

# **VMware Certified Advanced Professional**

## **Datacenter Administration Exam Study Guide**

VDCA410 Exam

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## About this Guide

This is a collection of my notes and studying for the VCAP-DCA. This guide is a compilation of my comments and many other VMware and independent resources related to topics on the exam. Some topics I will put much detail into and some I will simply have a few links.

This guide is provided to aid in studying for and passing the VCAP-DCA. This is likely one of the last revisions of this document I will make. Once I take the exam I will cease to add to this guide and will pass this along to anyone interested in continuing updating it.

You can also find all of my current study notes online at <http://www.vfail.net/vcap-dca/>

I will be updating both sources; however I felt it easier to continue studying for the VCAP-DCA exam with all of my notes in a single document as a point of reference.

# VDCA410 Section 1 – Implement and Manage Storage

## Objective 1.1 – Implement and Manage Complex Storage Solutions

### Knowledge

- Identify RAID levels
- Identify supported HBA types
- Identify virtual disk format types

### Skills and Abilities

- Determine use cases for and configure VMware DirectPath I/O
- Determine requirements for and configure NPIV
- Determine appropriate RAID level for various Virtual Machine workloads
- Apply VMware storage best practices
- Understand use cases for Raw Device Mapping
- Configure vCenter Server storage filters
- Understand and apply VMFS resignaturing
- Understand and apply LUN masking using PSA-related commands
- Analyze I/O workloads to determine storage performance requirements

### Tools

- Fibre Channel SAN Configuration Guide
- iSCSI SAN Configuration Guide
- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vscsiStats
- vSphere CLI
- vicfg-\*
- vifs
- vmkfstools
- esxtop/resxtop

## Notes

### Determine use cases for and configure VMware DirectPath I/O

VMware DirectPath I/O allows a guest VM to directly access an I/O device via bypassing the virtualization layer. This can result in improved performance and a good use case would be 10 Gigabit Ethernet for guests requiring a lot of network throughput.

Requirements from [VMware's Direct Path I/O documentation](#).

- *VMDirectPath supports a direct device connection for virtual machines running on Intel Xeon 5500 systems, which feature an implementation of the I/O memory management unit (IOMMU) called Virtual Technology for Directed I/O (VT-d). VMDirectPath can work on AMD platforms with I/O Virtualization Technology (AMDIO MMU), but this configuration is offered as experimental support.*
- Some machines might not have this technology enabled in the BIOS by default
- Each guest can support up to two pass through devices.
- A good guide to setup DirectPath I/O can be found at [Petri It Knowledgebase](#)

### Determine requirements for and configure NPIV

So far the best resource I've found for how to configure NPIV is [Simon Long's blog](#) which also reference's a great article from [Jason Boche's blog](#).

There are some specific requirements to using NPIV

- It can only be used with Raw Device Mappings.
- You must have NPIV aware FC switches
- ESX(i) hosts must have HBA's that support NPIV. This is currently limited to QLogic and Emulex with NPIV compatible firmware. I suspect this may have been expanded since some of the information I've read may be a little older.

### Determine appropriate RAID level for various Virtual Machine workloads

Similar to sizing physical servers, you will want to ensure your virtual machine workloads are evenly distributed (remember SCSI reservations) and on appropriately given storage for performance purposes. The determination of the RAID level of the storage will be made on a per virtual machine basis. I recommend reading the below to start thinking about how to best go about sizing virtual machine workloads.

Duncan Epping [has a discussion over on his blog](#) which highlights the write penalty and overall performance of different Raid levels, showing the differences in writes. For the test reads were consistent across the board, but writes suffered differently. Check out [this chart](#) which shows a real life example.

### Apply VMware storage best practices

Read these two to help gain a better understanding of best practices for storage.

- <http://www.vmware.com/technical-resources/virtual-storage/best-practices.html>
- [http://www.vmware.com/pdf/Perf\\_Best\\_Practices\\_vSphere4.0.pdf](http://www.vmware.com/pdf/Perf_Best_Practices_vSphere4.0.pdf)
- By default, Active/Passive storage arrays use Most Recently Used path policy.
- Do not use Fixed path policy for Active/Passive storage arrays to avoid LUN thrashing.

### Understand use cases for Raw Device Mapping

Raw device mappings allows management and access of raw SCSI disks or Luns as VMFS files. An RDM file exists on a VMFS volume acting as a proxy for the device, which contains metadata used for managing and redirecting access to the physical disk.

A good read is [the blog here](#) which discusses why RDM's should probably not be used for performance purposes. It's main source of information comes from VMware's write-up for [Performance Characterization of VMFS and RDM Using a SAN](#).

According to VMware:

- The main conclusions that can be drawn from the tests described in this study are:  
For random reads and writes, VMFS and RDM yield a similar number of I/O operations per second.
- For sequential reads and writes, performance of VMFS is very close to that of RDM (except on sequential reads with an I/O block size of 4K). Both RDM and VMFS yield a very high throughput in excess of 300megabytes per second depending on the I/O block size.
- For random reads and writes, VMFS requires 5 percent more CPU cycles per I/O operation compared to RDM.
- For sequential reads and writes, VMFS requires about 8 percent more CPU cycles per I/O operation compared to RDM.

You can configure RDM in two ways:

- Virtual compatibility mode—This mode fully virtualizes the mapped device, which appears to the guest operating system as a virtual disk file on a VMFS volume. Virtual mode provides such benefits of VMFS as advanced file locking for data protection and use of snapshots.
- Physical compatibility mode—This mode provides access to most hardware characteristics of the mapped device. VMkernel passes all SCSI commands to the device, with one exception, thereby exposing all the physical characteristics of the underlying hardware.

VMFS is the preferred option for most enterprise applications such as databases, ERP, CRM, VMware Consolidated Backup, Web servers, and file servers. Some of the common uses of RDM are in cluster data and quorum disks for configurations using clustering between virtual machines or between physical and virtual machines or for running SAN snapshot or other layered applications in a virtual machine.

When using RDM's you are limited in some of the actions you can perform:

- No migrating VMs with physical mode RDMs if the migration involves copying the disk (Storage VMotion)
- No VMotion with physical mode RDMs
- No VMware snapshots with physical mode RDMs
- No VCB support with physical mode RDMs, because VCB requires VMware snapshots
- No cloning VMs that use physical mode RDMs
- No converting VMs that use physical mode RDMs into templates

### Configure vCenter Server storage filters

A couple of good blogs can be found [here](#) and [here](#) for some background on the topic.

To turn off vCenter Server Storage Filters (from the [ESX configuration guide](#)):

When you perform VMFS datastore management operations, vCenter Server uses default storage filters. The filters help you to avoid storage corruption by retrieving only the storage devices, or LUNs, that can be used for a particular operation. Unsuitable LUNs are not displayed for selection. You can turn off the filters to view all LUNs. Before making any changes to the LUN filters, consult with the VMware support team. You can turn off the filters only if you have other methods to prevent LUN corruption.

#### Procedure

1 In the vSphere Client, select Administration > vCenter Server Settings.

2 In the settings list, select Advanced Settings.

3 In the Key text box, type a key.

config.vpxd.filter.vmfsFilter

config.vpxd.filter.rdmFilter

config.vpxd.filter.SameHostAndTransportsFilter

config.vpxd.filter.hostRescanFilter

NOTE If you turn off the Host Rescan Filter, your hosts continue to perform a rescan each time you present a new LUN to a host or a cluster.

4 In the Value text box, type False for the specified key.

5 Click Add.

6 Click OK.

You are not required to restart the vCenter Server system.

### Understand and apply VMFS resignaturing

Check out [this KB article from VMware](#) that will explain further VMFS resignaturing and how to do it from the GUI or command line. Prior to vSphere 4 enabling resignaturing was done server wide and applied to all volumes of the host. Now, with the use of the esxcfg-volume/vicfg-volume commands this can be done per volume.

The vicfg-volume command supports resignaturing a snapshot volume and mounting and unmounting the volume. You can also make the mounted volume persistent across reboots and query a list of snapshot volumes and original volumes. Remember, this command is for volumes with snapshots only and as such will only list those volumes.

See the [Appendix](#) for full syntax and usage of the [vicfg-volume](#) command.



**Understand and apply LUN masking using PSA-related commands**

Check out [Masking a LUN from ESX and ESXi 4.0 using the MASK PATH plug-in](#)

Refer to my previous [study topic on troubleshooting storage performance](#)

See the [Appendix](#) for full syntax and usage of the [vicfg-mpath](#) and [esxcli](#) commands.

**Analyze I/O workloads to determine storage performance requirements**

Refer to my previous [study topic on troubleshooting storage performance](#) and checkout this [great technical paper](#) that goes in depth on the topic.

## Objective 1.2 – Manage Storage Capacity in a vSphere Environment

### Knowledge

- Identify storage provisioning methods
- Identify available storage monitoring tools, metrics and alarms

### Skills and Abilities

- Apply space utilization data to manage storage resources
- Provision and manage storage resources according to Virtual Machine requirements
- Understand interactions between virtual storage provisioning and physical storage provisioning
- Apply VMware storage best practices
- Configure datastore alarms
- Analyze datastore alarms and errors to determine space availability

### Tools

- vSphere Datacenter Administration Guide
- Fibre Channel SAN Configuration Guide
- iSCSI SAN Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vmkfstools

## Notes

This section in a lot of ways was partially delved into from Objective 1.1 and [Objective 6.4](#). Additionally this topic delves into alarms and events pertaining to storage.

### **Apply space utilization data to manage storage resources**

In general you never want to have less than 20% space free. Other than that studying should be focused around on how to check these statistics out.

### **Provision and manage storage resources according to Virtual Machine requirements**

- I think a lot of this was already covered in the previous section. I will add the [following link for and in depth look at Windows counters](#) that will assist in determining virtual machine requirements.
- Additionally [this blog from simple-talk.com](#) contains a good overview of best practices when it comes to provisioning virtual machine storage.

### **Understand interactions between virtual storage provisioning and physical storage provisioning**

A couple of things to realize with this one. When you thin provision virtual machines you must account for the possibility of these virtual machines growing. It is often common nowadays to overprovision storage with thin provisioning and the risk is there that you could run out of physical storage as result. This is a very good use case for alarms in vCenter.

