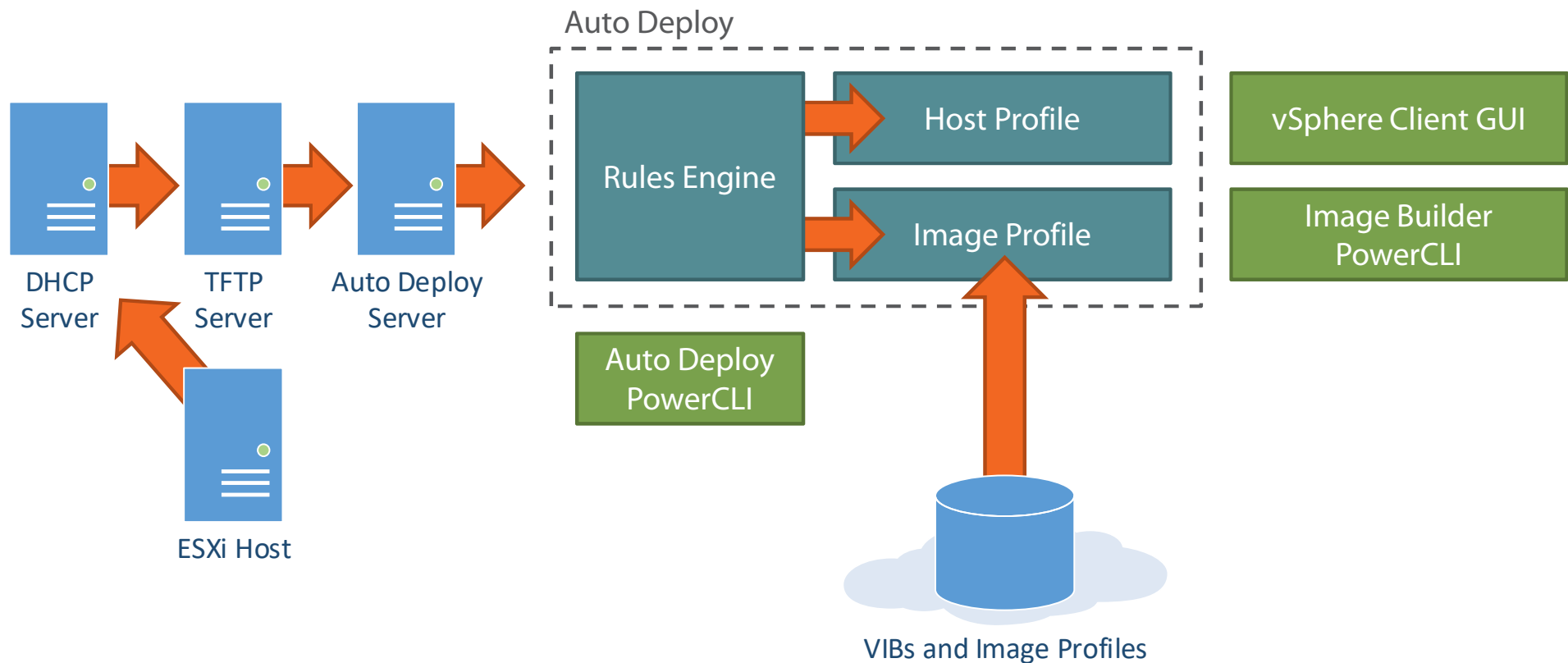
Modify Storage Configurations with a Host Profile

Tip #58

Grok the Architecture of Auto Deploy

Tip #59

Describe the Components and Architecture of an Auto Deploy Environment



Describe the Components and Architecture of an Auto Deploy Environment

State Information

Image State

Configuration State

Dynamic State

Virtual Machine State

User Input

Description and Source

Describe the Components and Architecture of an Auto Deploy Environment

State Information

Image State

Configuration State

Dynamic State

Virtual Machine State

User Input

Description and Source

Description –

The operating system that runs on an ESXi host

Source –

Image profile

Created with Image Builder PowerCLI

Describe the Components and Architecture of an Auto Deploy Environment

State Information

Image State
Configuration State
Dynamic State
Virtual Machine State
User Input

Description and Source

Description –
Configurable settings on the ESXi host

Source –
Host profile
Created with Host Profile GUI

Describe the Components and Architecture of an Auto Deploy Environment

State Information

Image State
Configuration State
Dynamic State
Virtual Machine State
User Input

Description and Source

Description –
Runtime state as generated by the operating system

Source –
Host memory
Created during regular operations / lost after reboot

Describe the Components and Architecture of an Auto Deploy Environment

State Information

Image State
Configuration State
Dynamic State
Virtual Machine State
User Input

Description and Source

Description –
Hosted VMs and their information

Source –
vCenter Server
Created during regular operations

Describe the Components and Architecture of an Auto Deploy Environment

State Information

Image State
Configuration State
Dynamic State
Virtual Machine State
User Input

Description and Source

Description –
Uniqueness configurations that cannot be contained within a host profile

Source –
Host customization (“answer files”)
Prompted as user input during the application of a targeted host profile

Explain the Auto Deploy Deployment Model

Default Operation

- Host does not store the image.
- On subsequent boots, host boots from Auto Deploy.
- Auto Deploy infrastructure required during deployment and at each subsequent boot.

Stateful Install

- Host stores the image.
- On subsequent boots, host boots from stored image.
- Auto Deploy infrastructure required only during deployment.

Explain the Auto Deploy Deployment Model

Default Operation

- Host does not store the image.
- On subsequent boots, host boots from Auto Deploy.
- Auto Deploy infrastructure required during deployment and at each subsequent boot.

Stateless Caching

- Host stores the image.
- On subsequent boots, host boots from stored image if unable to access Auto Deploy.
- Auto Deploy infrastructure required to complete configuration.

Locate the VMware Online Depot

(the not-GUI way)

Tip #60

Create an ESXi Image Profile and Deployment Rule

Tip #61

Understand PowerCLI Cmdlets for Auto Deploy

Connect-VIServer

Add-EsxSoftwareDepot

Export-EsxImageProfile

Remove-EsxSoftwareDepot, Add-EsxSoftwareDepot

New-DeployRule -Name "Install"

New-DeployRule -Name "Host Profile"

Add-DeployRule -Name "Install"

Add-DeployRule -Name "Host Profile"

Tune and Implement Host Profiles for Auto Deploy

Tip #62

Deploy an ESXi Host with Auto Deploy

Tip #63

Customize an ESXi Image for Auto Deploy

Tip #64

Configure and Administer Security

Configure Advanced Networking

Configure Advanced Storage

Administer and Manage Resources

Configure Availability Solutions

Deploy and Consolidate a vSphere Data Center



Epilogue

Never Trust a Conference Session that Suggests Never Trusting a Conference Title

Tip #65



Remember
the Number 5
when Filling Out Evaluations!

Tip #66

Have a Great TechMentor!

Tip #67



Extra Content

Troubleshoot and Monitor vSphere Performance



Greg Shields

@ConcentratdGreg | www.pluralsight.com

Describe and Differentiate Critical CPU Performance Metrics

%RUN	Percentage of CPU time used	High %RUN means a VM is using lots of CPU resources
%SYS	Percentage of time used by system services	High %SYS can mean one or more VMs is operating with heavy I/O
%WAIT	Wait time for CPU resources, including I/O wait, idle wait, others	High %WAIT can mean nothing, because %WAIT includes idle time
%VMWAIT	$\%VMWAIT = \%WAIT - \%IDLE$	High %VMWAIT can indicate resource latency
%RDY	Percentage of time a group was ready to run, but was not provided CPU resources	High %RDY can mean a deliberate resource constraint is preventing access to CPU