Additionally the physical storage provisioned will affect the performance of the guest. Read [the other topics on storage](#) already covered to understand the different raid levels and how they can affect performance.

### **Apply VMware storage best practices**

#### **Configure datastore alarms**

vSphere has added a lot of alarms with its recent release. A blog from [Jeremy Waldrop](#) does a good job of focusing specifically on datastore alarms.

### **Analyze datastore alarms and errors to determine space availability**

I'd recommend roaming the VMware community for this one.

<http://communities.vmware.com/thread/257031>

## Objective 1.3 – Configure and Manage Complex Multipathing and PSA Plug-ins

### Knowledge

- Explain the Pluggable Storage Architecture (PSA) layout

### Skills and Abilities

- Install and Configure PSA plug-ins
- Understand different multipathing policy functionalities
- Perform command line configuration of multipathing options
- Change a multipath policy
- Configure Software iSCSI port binding

### Tools

- vSphere Command-Line Interface Installation and Scripting Guide
- ESX Configuration Guide
- ESXi Configuration Guide
- Fibre Channel SAN Configuration Guide
- iSCSI SAN Configuration Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- esxcli

## Notes

### Explain the Pluggable Storage Architecture (PSA) layout

#### [What is Pluggable Storage Architecture \(PSA\) and Native Multipathing\(NMP\)?](#)

#### [Understanding VMware vSphere 4.1 PSA](#)

Know the acronyms and understand the PSA. From [Duncan Epping's blog](#) the acronyms below and a lot more in depth information on each.

- PSA = Pluggable Storage Architecture
- NMP = Native Multipathing
- MPP = Multipathing Plugin (associates physical path with logical device)
- PSP = Path Selection Plugin (load-balancing)
- SATP = Storage Array Type Plugin (for failover) i.e. powerpath
- NMP “associates” a SATP with the set of paths from a given type of array.
- NMP “associates” a PSP with a logical device.
- NMP specifies a default PSP for every logical device based on the SATP associated with the physical paths for that device.
- NMP allows the default PSP for a device to be overridden.

### Install and Configure PSA plug-ins

### Understand different multipathing policy functionalities

Check out [vStorage Multi Paths Options in vSphere](#)

- Fixed will use the designate preferred path if configured and otherwise will use the first path discovered that works at system boot. A path is randomly selected when a failure occurs and the original path is selected when it comes back.
- Most recently uses the first working path at system boot. If this is unavailable, an alternative path is switched to and is used until the new path fails.
- Round Robin uses an automatic path selection that rotates and uses all available paths. It includes the ability to load balance across paths using active paths and is of most use on active/active array. In Active/passive arrays it will load between ports to the same storage processor. Not supported in MSCS environments.
- Fixed with array preference extends to fixed functionality to active/passive and ALUA mode arrays. VMW\_PSP\_FIXED\_AP will select the preferred path according to array path preference and current path state.

### Perform command line configuration of multipathing options

See the [Appendix](#) for full syntax and usage of the [vicfg-mpath](#) command.

### Change a multipath policy

See the [Appendix](#) for full syntax and usage of the [vicfg-mpath](#) and [esxcli](#) commands.

Reminder, you must add `--server <servername>` as a connection option, otherwise the `esxcli` command will assume localhost, which will not work when running inside the vMA.

You use the `esxcli` command to set path policy like below, where `VMW_PSP_XXX` will either be `Fixed`, `Fixed_AP`, `MRU`, or `RR`

- `esxcli <connection options> nmp device setpolicy --device naa.xxx --psp VMW_PSP_XXX`

For more usage of this command check out [Objective 6.4](#)

### Configure Software iSCSI port binding (also referred to as multipathing)

See the [Appendix](#) for full syntax and usage of the [esxcli](#) command.

List available uplinks for use with iSCSI adapters

- `esxcli swiscsi vmnic list -d <vmhba>`

Connect iSCSI initiator to the VMkernel ports

- `esxcli swiscsi nic add -n <port_name> -d <vmhba>`

To disconnect iSCSI initiator from VMkernel ports

- `esxcli swiscsi nic remove -n <port_name> -d <vmhba>`

To list all sw iSCSI sessions at the adapter level or target level

- `esxcli swiscsi session list -d <iscsi_adapter>`
- `esxcli swiscsi session list -d vmhba36`

Remove iSCSI sw sessions

- `esxcli swiscsi session remove -d`

## Section 2 – Implement and Manage Networking

### Objective 2.1 – Implement and Manage Complex Virtual Networks

#### Knowledge

- Identify common virtual switch configurations

#### Skills and Abilities

- Determine use cases for and apply IPv6
- Configure NetQueue
- Configure SNMP
- Determine use cases for and apply VMware DirectPath I/O
- Migrate a vSS network to a Hybrid or Full vDS solution
- Configure vSS and vDS settings using command line tools
- Analyze command line output to identify vSS and vDS configuration details

#### Tools

- [vSphere Command-Line Interface Installation and Scripting Guide](#)
- vNetwork Distributed Switch: Migration and Configuration
- ESX Configuration Guide
- ESXi Configuration Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-\*

## Notes

### Determine use cases for and apply IPv6



To enable IPv6 using a command line:

1. To enable IPv6 for the VMkernel, run the command:  
`vicfg/esxcfg-vmknics -6 true`
2. To enable IPv6 for the Service Console, run the command:  
`esxcfg-vswif -6 true`
3. To verify that IPv6 has been enabled, run the command:  
`vmkload_mod --list`

Note the below:

- ESX 3.5 supports virtual machines configured for IPv6.
- ESX 4.0 supports IPv6 with the following restrictions:
  - IPv6 Storage (software iSCSI and NFS) is experimental in ESX 4.0.
  - ESX does not support TCP Segmentation Offload (TSO) with IPv6.
  - VMware High Availability and Fault Tolerance do not support IPv6.

### Configure NetQueue

NetQueue is disabled by default and can be configured from the gui or the command line

Enable NetQueue in VMkernel using VMware Infrastructure (VI) Client.

1. Choose **Configuration > Advanced Settings > VMkernel**.
2. Select the checkbox for **VMkernel.Boot.netNetqueueEnabled**.

At the command line you can also add a line to `/etc/vmware/esx.conf`

```
/vmkernel/NetQueueEnabled=True
```

After you enable NetQueue by either of the above methods you must enable NetQueue on the adapter module itself using the `vicfg-module` command.

Configure a supported NIC to use NetQueue:

```
vicfg-module <conn_options> -s "intr_type=2 rx_ring_num=8" s2io
```



Verify that NetQueue has been configured:

```
vicfg-module <conn_options> -g s2io
```

List the set of modules on the host:

```
vicfg-module <conn_options> -l
```

Changes require a reboot to take effect.

## **Configure SNMP**

For ESX(i)

### **1 Configure SNMP Communities**

```
vicfg-snmp.pl --server <hostname> --username <username> --password <password> -c <community1>
```

Each time you specify a community with this command, the settings you specify overwrite the previous configuration. To specify multiple communities, separate the community names with a comma.

### **2 Configure SNMP Agent to Send Traps**

```
vicfg-snmp.pl --server <hostname> --username <username> --password <password> -t target  
address>@<port>/<community>.
```

You can then enable the SNMP agent by typing

```
vicfg-snmp.pl --server <hostname> --username <username> --password <password> --enable.
```

And then send a test by typing

```
vicfg-snmp.pl --server <hostname> --username <username> --password <password> --test.
```

### **3 Configure SNMP Agent for Polling**

```
vicfg-snmp.pl --server <hostname> --username <username> --password <password> -p <port>
```

For vCenter server

#### **1 Select Administration—>vCenter Server Settings**

2 If the vCenter Server is part of a connected group, in Current vCenter Server, select the appropriate server.

3 Click SNMP in the navigation list.

4 Enter primary Receiver info, note if the port value is empty vCenter Server uses the default of 162.

5 Optionally enable additional receivers.

6 Click OK.

### Determine use cases for and apply VMware DirectPath I/O

- VMware DirectPath I/O allows a guest vm to directly access an I/O device via bypassing the virtualization layer. This can result in improved performance and a good use case would be 10 Gigabit Ethernet for guests requiring a lot of network throughput. Each guest can support up to two pass through devices.
- Requirements from [VMware's Direct Path I/O documentation](#).
- *VMDirectPath supports a direct device connection for virtual machines running on Intel Xeon 5500 systems, which feature an implementation of the I/O memory management unit (IOMMU) called Virtual Technology for Directed I/O (VT-d). VMDirectPath can work on AMD platforms with I/O Virtualization Technology (AMDIOVMU), but this configuration is offered as experimental support.*
- Some machines might not have this technology enabled in the BIOS by default
- A good guide to setup DirectPath I/O can be found at [Petri It Knowledgebase](#)

### Migrate a vSS network to a Hybrid or Full vDS solution

[This document](#) from VMware covers this topic in its entirety. Read it to gain a better understanding of vDS and reasoning on why a Hybrid solution may or may not work. This is a good excerpt from the document below:

*In a hybrid environment featuring a mixture of vNetwork Standard Switches and vNetwork Distributed Switches, VM networking should be migrated to vDS in order to take advantage of Network VMotion. As Service Consoles and VMkernel ports do not migrate from host to host, these can remain on a vSS. However, if you wish to use some of the advanced capabilities of the vDS for these ports, such as Private VLANs or bi-directional traffic shaping, or, team with the same NICs as the VMs (for example, in a two port 10GbE environment), then you will need to migrate all ports to the vDS.*

### Configure vSS and vDS settings using command line tools

<http://blog.scottlowe.org/2009/05/21/vmware-vsphere-vds-vmkernel-ports-and-jumbo-frames/>

### Analyze command line output to identify vSS and vDS configuration details

vicfg-vswitch -l (to get DVSwitch, DVPort, and vmnic names)

esxcfg-vswif -l (get vswif IP address, netmask, dvPort id, etc. ESX Only)

## Objective 2.2 – Configure and Maintain VLANs, PVLANS and VLAN Settings

### Knowledge

- Identify types of VLANs and PVLANS

### Skills and Abilities

- Determine use cases for and configure VLAN Trunking
- Determine use cases for and configure PVLANS
- Use command line tools to troubleshoot and identify VLAN configurations

### Tools

- vSphere Command-Line Interface Installation and Scripting Guide
- ESX Configuration Guide
- ESXi Configuration Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-\*

## Notes

### Determine use cases for and configure VLAN Trunking

Several good blog articles that describe configuring VLAN Trunking on both the VMware and switch side can be found below.

- [http://searchnetworking.techtarget.com/tip/0,289483,sid7\\_gci1515418,00.html](http://searchnetworking.techtarget.com/tip/0,289483,sid7_gci1515418,00.html)
- [http://searchnetworking.techtarget.com/tip/0,289483,sid7\\_gci1515654,00.html](http://searchnetworking.techtarget.com/tip/0,289483,sid7_gci1515654,00.html)
- <http://blog.scottlowe.org/2010/04/23/configuring-inter-vlan-routing/>
- <http://blog.scottlowe.org/2008/09/05/vmware-esx-nic-teaming-and-vlan-trunking-with-hp-procurve/>

### Determine use cases for and configure PVLANS

I'd recommend checking out [Eric Sloof's video training session](#) on PVLANS.

- A private VLAN is an extension of the VLAN standard.
- It allows further segmentation to create private groups.
- This means hosts in the same PVLAN cannot be seen by others, with the exception of those in the promiscuous PVLAN.

VMware has a good [knowledge base article on configuring PVLANS](#) on vNetwork Distributed Switches. The below from that article shows how to create a PVLAN table and set the PVLAN in the dvPortGroup.

To create the PVLAN table in the dvSwitch:

1. In vCenter, go to **Home > Inventory > Networking**.
2. Click **Edit Setting** for the dvSwitch.
3. Choose the Private VLAN tab.
4. On the Primary tab, add the VLAN that is used outside the PVLAN domain. Enter a private VLAN ID and/or choose one from the list.
5. On the Secondary tab, create the PVLANS of the desired type. Enter a VLAN ID in the VLAN ID field.
6. Select the Type for the Secondary VLANID. Choose one of the options from the dropdown menu.
  - Isolated
  - Community

**Note:** There can be only one Promiscuous PVLAN and is created automatically for you.

**Beware:** Before deleting any primary/secondary PVLANS, make sure that they are not in use or the operation is not be performed.

Click **OK**.

To set PVLAN in the dvPortGroup:

1. Highlight dvPortGroup and click **Edit Settings**.
2. Click **General > VLAN > Policies**.
3. Using the dropdown, set the VLAN type to **Private**.
4. Select VLAN from the Private VLAN Entry dropdown.

**Note:** The VLANs created in step 1 are listed here.

### Use command line tools to troubleshoot and identify VLAN configurations

Reference the [vSphere Command Line reference](#).

Show VLAN of port groups `vicfg-vswitch -l`

## Objective 2.3 – Deploy and Maintain Scalable Virtual Networking

### Knowledge

- Identify VMware NIC Teaming policies
- Identify common network protocols

### Skills and Abilities

- Understand the NIC Teaming failover types and related physical network settings
- Determine and apply Failover settings
- Configure explicit failover to conform with VMware best practices
- Configure port groups to properly isolate network traffic

### Tools

- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-\*

## Notes

### Understand the NIC Teaming failover types and related physical network settings

A great blog below goes over this in detail.

<http://vteardown.com/2009/08/07/vsphere-over-hyper-v-built-in-nic-teaming-support-for-any-nic-with-easy-set-up-directly-from-vsphere-client/>

### Determine and apply Failover settings

Configurable from the NIC teaming tab of the vSwitch

From the [ESX\(i\) server configuration guides](#)

#### Load Balancing Settings

- Route based on the originating port ID — Choose an uplink based on the virtual port where the traffic entered the virtual switch.
- Route based on ip hash — Choose an uplink based on a hash of the source and destination IP addresses of each packet. For non-IP packets, whatever is at those offsets is used to compute the hash.
- Route based on source MAC hash — Choose an uplink based on a hash of the source Ethernet.
- Use explicit failover order — Always use the highest order uplink from the list of Active adapters which passes failover detection criteria. This is a best practice but is not the default.
- NOTE IP-based teaming requires that the physical switch be configured with EtherChannel. For all other options, EtherChannel should be disabled.

#### Network Failover Detection

- Link Status only – Relies solely on the link status that the network adapter provides. This option detects failures, such as cable pulls and physical switch power failures, but not configuration errors, such as a physical switch port being blocked by spanning tree or that is misconfigured to the wrong VLAN or cable pulls on the other side of a physical switch.
- Beacon Probing – Sends out and listens for beacon probes on all NICs in the team and uses this information, in addition to link status, to determine link failure. This detects many of the failures previously mentioned that are not detected by link status alone.

#### Notify Switches

- Select Yes or No to notify switches in the case of failover.  
If you select Yes, whenever a virtual NIC is connected to the vSwitch or whenever that virtual NIC's traffic would be routed over a different physical NIC in the team because of a failover event, a notification is sent out over the network to update the lookup tables on physical switches. In almost all cases, this process is desirable for the lowest latency of failover occurrences and migrations with VMotion.

- **NOTE** Do not use this option when the virtual machines using the port group are using Microsoft Network Load Balancing in unicast mode. No such issue exists with NLB running in multicast mode.

#### Failback

- Select Yes or No to disable or enable failback.
- This option determines how a physical adapter is returned to active duty after recovering from a failure. If failback is set to Yes (default), the adapter is returned to active duty immediately upon recovery, displacing the standby adapter that took over its slot, if any. If failback is set to No, a failed adapter is left inactive even after recovery until another currently active adapter fails, requiring its replacement.

#### Failover Order

Specify how to distribute the work load for uplinks. If you want to use some uplinks but reserve others for emergencies in case the uplinks in use fail, set this condition by moving them into different groups:

- **Active Uplinks** — Continue to use the uplink when the network adapter connectivity is up and active.
- **Standby Uplinks** — Use this uplink if one of the active adapter's connectivity is down.
- **Unused Uplinks** — Do not use this uplink.

#### **Configure explicit failover to conform with VMware best practices**

Recognizing this is a best practice is probably all that needs to be stated here. To configure explicit failover, just go to the NIC teaming tab of the vSwitch properties to configure this. Set Load balancing to 'Use explicit failover order' and configure the appropriate order for NIC's in your environment.

#### **Configure port groups to properly isolate network traffic**

Not much to this section, use VLAN tagging and port groups to isolate network traffic on the same vSwitch.

## Objective 2.4 – Administer vNetwork Distributed Switch Settings

### Knowledge

- Explain relationship between vDS and logical vSses

### Skills and Abilities

- Understand the use of command line tools to configure appropriate vDS settings on an ESX/ESXi host
- Determine use cases for and apply Port Binding settings
- Configure Live Port Moving
- Given a set of network requirements, identify the appropriate distributed switch technology to use
- Use command line tools to troubleshoot and identify configuration items from an existing vDS

### Tools

- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-\*



## Notes

### Understand the use of command line tools to configure appropriate vDS settings on an ESX/ESXi host

Explore and be familiar with the usage of the vicfg-vswitch command.

From the [vSphere Command Line Reference](#), the three options below are specific to the distributed virtual switch.

Add an uplink adapter to a distributed virtual port

```
-add-dvp-uplink | -P
```

Deletes an uplink adapter from a port on the distributed virtual switch.

```
-del-dvp-uplink | -Q <adapter_name> -dvp <DVPort_id><dvswitchname>
```

Name of a distributed virtual port

```
-dvp | -V
```

### Determine use cases for and apply Port Binding settings

Three different types of port binding exist. A good read on the topic is a [VMware KB here](#)

#### Static Binding

- When you connect a VM to a dvPort group a port is reserved and is immediately assigned.
- This port is freed up only when the VM is removed from the dvPort group.
- No command line option and can only be done through vCenter.
- This is the default setting and is recommended for general use.

#### Dynamic Binding

- dvPort is assigned to a VM only when the VM is powered on and the NIC is connected.
- The dvPort is freed up when the VM is powered off or the NIC is disconnected.
- VMs connected to a dvPort group configured with dynamic binding MUST be powered on and off through vCenter.
- A use case for this would be an environment where you have more VMs than available ports.

#### Ephemeral binding

- dvPort is created and assigned to the VM when the VM is powered on and NIC is connected.
- dvPort is deleted when the VM is powered off or VM NIC is disconnected.
- Ephemeral dvPort assignments can be made through ESX(i) or vCenter.
- This is the only method that will allow you to manage ports when vCenter is down, although network traffic will be unaffected using the other binding methods when vCenter is down.
- Best use case is for emergency and recovery situations

**Configure Live Port Moving**

Live port migration means a standalone dvPort can be moved to a dvPortGroup and thus acquiring the all the configuration of the dvPortGroup and a dvPort which is a part of a dvPortGroup can be moved out from a dvPortGroup, the subsequent config changes to the dvPortGroup does not apply to this dvPort.

**Given a set of network requirements, identify the appropriate distributed switch technology to use**

Learn the differences between using the Nexus 1KV vs. VMware's distributed virtual switch.

There is certainly a price difference and then there is also a management difference. The 1KV is administered like a standard switch, so the Cisco guys in the organization can manage the virtual switching environment consistently with the physical switching environment.

This [article here](#) is a good read on the discussion of what option to approach and why.

**Use command line tools to troubleshoot and identify configuration items from an existing vDS**

I've covered this topic I believe in other sections of Objective 2 and the network troubleshooting section in Objective 6.

## Section 3 – Deploy DRS Clusters and Manage Performance

### Objective 3.1 – Tune and Optimize vSphere Performance

#### Knowledge

- Identify appropriate BIOS and firmware setting requirements for optimal ESX/ESXi Host performance
- Identify appropriate ESX driver revisions required for optimal ESX/ESXi Host performance
- Recall where to locate information resources to verify compliance with VMware and third party vendor best practices

#### Skills and Abilities

- Tune ESX/ESXi Host and Virtual Machine memory configurations
- Tune ESX/ESXi Host and Virtual Machine networking configurations
- Tune ESX/ESXi Host and Virtual Machine CPU configurations
- Tune ESX/ESXi Host and Virtual Machine storage configurations
- Configure and apply advanced ESX/ESXi Host attributes
- Configure and apply advanced Virtual Machine attributes
- Tune and optimize NUMA controls

#### Tools

- vSphere Resource Management Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Performance Troubleshooting for VMware vSphere 4
- Product Documentation
- vSphere Client
- Performance Graphs
- vSphere CLI
- vicfg-\*
- resxtp/esxtp
- vscsiStats

## Notes

### Identify appropriate BIOS and firmware setting requirements for optimal ESX/ESXi Host performance

Some of this will vary system to system so this is going to be one where you play around a bit and get outside of your comfort zone and using the type of system you usually do.