Describe and Differentiate Critical CPU Performance Metrics

%RUN	Percentage of CPU time used	High %RUN means a VM is using lots of CPU resources
%SYS	Percentage of time used by system services	High %SYS can mean one or more VMs is operating with heavy I/O
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%VMWAIT	$\%VMWAIT = \%WAIT - \%IDLE$	High %VMWAIT can indicate resource latency
%RDY	Percentage of time a group was ready to run, but was not provided CPU resources	High %RDY can mean a deliberate resource constraint is preventing access to CPU

Describe and Differentiate Critical CPU Performance Metrics

%RUN	Percentage of CPU time used	High %RUN means a VM is using lots of CPU resources
%SYS	Percentage of time used by system services	High %SYS can mean one or more VMs is operating with heavy I/O
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Describe and Differentiate Critical Memory Performance Metrics

MEMSZ	Amount of physical memory allocated to a resource pool or VM
GRANT	Amount of guest physical memory allocated to a resource pool or VM
SZTGT	Amount of memory the VMkernel wants to allocate to a resource pool or VM
TCHD	Working set estimate for a resource pool or VM

Describe and Differentiate Critical Memory Performance Metrics

%ACTV	Instantaneous value percentage of guest physical memory that is being referenced by the guest
%ACTVS	Slow moving average percentage of guest physical memory that is being referenced by the guest
%ACTVF	Fast moving average percentage of guest physical memory that is being referenced by the guest
%ACTVN	VMware internal use

Describe and Differentiate Critical Memory Performance Metrics

MCTL?	Is the memory balloon driver installed?	If not, install VMware Tools
MCTLSZ	Amount of physical memory reclaimed from VM or resource pool via ballooning	If MCTLSZ is changing, then the balloon driver is actively reclaiming memory
MCTLTGT	Amount of physical memory attempted to be reclaimed from VM or resource pool by ballooning	VM memory is reclaimed (e.g. the balloon “inflates”) when $MCTLTGT > MCTLSZ$, as well as the opposite
MCTLMAX	Maximum amount of physical memory that could be reclaimed by ballooning	Adjust and/or disable by adjusting value for sched.mem.maxmemctl

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Describe and Differentiate Critical Memory Performance Metrics

SWCUR	Current swap usage	A high SWCUR means guest physical memory has been moved from RAM to disk
SWTGT	Target swap usage	VMware internal use
SWR/s	Rate at which memory is being swapped in from disk	A high SWR/s will generally indicate poor VM performance when VM needs those swapped memory pages
SWW/s	Rate at which memory is being swapped out to disk	A high SWW/s often indicates memory resource contention, either out of RAM or deliberate resource constraint

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Describe and Differentiate Critical Storage Performance Metrics

CMDS/s	Commands issued per second
READS/s	Read commands issued per second
WRITES/s	Write commands issued per second
MBREAD/s	Megabytes read per second
MBWRTN/s	Megabytes written per second

Describe and Differentiate Critical Storage Performance Metrics

DAVG/cmd	Average response time between host HBA and storage device for a storage command	A high DAVG can indicate insufficient hardware in the connected storage array
KAVG/cmd	Average response time in the VMkernel for a storage command	KAVG > 0 can mean I/O is waiting in a device or adapter queue
GAVG/cmd	Average response time as perceived by the guest for a storage command	$GAVG = DAVG + KAVG$
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Describe and Differentiate Critical Storage Performance Metrics

DQLEN	Device queue depth	Configured value
ACTV	Active commands	Measurement of storage activity
QUED	Queued commands	A high QUED can indicate that storage is overloaded or queue depth should be increased
%USD	Percentage used	$\%USD = ACTV / QLEN * 100\%$
LOAD	Ratio of the sum of active/queued commands to queue depth	Provides the total number of outstanding commands issued

Describe and Differentiate Critical Network Performance Metrics

PKTTX/s	Number of packets transmitted per second
MbTX/s	Megabits transferred per second

Describe and Differentiate Critical Network Performance Metrics

%DRPTX	Percentage of transmit packets dropped	A high %DRPTX can indicate the need for higher-speed NICs, more NICs, or a different NIC teaming policy
%DRPRX	Percentage of receive packets dropped	A high %DRPRX can indicate insufficient CPU resources for the impacted VM

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