#### Hyperthreading

- ESX(i) will use hyperthreading by default, but it may need to be enabled in the bios.
- Cannot enable hyperthreading on a system with greater than 32 physical cores because of the logical limit of 64 CPUs
- <http://www.dabcc.com/article.aspx?id=9482>

#### Enable Power Management

- Enable power management or Demand-Based Switching (DBS) in the bios.
- You can then configure the CPU power management policy in the advanced host attribute, Power.CpuPolicy
- You will set this to either static (default) or dynamic. In dynamic the VMkernel optimizes each CPU's frequency to match demand. When CPU demands increase the policy ensures that CPU frequencies also increase.
- With static the VMkernel can detect power management feature available on the host but doesn't actively use them unless requested to do so by the BIOS.

### Identify appropriate ESX driver revisions required for optimal ESX/ESXi Host performance

- Same as the above, this will vary implementation to implementation. Be aware of the memory requirements for drivers.
- Some drivers need 40MB, which almost doubles base system memory.
- An ESXi host uses additional system memory for management agents that run in the service console of an ESX host.

### Recall where to locate information resources to verify compliance with VMware and third party vendor best practices

<http://www.vmware.com/resources/compatibility/search.php?ie=UTF-8&q=vmware%20hcl>

#### **Tune ESX/ESXi Host and Virtual Machine memory configurations**

For these tuning sections I am going to recommend referring to the troubleshooting sections I've previously covered as well as the links at the bottom of these notes.

<http://www.vfail.net/?p=191>

#### **Tune ESX/ESXi Host and Virtual Machine networking configurations**

For these tuning sections I am going to recommend referring to the troubleshooting sections I've previously covered as well as the links at the bottom of these notes.

<http://www.vfail.net/2010/08/14/vcap-dca-objective-6-3-troubleshoot-network-performance-and-connectivity/>

#### **Tune ESX/ESXi Host and Virtual Machine CPU configurations**

For these tuning sections I am going to recommend referring to the troubleshooting sections I've previously covered as well as the links at the bottom of these notes.

<http://www.vfail.net/?p=191>

#### **Tune ESX/ESXi Host and Virtual Machine storage configurations**

For these tuning sections I am going to recommend referring to the troubleshooting sections I've previously covered as well as the links at the bottom of these notes.

<http://www.vfail.net/2010/08/18/objective-6-4-troubleshoot-storage-performance-and-connectivity/>

### Configure and apply advanced ESX/ESXi Host attributes

From pg 97-99 of the [vSphere Resource Management Guide](#)

The process is easy but you will need to be familiar with a lot of different advanced settings and the pages above contain those settings.

- In the vSphere Client inventory panel, select the host to customize.
- Click the Configuration tab.
- In the Software menu, click Advanced Settings.
- In the Advanced Settings dialog box select the appropriate item (for example, CPU or Memory), and scroll in the right panel to find and change the attribute.

### Configure and apply advanced Virtual Machine attributes

pg 99 of the [vSphere Resource Management Guide](#)

- Select the virtual machine in the vSphere Client inventory panel, &select Edit Settings from right click menu.
- Click Options and click Advanced > General.
- Click the Configuration Parameters button.
- In the dialog box that appears, click Add Row to enter a new parameter and its value.

#### Advanced Virtual Machine Attributes

- sched.mem.maxmemctl Maximum amount of memory reclaimed from the selected virtual machine by ballooning, in megabytes (MB). If the ESX/ESXi host needs to reclaim additional memory, it is forced to swap. Swapping is less desirable than ballooning.
- sched.mem.pshare.enable Enables memory sharing for a selected virtual machine. This boolean value defaults to True. If you set it to False for a virtual machine, this turns off memory sharing.
- sched.swap.persist Specifies whether the virtual machine's swap files should persist or be deleted when the virtual machine is powered off. By default, the system creates the swap file for a virtual machine when the virtual machine is powered on, and deletes the swap file when the virtual machine is powered off.
- sched.swap.dir VMFS directory location of the virtual machine's swap file. Defaults to the virtual machine's working directory, that is, the VMFS directory that contains its configuration file. This directory must remain on a host that is accessible to the virtual machine. If you move the virtual machine (or any clones created from it), you might need to reset this attribute.

### Tune and optimize NUMA controls

Pg 73-77 of the [vSphere Resource Management Guide](#)

- The VMkernel.Boot.sharePerNode option controls whether memory pages can be shared (de-duplicated) only within a single NUMA node or across multiple NUMA nodes.
- VMkernel.Boot.sharePerNode is turned on by default, and identical pages are shared only within the same NUMA node. This improves memory locality, because all accesses to shared pages use local memory.
- In most situations the ESX(i) host's automatic NUMA optimizations will result in good performance, however you may need to tune this.
- You can do this through controlling memory and processor placement via CPU and Memory Affinity.

### Other Relevant Reading Related To This Section

<http://www.virtualinsanity.com/index.php/2010/03/29/performance-troubleshooting-vmware-vsphere-network/>  
<http://www.virtualinsanity.com/index.php/2010/03/16/performance-troubleshooting-vmware-vsphere-storage/>  
<http://www.virtualinsanity.com/index.php/2010/02/19/performance-troubleshooting-vmware-vsphere-memory/>  
<http://www.virtualinsanity.com/index.php/2010/02/15/performance-troubleshooting-vmware-vsphere-cpu/>

## Objective 3.2 – Optimize Virtual Machine Resources

### Knowledge

- Compare and contrast virtual and physical hardware resources
- Identify VMware memory management techniques
- Identify VMware CPU load balancing techniques
- Identify pre-requisites for Hot Add features

### Skills and Abilities

- Calculate available resources
- Properly size a Virtual Machine based on application workload
- Configure large memory pages
- Understand appropriate use cases for CPU affinity

### Tools

- vSphere Resource Management Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Understanding Memory Resource Management in VMware® ESX™ Server 4.1
- VMware vSphere™ : The CPU Scheduler in VMware® ESX™ 4.1
- vSphere Client
- Performance Charts
- vSphere CLI
- resxtop/esxtop

## Notes

Review topic on troubleshooting.

### Identify VMware memory management techniques

[http://www.vmware.com/files/pdf/perf-vsphere-memory\\_management.pdf](http://www.vmware.com/files/pdf/perf-vsphere-memory_management.pdf)

### Identify VMware CPU load balancing techniques

See the [vSphere 4: The CPU Scheduler in VMware ESX4 Whitepaper](#) and PG 73 of the vSphere 4 Resource Management Guide. From the Guide:

#### *NUMA Systems*

*In a NUMA (Non-Uniform Memory Access) system, there are multiple NUMA nodes that consist of a set of processors and the memory.*

*The NUMA load-balancer in ESX assigns a home node to a virtual machine. For the virtual machine, the memory is allocated from the home node. Since the virtual machine rarely migrates away from the home node, the memory access from the virtual machine is mostly local. Note that all vCPUs of the virtual machine are scheduled within the home node.*

*If a virtual machine's home node is more heavily loaded than others, migrating to a less loaded node generally improves performance, although it suffers from remote memory accesses. The memory migration may also happen to increase the memory-locality. Note that the memory is moved gradually because copying memory has high overhead.*

#### *Hyperthreaded Systems*

*Hyperthreading enables concurrently executing instructions from two hardware contexts in one processor. Although it may achieve higher performance from thread-level parallelism, the improvement is limited as the total computational resource is still capped by a single physical processor. Also, the benefit is heavily workload dependent.*

*It is clear that a whole idle processor, that has both hardware threads idle, provides more CPU resource than only one idle hardware thread with a busy sibling thread. Therefore, the ESX CPU scheduler makes sure the former is preferred as the destination of a migration.*

### Identify pre-requisites for Hot Add features

A couple of good blogs by [David Davis](#) and [Jason Boche](#) outline what and how to use Hot-Add/Hot-Plug. The ability to use this without having to reboot the guest virtual machine is extremely limited. ON the Microsoft side Windows 2008 Server Datacenter is necessary to support both features without a reboot while Windows 2008 Server Enterprise edition does not require a reboot for Hot Adding memory. When it comes to removing either hot added memory or hot plugged cpu's a reboot is required for all Windows guest operation systems.

## Properly size a Virtual Machine based on application workload

Most physical machines do not need the 8 cores and 16 GB of memory or so they have assigned to them. When bringing a physical system over take note of what is assigned and properly allocate and plan for what is actually needed.

For memory, make sure you have enough to run the applications needed on the server. Avoid memory swapping, but also avoid allocating more memory than is needed. When this is done the virtual machine's memory overhead is increased, taking away from the resources that other virtual machines could potentially use.

When sizing the number of processors the same concept applies. If the application(s) can't utilize more than 2 CPUs then there really is not much good in giving more than two CPUs.

## Configure large memory pages

From pg 25

[http://www.vmware.com/pdf/Perf\\_Best\\_Practices\\_vSphere4.0.pdf](http://www.vmware.com/pdf/Perf_Best_Practices_vSphere4.0.pdf)

Large Memory Pages for Hypervisor and Guest Operating System

In addition to the usual 4KB memory pages, ESX also makes 2MB memory pages available (commonly referred to as "large pages"). By default ESX assigns these 2MB machine memory pages to guest operating systems that request them, giving the guest operating system the full advantage of using large pages. The use of large pages results in reduced memory management overhead and can therefore increase hypervisor performance.

If an operating system or application can benefit from large pages on a native system, that operating system or application can potentially achieve a similar performance improvement on a virtual machine backed with 2MB machine memory pages. Consult the documentation for your operating system and application to determine how to configure them each to use large memory pages.

More information about large page support can be found in the performance study entitled Large Page Performance (available at <http://www.vmware.com/resources/techresources/1039>).

[http://www.vmware.com/files/pdf/large\\_pg\\_performance.pdf](http://www.vmware.com/files/pdf/large_pg_performance.pdf)

Enabling Large Page Support in Windows Server 2003

To enable large page support in Windows Server 2003, the system administrator must grant appropriate users the privilege to "Lock pages in memory." This privilege is not enabled by default when Windows is installed.

To grant this privilege, take the following steps:

- 1 Choose Start > Control Panel > Administrative Tools > Local Security Policy.
- 2 In the left pane of the Local Security Settings window, expand Local Policies and choose User Rights Assignment.
- 3 In the right pane of the Local Security Settings window, choose Lock pages in memory and choose Action > Properties. The Local Security Setting dialog box opens.
- 4 In the Local Security Setting dialog box, click Add User or Group.
- 5 Enter the appropriate user name, then click OK to close the Select Users or Groups dialog box.

## Understand appropriate use cases for CPU affinity

- CPU intensive app, move away from core 0
- A good example that requires this is Cisco's Unity
- No HA if one of the VMs has CPU affinity set.

A must read on this topic is [this article from Duncan Epping](#)



## Objective 3.3 – Implement and Maintain Complex DRS Solutions

### Knowledge

- Explain DRS affinity and anti-affinity rules
- Identify required hardware components to support DPM
- Identify EVC requirements, baselines and components
- Understand the DRS slot-size algorithm and its impact on migration recommendations

### Skills and Abilities

- Properly configure BIOS and management settings to support DPM
- Test DPM to verify proper configuration
- Configure appropriate DPM Threshold to meet business requirements
- Configure EVC using appropriate baseline
- Change the EVC mode on an existing DRS cluster
- Create DRS and DPM alarms
- Configure applicable power management settings for ESX Hosts
- Properly size virtual machines and clusters for optimal DRS efficiency
- Properly apply virtual machine automation levels based upon application requirements

### Tools

- vSphere Resource Management Guide
- Product Documentation
- vSphere Client
- DRS Resource Distribution Chart

## Notes

### Explain DRS affinity and anti-affinity rules

- Specifies that two or more virtual machines are placed on the same host or on different hosts.
- When a conflict in rules occurs, the older rule takes precedence and the new rule is disabled.
- Disabled rules are then ignored.
- Higher precedence is given to preventing violations of anti-affinity rules then violations of affinity rules.

To check on affinity rule violations

1. Select the cluster in the inventory panel of the vSphere Client
2. Select the DRS tab, and click Faults
3. Any rule currently being violated has a corresponding fault on this page. Read the fault to determine why DRS is not able to satisfy the particular rule.

### Identify required hardware components to support DPM

- Uses IPMI, iLO or WOL
- If one of those three is not supported, DPM can put the host in standby mode.
- If a host supports multiple protocols, the order of precedence is IPMI, iLO, WOL.
- For WOL make sure WOL is supported for physical NICs

### Identify EVC requirements, baselines and components

- Configured at Cluster Level
- Helps to ensure VMotion compatibility for the hosts in a cluster by presenting the same CPU feature set to virtual machines.
- Must use same CPU vendors in cluster
- Verify CPU compatibility  
here [http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=1003212](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1003212)
- Intel VT or AMD-V
- XD (Execute Disable) or NX (No Execute)

### Properly configure BIOS and management settings to support DPM

- See some of the information above. You will want to make sure you properly configure IPMI/iLO as well as WOL if used. WOL will need to be configured and supported for the NIC.

### Test DPM to verify proper configuration

- Manually put a host into standby
- Power off VM resources to let DPM take action based on the configured DPM Threshold

### Configure appropriate DPM Threshold to meet business requirements

pg 63

- Similar to DRS, the DPM power on/off recommendations are assigned priorities ranging from 1 to 5 stars.
- Priority 1 is mandatory while priority five will bring just a slight improvement.
- Configured per cluster under Power Management.
- You can override DPM on a host level, specifying particular hosts you would like to only manually involve or disable involvement entirely.

### Configure EVC using appropriate baseline

This [VMware KB](#) covers this topic in depth. In it you can find what version of vSphere/ESX support what baselines and what CPUs support what baselines.

### Change the EVC mode on an existing DRS cluster

- Cluster Settings—>VMware EVC

### Create DRS and DPM alarms

Check out this spreadsheet for a complete list of DRS alarms.

<http://communities.vmware.com/servlet/JiveServlet/download/12145-1-35516/vSphere%20Alarms%20v2.xlsx;jsessionid=B696F778AA032D9AE6E36FBA38F1D98D>

Specifically related to DPM

Your most common event to monitor for will be a failure to bring a server back online when it is needed again.

Exist Standby Error alarm DrsExitStandbyModeFailedEvent

Additionally these other events exist

Entering Standby mode (about to power off host)	DrsEnteringStandbyModeEvent
Successfully entered Standby mode (host power off succeeded)	DrsEnteredStandbyModeEvent
Exiting Standby mode (about to power on the host)	DrsExitingStandbyModeEvent
Successfully exited Standby mode (power on succeeded)	DrsExitedStandbyModeEvent

### Configure applicable power management settings for ESX Hosts

You can set advanced host attributes to manage power settings.

**Power.CpuPolicy** When you set this attribute to the default value of static, VMkernel does not directly set CPU power management states and only responds to requests from the BIOS. When you enable this policy (set to dynamic), VMkernel dynamically selects appropriate power management states based on current usage. This can save power without degrading performance. Enabling this option on systems that do not support power management results in an error message.

### Properly size virtual machines and clusters for optimal DRS efficiency

Realize how not properly sizing your virtual machines will affect the efficiency of DRS. If you give a system too much memory that is less memory available to other systems. Additionally remember the overhead for the system will be higher with a higher amount of configured memory. Ultimately this can result in a increased slot size.

One big mistake you can make is simply porting systems over with the same specs they had virtually, when they don't need it. If you bring enough 4 core systems over you will see performance issues quickly.

### Properly apply virtual machine automation levels based upon application requirements

- This will override the cluster settings for that virtual machine.
- Under Cluster Settings—> VMware DRS—>Virtual machine Options
- Fully Automated(default)
- Partially Automated
- Manual
- Disabled

## Other Links

<http://frankdenneman.nl/2010/03/drs-resource-distribution-chart/>

<http://www.virtualizationteam.com/uncategorized/vmware-evc-enhanced-vmotion-compatibility-enable-vmware-vmotion-across-cpu-generations.html>

<http://www.yellow-bricks.com/2010/03/09/vm-powered-on-alarm/>

## Objective 3.4 – Perform Capacity Planning in a vSphere Environment

### Knowledge

- Understand the DRS slot-size algorithm and its impact on migration recommendations
- Identify tools needed for monitoring capacity planning
- Identify performance metrics related to resource contention and saturation

### Skills and Abilities

- Predict when additional ESX/ESXi Host, network or storage resources will be required by observing an existing environment
- Determine when to expand or contract provisioned Virtual Machine resources based upon observed Virtual Machine utilization
- Interpret performance metrics from vCenter to properly size the environment

### Tools

- vSphere Resource Management Guide
- Overview Performance Charts Help
- Product Documentation
- vSphere Client

## Notes

### **Predict when additional ESX/ESXi Host, network or storage resources will be required by observing an existing environment**

Properly planning for capacity can help avoid this, but sometimes you just outgrow your environment. vCenter now has many more charts and resources that will give you a visual representation of performance and other metrics. Using these metrics you can see where you are at today and the trends on utilization, targeting the need to increase storage, network, or host requirements for your environment.

### **Determine when to expand or contract provisioned Virtual Machine resources based upon observed Virtual Machine utilization**

After you have provisioned a virtual machine you may find it is not performing as well. The first question to ask is if this virtual machine has lesser resources than its physical counterpart did before. If so you will want to increase the CPU, memory, or storage requirements to get closer towards the original configuration.

Often times though the physical host will be way more powerful than the virtual machine needs to be. Giving a virtual machine more than enough resources will ensure it runs smoothly, but it will also waste expensive resources and prevent or hinder those resources from being utilized by other virtual machines. One big and mid-sized virtual machine with any customization to the slot size settings can heavily affect the slot size of your environment.

Refer to my other sections for VCAP-DCA troubleshooting to go through ESXTOP and other performance monitoring metrics.

### **Interpret performance metrics from vCenter to properly size the environment**

Depending on your experience level it may not be completely straight forward what you are looking for here. Checkout this document from VMware to gain a better understanding of performance charts in vCenter and what you are looking for.

## Other Links

[http://communities.vmware.com/servlet/JiveServlet/downloadBody/12619-102-1-13397/vSphere\\_perf\\_charts.pdf&rct=j&q=vsphere\\_perf\\_charts&ei=4QSATLuUI4S0IQfZ\\_OWYDw&usg=AFQjCNHGq8bdy0yIkrixJ8yQLewFhxDD0w&sig2=3Mks5xAOpVzUMk4RvS6UIg](http://communities.vmware.com/servlet/JiveServlet/downloadBody/12619-102-1-13397/vSphere_perf_charts.pdf&rct=j&q=vsphere_perf_charts&ei=4QSATLuUI4S0IQfZ_OWYDw&usg=AFQjCNHGq8bdy0yIkrixJ8yQLewFhxDD0w&sig2=3Mks5xAOpVzUMk4RvS6UIg)

## Objective 3.5 – Utilize Advanced vSphere Performance Monitoring Tools

### Knowledge

- Identify hot keys and fields used with resxtop/esxtop
- Identify fields used with vscsiStats

### Skills and Abilities

- Configure esxtop/resxtop custom profiles
- Determine use cases for and apply esxtop/resxtop Interactive, Batch and Replay modes
- Use vscsiStats to gather storage performance data
- Use esxtop/resxtop to collect performance data
- Given esxtop/resxtop output, identify relative performance data for capacity planning purposes

### Tools

- vSphere Resource Management Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- esxtop/resxtop
- vscsiStats

## Notes

Reading through the following three links will give you a great insight into using esxtop and vscsiStats.

- <http://communities.vmware.com/docs/DOC-11812.pdf>
- <http://www.yellow-bricks.com/esxtop/>
- <http://www.yellow-bricks.com/2009/12/17/vscsistats/>

### Identify hot keys and fields used with resxtop/esxtop

See appendix section for [esxtop](#)

### Identify fields used with vscsiStats

See appendix [section for vscsiStats](#).

### Configure esxtop/resxtop custom profiles

1. Load esxtop
2. Use hot keys to configure how you would like.
  - 'f' will add and remove fields
  - 'o' will change the order
  - other hot keys will give you settings specific to that view.
3. 'W' will save the settings to a new config file
4. Next time you load esxtop use the '-c' option to specify a configuration file

### Determine use cases for and apply esxtop/resxtop Interactive, Batch and Replay modes

Batch

Batch mode allows collection that will be captured to a file.

Esxtop -b > file.csv

Replay

Esxtop will replay resource utilization stats that were collected using the vm-support command

The capture from the vm-support command would have been generated by the following command

Vm-support -s -d duration -l interval

You would then unzip/untar this for esxtop to use it.

Esxtop -R <path to dir>

### Use vscsiStats to gather storage performance data

<http://communities.vmware.com/docs/DOC-10095>

<http://www.gabesvirtualworld.com/converting-vscsistats-data-into-excel-charts/>

### Given esxtop/resxtop output, identify relative performance data for capacity planning purposes

Again check out the links mentioned above in this section. They are a must read and will be a great guide in helping to identify performance related issues.



## Section 4 – Manage Business Continuity and Protect Data

### Objective 4.1 – Implement and Maintain Complex VMware HA Solutions

#### Knowledge

- Identify the three admission control policies for HA
- Identify heartbeat options and dependencies

#### Skills and Abilities

- Calculate host failure requirements
- Configure customized isolation response settings
- Configure HA redundancy in a mixed ESX/ESXi environment
- Configure HA related alarms and monitor an HA cluster
- Create a custom slot size configuration
- Understand interactions between DRS and HA
- Create an HA solution that ensures primary node distribution across sites
- Analyze vSphere environment to determine appropriate HA admission control policy
- Analyze performance metrics to calculate host failure requirements
- Analyze Virtual Machine workload to determine optimum slot size
- Analyze HA cluster capacity to determine optimum cluster size

#### Tools

- vSphere Availability Guide
- Product Documentation
- vSphere Client

## Notes

### Configure customized isolation response settings

- The isolation response is the action HA will take when the heartbeat network is isolated. The response is either power off, leave powered on (default), or shut down.
- HA will try to restart the affected Virtual Machines and by default will try up to five times. This is configurable with the parameter `das.maxvmrestartcount`
- The default value for isolation failure detection is 15 seconds. This is configurable with the parameter `das.failedetectiontime`
- At this point a restart is initiated by one of the primary hosts. The isolation response is actually initiated 1 second before the failure detection time.

Read the below excerpt from Duncan Epping's blog on why it is important to understand these different parameters and what affect configuring isolation response settings can have on your environment.

*The default value for isolation/failure detection is 15 seconds. In other words the failed or isolated host will be declared dead by the other hosts in the HA cluster on the fifteenth second and a restart will be initiated by one of the primary hosts.*

*For now let's assume the isolation response is "power off". The "power off"(isolation response) will be initiated by the isolated host 1 second before the `das.failedetectiontime`. A "power off" will be initiated on the fourteenth second and a restart will be initiated on the fifteenth second.*

*Does this mean that you can end up with your VMs being down and HA not restarting them?  
Yes, when the heartbeat returns between the 14th and 15th second the "power off" could already have been initiated. The restart however will not be initiated because the heartbeat indicates that the host is not isolated anymore.*

*How can you avoid this?*

*Pick "Leave VM powered on" as an isolation response. Increasing the `das.failedetectiontime` will also decrease the chances of running in to issues like these.*

*Basic design principle: Increase "`das.failedetectiontime`" to 30 seconds (30000) to decrease the likelihood of a false positive.*

*A couple of additional parameters I've found necessary*

*`das.isolationaddressx` Used to configure multiple isolation addresses.*

*`das.usedefaultisolationaddress` Set to true/false and used in the cse where a default gateway is not pingable, in which case this set to false in conjunction with configuring another address for `das.isolationaddress`*

## **Configure HA redundancy in a mixed ESX/ESXi environment**

- Redundant management networks are recommended for HA and there are two options to choose from, Network Redundancy Using NIC Teaming or Network Redundancy Using a Secondary Network.

## **Create a custom slot size configuration**

A slot refers to a logical representation to power on a virtual machine in the cluster, taking into account memory and cpu resources that will satisfy this request.

This is calculated using the highest cpu and memory reservation of any given VM, with a default of 256mhz for cpu and 0MB + memory overhead if no reservations are specified.

Set `das.slotCpuInMHz` or `das.slotMemInMB` to manually lower the slot size in cases where one VM causes a really large slot size.

## **Understand interactions between DRS and HA**

4.1 has brought a lot of changes to this topic and until I know with certainty that 4.1 will not be included any time soon I will shy away from speaking of those changes.

In terms of functionality today, DRS and HA while separate pieces do work together to provide availability and performance. When a host goes down and HA performs a failover and restarts a virtual machine it is looking for to provide availability. It is then DRS's job to balance these machines across the cluster.

## **Create an HA solution that ensures primary node distribution across sites**

The first 5 hosts that join the HA cluster are automatically selected as primary nodes.

You can manually view which nodes are primary with this command

```
cat /var/log/vmware/aam/aam_config_util_listnodes.log
```

Re-election of a primary will only occur when a primary is placed in maintenance mode, disconnected or removed from the cluster, or when a cluster is reconfigured for HA.

If all fail simultaneously, there is no HA initiated restart of VMs that occur.

In order to design an HA solution that ensures a primary is always available, the placement of your hosts is crucial. For each cluster, never put more than four hosts in a place where it could be a single point of failure, for example a chassis of blades. If you have 10 blades and two chassis, look to separate the blades amongst two chassis, and additionally make sure that no more than four blades are from one cluster in each chassis.

Read more about this concept here <http://www.yellow-bricks.com/2009/02/09/blades-and-ha-cluster-design/>

## **Analyze vSphere environment to determine appropriate HA admission control policy**

You have three choices for HA admission control policies

Host failures cluster tolerates

Host with most slots is taken out of the equation, and then the next most if more than one 1 is set.

Your percentage of resources should be equal or larger than your largest host so that all vm's on that host can be restarted.

Tends to be very conservative as largest reservation dictates the slot size.

Percentage of cluster resources reserved as failover spare capacity

Instead of using slot sizes, sets a percentage of resources to be left unused for HA purposes

Tends to be a more realistic view of reservations as it uses actual reservations vs. slot size.

More flexible.

Specify a failover host

Specifies a single host specifically for failover purposes. You may end up with a lot of reserved capacity for failover, but you also will only get a single host for use as a failover server.

### **Analyze Virtual Machine workload to determine optimum slot size**

If you are manually specifying the memory and cpu values for the slot size, make sure the slot size is representative of typical workloads.

### **Analyze HA cluster capacity to determine optimum cluster size**

How many hosts in your cluster?

How many host failures can you tolerate?

What is the resource utilization of your virtual machines?

Other Relevant Articles and Links Related to this Section

[http://searchsystemschannel.techtarget.com/generic/0,295582,sid99\\_gci1515486,00.html](http://searchsystemschannel.techtarget.com/generic/0,295582,sid99_gci1515486,00.html)

<http://www.dailyhypervisor.com/2009/03/31/vmware-ha-cluster-sizing-considerations/>

<http://www.yellow-bricks.com/vmware-high-availability-deepdiv/>

<http://www.b3rg.nl/vcdx/section-4-business-continuity-and-data-protection/objective-4.2-configure-advanced-ha-deployments.html>

<http://geeksilver.wordpress.com/2010/10/04/vcap-dca-section-4-%E2%80%93manage-business-continuity-and-protect-data-objective-4-1/>

## Objective 4.2 – Deploy and Test VMware FT

### Knowledge

- Identify VMware FT hardware requirements
- Identify VMware FT compatibility requirements

### Skills and Abilities

- Modify VM and ESX/ESXi Host settings to allow for FT compatibility
- Use VMware best practices to prepare a vSphere environment for FT
- Configure FT logging
- Prepare the infrastructure for FT compliance
- Test FT failover, secondary restart and application fault tolerance in a FT Virtual Machine

### Tools

- vSphere Availability Guide
- Product Documentation
- vSphere Client

## Notes

This is a fairly quick objective to run through. I recommend giving [Eric Siebert's blog article](#) a good read if you are not familiar with the requirements and concepts behind fault tolerance. Additionally Vladan Seget has [a great blog on troubleshooting FT](#).

### Identify VMware FT hardware requirements

Requires a Fault Tolerance capable processor and both hosts but have the same processor family. While the speeds don't have to match remember that FT relies on close synchronization so the closer they are the better.

### Identify VMware FT compatibility requirements

Same Build number for ESX(i) hosts

Gigabit NIC's

Common Shared Storage

Single Proc machine

Thin Provisioned disks not supported(automatically converted)

No snapshots

### Use VMware best practices to prepare a vSphere environment for FT

Use the [VMware Site Survey utility](#) to check configuration compatibility with advanced features such as Fault Tolerance.

### Configure FT logging

Check the box on the virtual NIC for "Use this virtual adapter for Fault Tolerance logging"

Separate NIC for FT Logging and vMotion recommended.

### Prepare the infrastructure for FT compliance

On the Summary page of each host you will see the status of Fault Tolerance and can view the requirements you will need to take action on there.

### Other relevant blogs and websites related to this section

<http://itknowledgeexchange.techtarget.com/virtualization-pro/masters-guide-to-vmware-fault-tolerance/>

[http://www.vmware.com/files/pdf/resources/ft\\_virtualization\\_wp.pdf](http://www.vmware.com/files/pdf/resources/ft_virtualization_wp.pdf)

<http://www.vladan.fr/troubleshooting-fault-tolerance-in-vsphere/>

## **Objective 4.3 – Configure a vSphere Environment to support MSCS Clustering**

### **Knowledge**

- Identify MSCS clustering solution requirements
- Identify the three supported MSCS configurations

### **Skills and Abilities**

- Configure Virtual Machine hardware to support cluster type and guest OS
- Configure a MSCS cluster on a single ESX/ESXi Host
- Configure a MSCS cluster across ESX/ESXi Hosts
- Configure standby host clustering

### **Tools**

- Setup for Failover Clustering and Microsoft Cluster Service
- Product Documentation
- vSphere Client

## Notes

Your biggest resource for this section will be the [Setup for Failover Clustering and Microsoft Cluster Service document](#) from VMware.

## Knowledge

### Identify MSCS clustering solution requirements

**Table 1-1. Clustering Requirements**

Component	Requirement
Virtual NIC adapter	<ul style="list-style-type: none"> <li>UIX Logic Parallel for Windows 2000 Server</li> <li>UIX Logic Parallel for Windows Server 2003</li> <li>UIX Logic SA7 for Windows Server 2008</li> </ul>
Operating system	Windows Server 2003 SP2, Windows 2008 Server SP2, or Windows Server 2008
Virtual NIC	Use the default type for all guest operating systems
IO timeout	Set to all seconds or less. Modify <code>MSDT_IOCTL_TIMEOUT</code> (parameter <code>CurrentControlSet</code> )
	Set to <code>0x00000000</code> (0 seconds) if you are using a cluster. This must not be the value in that case.
Disk layout	Select <b>Suggested clustering features such as Fault Tolerance</b> in the <code>disk layout configuration</code> wizard.
Disk and networking setup	Add networking before disks. Refer to the VMware knowledge base article at <a href="http://kb.vmware.com/kb/1512">http://kb.vmware.com/kb/1512</a> if you encounter any issues.
Number of nodes	Use two-node clustering.
NTFS permissions	Techniques describe controllers and cluster nodes with a consistent NTFS permissions, and double boot-based type or configuration when using clustering on the guest.

**Table 1-2. Shared Storage Requirements**

Storage Type	Clusters on One Physical Machine (i.e. Node in a Box)	Clusters Across Physical Machines (i.e. Cluster Across Nodes)	Clusters of Physical and Virtual Machines (Shared Host / Clustering)
Virtual disks	Yes (recommended)	No	No
Pass-through RDM (physical compatibility mode)	No	Yes (recommended)	Yes
Raw-pass-through RDM (virtual compatibility mode)	Yes	Yes	No

Note: Clusters across physical machines with raw-pass-through RDM is supported only for clustering with Windows 2000 Server or Windows Server 2003. It is not supported for clustering with Windows Server 2008.

### Identify the three supported MSCS configurations

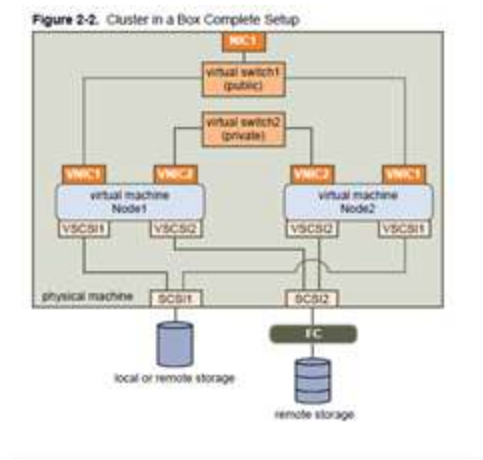
- Clustering virtual machines on a single host
- Storage can be local or on a san.
- Clustering virtual machines across physical hosts
- Clustering physical machines with virtual machines

### Configure Virtual Machine hardware to support cluster type and guest OS

- See requirements above.

### Configure a MSCS cluster on a single ESX/ESXi Host

- Refer to the [Setup for Failover Clustering and Microsoft Cluster Service document](#) for complete guidance on the process. Note that with a cluster on a single box you could use local storage or shared storage.
- A cluster on a single ESX(i) host requires A separate physical network adapter for clustered virtual machines to connect with external hosts.





### Configure a MSCS cluster across ESX/ESXi Hosts

- A cluster across ESX(i) hosts requires

Two physical network adapters dedicated to the MSCS cluster and to the public and private networks.

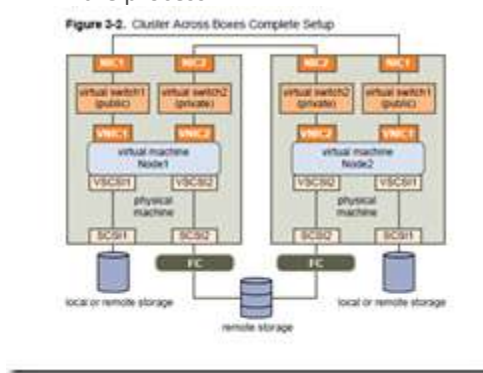
One physical network adapter dedicated to the service console (ESX hosts) or the VMkernel (ESXi hosts).

Fibre Channel (FC) SAN. Shared storage must be on an FC SAN.

RDM in physical compatibility (pass-through) or virtual compatibility (non-pass-through) mode. VMware recommends physical compatibility mode. The cluster cannot use virtual disks for shared storage.

Note-Failover clustering with Windows Server 2008 is not supported with virtual compatibility mode (nonpass-through) RDMs.

- Refer to the [Setup for Failover Clustering and Microsoft Cluster Service document](#) for complete guidance on the process.



### Configure standby host clustering (Cluster physical and virtual machines)

- Standby host clustering requires:

Two physical network adapters dedicated to the MSCS cluster and to the public and private networks.

One physical network adapter dedicated to the service console (ESX hosts) or the VMkernel (ESXi hosts).

Use RDMs in physical compatibility mode (pass-through RDM). You cannot use virtual disks or RDMs in virtual compatibility mode (non-pass-through RDM) for shared storage.

Use the STORport Miniport driver for the Fibre Channel (FC) HBA (QLogic or Emulex) in the physical Windows machine.

Do not run multipathing software in the physical or virtual machines.

Use only a single physical path from the host to the storage arrays in standby host configurations.

- Refer to the [Setup for Failover Clustering and Microsoft Cluster Service document](#) for complete guidance on the process.

### The following limitations also exist to using MSCS clustering(not supported)

- Clustering on iSCSI, FCoE, and NFS disks.
- Mixed environments, such as configurations where one cluster node is running a different version of ESX/ESXi than another cluster node.
- Clustered virtual machines as part of VMware clusters (DRS or HA).
- Use of MSCS in conjunction with VMware Fault Tolerance.
- Migration with VMotion of clustered virtual machines.
- N-Port ID Virtualization (NPIV)

- With native multipathing (NMP), clustering is not supported when the path policy is set to round robin.
- You must use hardware version 7 with ESX/ESXi 4.0.

**Other Relevant Reading related to this Section**

[http://www.infortrend.com/doc/appNote/APP\\_Note\\_MSCS%20in%20vSphere4.pdf](http://www.infortrend.com/doc/appNote/APP_Note_MSCS%20in%20vSphere4.pdf)

[http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=1004617](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1004617)

<http://www.yellow-bricks.com/2009/06/03/mscs-vms-in-a-hadr-cluster/>

<http://www.boche.net/blog/index.php/2009/04/01/setup-for-microsoft-cluster-service/>

<http://blog.vmote.net/?p=248>

## Objective 4.4 – Deploy and Maintain vCenter Server Heartbeat

### Knowledge

- Identify the five protection levels for vCenter Server Heartbeat
- Identify the three server protection options for vCenter Server Heartbeat
- Identify supported cloning options

### Skills and Abilities

- Install and configure vCenter Server Heartbeat
- Determine use cases for and execute a manual switchover
- Recover from a failover
- Monitor vCenter Server Heartbeat and communication status
- Configure heartbeat settings
- Configure shutdown options
- Configure application protection
- Add/Edit Services
- Add/Edit Tasks
- Edit/Test Rules
- Install/Edit Plug-ins
- Add/Remove Inclusion/Exclusion Filters
- Perform Full System and Full Registry checks
- Configure/Test Alerts
- Troubleshoot common vCenter Server Heartbeat error conditions

### Tools

- vCenter Server Heartbeat QuickStart Guide
- vCenter Server Heartbeat Reference Guide
- Product Documentation
- vSphere Client

## Notes

Your main resource for this section will be the [vCenter Server Heartbeat and Reference Guide](#) and most of the following notes are directly from that document.

### Identify the five protection levels for vCenter Server Heartbeat

- Server Protection- Provides continuous availability to end users through hardware failures or operating system crashes.
- Network Protection- Polls up to three nodes and ensures that the active server is visible on the network.
- Application Protection- Ensures applications and services stay alive on the network.
- Performance Protection- Monitors specific application attributes to ensure they remain within normal operating ranges.
- Data Protection- Intercepts data and maintains a copy of the data on the passive server for use in the event of a failure.

### Identify the three server protection options for vCenter Server Heartbeat

- vCenter Server with SQL on same host
- vCenter Server with SQL Server on separate host
- vCenter Server only

### Identify supported cloning options

- For creating supported pre-cloned images for use as a secondary server you can either use VMware Converter for a P2V or VMware vCenter to clone a VM for a V2V.
- At the time of installation you may also select “Not a clone of the Primary Server”. This option will run a clone process for the specified secondary (physical or vm) and clone the servers for you.

### Install and configure vCenter Server Heartbeat

RTFM on this one and even literally if you take a look at the recent [blogs from Mike Laverick](#), the first 2 of a four part series.

### Determine use cases for and execute a manual switchover

You can click Make Active on the vCenter Server Heartbeat Console Server: Summary page to manually initiate a managed switchover. When a managed switchover is triggered, the running of protected applications is transferred from the active machine to the passive machine in the server pair. The server roles are reversed.

### Recover from a failover

- 1 Correct the conditions that caused the failover.
- 2 Verify the integrity of the disk data on the failed server.
- 3 Restart the failed, now passive, server after all issues are resolved.
- 4 Start vCenter Server Heartbeat on the passive server.

At this point, the instances of vCenter Server Heartbeat running on the servers connect and begin to re-synchronize the data on the Primary server.

5 Wait until vCenter Server Heartbeat is fully synchronized. When the re-synchronization is complete, you can continue operating with this configuration (for example, the Secondary server is the active server and the Primary server is the passive server), or initiate a managed switchover.

6 Optionally, perform a managed switchover to return the Primary and Secondary servers to the same roles they had before the failover.

### Monitor vCenter Server Heartbeat and communication status

The server monitoring page provides information about the status of communications between the pair of vCenter servers. In addition to a heartbeat a ping is also sent to ensure the servers can see each other.

### Configure heartbeat settings

On the server monitoring page you can configure pings, configure failover, and configure response times.

#### To configure pings

- 1 Click Configure Pings to open the Server Monitoring: Ping Configuration dialog.
- 2 Click on the Ping Settings tab to configure the Ping Interval.
- 3 Click on the Ping Routing tab to add additional IP address for redundant NICs.

#### To configure failover(default 60 seconds)

- 1 Click Configure Failover to open the Server Monitoring: Failover Configuration dialog.
- 2 Type a new numeric value (seconds) in the Failover timeout text box or use the arrow buttons to set a new value.
- 3 Mark or clear the check boxes to select the actions to take if the specified Failover timeout is exceeded.
- 4 Click OK.

#### To configure response times

- 1 Click Configure Response Times to open the Server Monitoring: Response Times dialog.
- 2 Type new numeric values (seconds) into the text boxes or use the arrow buttons to select new values.
- 3 Click OK.

#### **Configure shutdown options**

Shutdown — Prompts you to select the server(s) to shut down. If you select the active server, additional options to stop or not stop protected applications appear in the dialog. Click OK.

#### **Configure application protection**

##### To configure applications

- 1 Click Configure on the Applications page.  
You can protect services and start monitoring applications or unprotect services and stop monitoring applications. You can also enable Verbose Plugin logging, Discover protected data at startup, Discover protected services at startup, and set the rule trigger count.
- 2 After making modifications to the configuration, click OK.

#### **Add/Edit Services**

##### To protect a service

- 1 Right-click on a service and select Add from the menu or click Add on Applications: Services page to invoke the Add Service dialog. The Name drop-down list contains a list of all currently running services.
- 2 Select the service and set the values for Target State on Active and Target State on Passive. Normally the Target State on Active is set to Running and the Target State on Passive is set to Stopped.
- 3 If vCenter Server Heartbeat is to manage the start and stop of the service, select Manage Starting and Stopping. If vCenter Server Heartbeat is to monitor the state of the service, select Monitor State. vCenter Server Heartbeat also assigns three sequential tasks to perform in the event of failure. Task options include Recover Service, Application Restart, Log Warning, Switchover, and any additional user-defined tasks previously created.
- 4 Assign a task to each of the three failure options and click OK.

##### Editing a Service

- 1 Select the service and click Edit. The Edit Service dialog opens to provide a subset of same options available when adding a new service.
- 2 Make the modifications and click OK.

#### **Add/Edit Tasks**

##### To add a task

- 1 Click Add to invoke the Add Task dialog. Assign a name to the task.
- 2 Select the task type from the drop-down list.
- 3 Select the identity of the server the task runs on (Primary or Secondary).
- 4 In the Command text box, type in the path or browse to the script, .bat file, or command for the task to perform.
- 5 Click OK.

### Editing a Task

- 1 Right-click on an existing task and select Edit from the menu or select the task and click Edit at the top of the pane to invoke the Edit Task dialog.
- 2 Edit the parameters of the task.
- 3 Click OK.

### **Edit/Test Rules**

#### To edit a rule

- 1 Right-click on the rule and select Edit from the menu or click Edit at the top of the pane.
- 2 Edit the parameters of the rule and click OK.

#### To check a rule condition

Right-click on the rule and select Check Now from the menu or click Check Now at the top of the pane. The rule condition is displayed in the pane.

### **Install/Edit Plug-ins**

#### To install a new plug-in

- 1 Click Applications: Plugin to open the Plugins page.
- 2 Right-click an existing plug-in and select Install from the menu or click Install at the top of the pane to invoke the Install Plugins dialog.
- 3 Type a path to the plug-in location or click Browse to navigate to the plug-in location. The path statement is case-sensitive.
- 4 Click OK.

#### To edit the plug-in configuration

- 1 Right-click on an existing plug-in from the Plugins list and select Edit from the menu or select the plug-in and click Edit at the top of the pane to invoke the Edit Plugin dialog.
- 2 Review the configuration options before making modifications as they are specific to each plug-in.
- 3 Click OK.

### **Add/Remove Inclusion/Exclusion Filters**

#### To define filters that include files and folders for protection and replication

- 1 In the Data: File Filters pane, click Add Inclusion Filter to open the Add Inclusion Filter dialog.
- 2 Type the complete path and pattern, specify a pattern containing wildcards, or use Browse to locate the file or folder.
- 3 Click OK. The two forms of wildcards available are \*, which matches all files in the folder, and \*\*, which matches all files, subfolders and the files in the subfolders of the folder. After defining the filter, you can add additional Inclusion Filters.

Inclusion and exclusion filters can be edited by selecting the filter and clicking Edit at the top of the File Filters pane or right-clicking the filter and selecting Edit from the menu. Edit the value in the Pattern: text box by typing over the current file filter definition.

### **Perform Full System and Full Registry checks**

To initiate a full registry check Click Full Registry Check in the Registry Synchronization pane.

When you click Full System Check, a dialog asks you to confirm the request and warns you that depending on the amount of data under protection, this task can take a long time to complete (for example, a number of hours). Click Yes to perform the check.

### **Configure/Test Alerts**

You can configure alerts in by clicking Configure Alerts on the Logs page

Click Test Alert Reporting to run a test alert email. This way you can avoid triggering an actual alert during the operation of the active server

**Troubleshoot common vCenter Server Heartbeat error conditions**

Refer to the troubleshooting section of the guide of the [vCenter Server Heartbeat and Reference Guide](#) for common scenarios and troubleshooting.

**Other relevant blogs and websites related to this section**

[http://www.vmware.com/support/pubs/heartbeat\\_pubs.html](http://www.vmware.com/support/pubs/heartbeat_pubs.html)

[https://www.vmware.com/tryvmware/p/activate.php?p=vmware-vmware&lp=1#tab\\_install](https://www.vmware.com/tryvmware/p/activate.php?p=vmware-vmware&lp=1#tab_install)

[http://searchvirtualdatacentre.techtarget.co.uk/news/column/0,294698,sid203\\_gci1518928,00.html](http://searchvirtualdatacentre.techtarget.co.uk/news/column/0,294698,sid203_gci1518928,00.html)

[http://searchvirtualdatacentre.techtarget.co.uk/news/column/0,294698,sid203\\_gci1518932,00.html](http://searchvirtualdatacentre.techtarget.co.uk/news/column/0,294698,sid203_gci1518932,00.html)

[vCenter Server Heartbeat and Reference Guide](#)

## **Section 5 – Perform Operational Maintenance**

### **Objective 5.1 – Implement and Maintain Host Profiles**

#### **Skills and Abilities**

- Use Profile Editor to edit and/or disable policies
- Create sub-profiles
- Use Host Profiles to deploy vDS

#### **Tools**

- vSphere Datacenter Administration Guide
- VMware vSphere™ 4: Deployment Methods for the VMware® vNetwork Distributed Switch
- Product Documentation
- vSphere Client



## Notes

### Create sub-profiles

<http://www.vmware.com/files/pdf/techpaper/VMW-Host-Profiles-Tech-Overview.pdf>

<http://blogs.vmware.com/management/2010/08/vmware-host-profiles.html>

<http://www.vadapt.com/2010/03/232/>

<http://jasonnash.wordpress.com/2009/05/04/video-demo-of-vspheres-host-profiles/>

### Use Host Profiles to deploy vDS

<http://www.vmware.com/resources/techresources/10050>

<http://www.virtualinsanity.com/wp-content/uploads/vDS-Implementation-Cheat-Sheet-b.pdf>

### Other relevant blogs and websites related to this section

<http://www.yellow-bricks.com/2009/01/19/compare-your-hosts/>

[http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=1017477](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1017477)

## Objective 5.2 – Deploy and Manage Complex Update Manager Environments

### Knowledge

- Identify firewall access rules for Update Manager

### Skills and Abilities

- Determine use case for, install and configure Update Manager Download Service
- Configure a shared repository
- Configure smart rebooting
- Manually download updates to a repository
- Perform orchestrated vSphere upgrades
- Create and modify baseline groups
- Troubleshoot Update Manager problem areas and issues
- Generate database reports using MS Excel or MS SQL
- Upgrade vApps using Update Manager

### Tools

- VMware vCenter Update Manager Installation and Administration Guide
- Product Documentation
- vSphere Client
- VMware-umds

## Notes

For the most part all of the content you are going to find for this objective can be found in the [vCenter Update Manager Installation and Administration Guide](#).

### Identify firewall access rules for Update Manager

Network port requirements for Update Manager are outlined in [this kb article](#) from VMware.

### Configure a shared repository

To configure a shared repository you will need to download the files to a location of your choice then follow the following steps.

From the [vCenter Update Manager Installation and Administration Guide](#).

You can configure Update Manager to use a shared repository as a source for downloading patches and notifications.

#### Prerequisites

You must create the shared repository using the UMDS and host it on a Web server or a local disk. The UMDS you use must be of a version compatible with Update Manager. You cannot set up Update Manager to use a shared repository if the patch binaries, patch metadata, and notifications are downloaded with a version of UMDS that is not compatible with the current version of Update Manager. For more information, about the compatibility, see “Compatibility Between UMDS and the Update Manager Server,” on page 58. You can find the detailed procedure about exporting the patch binaries, patch metadata, and notifications in “Export the Downloaded Patches and Notifications,” on page 63. Connect the vSphere Client to a vCenter Server system with which Update Manager is registered, and click Update Manager under Solutions and Applications on the Home page. If your vCenter Server system is part of a connected group in vCenter Linked Mode, you must specify the Update Manager instance to use, by selecting the name of the corresponding vCenter Server system in the navigation bar.

#### Procedure

1 On the Configuration tab, under Settings, click Patch Download Settings.

2 In the Patch Download Sources pane, select Use a shared repository.

3 Enter the path or the URL to the shared repository.

For example: C:\repository\_path\, [https://repository\\_path/](#), or [http://repository\\_path/](#)

In these examples, repository\_path is the path to the folder to which you have exported the patches and notifications. In a semi-air-gap environment (where the Update Manager server does not have direct access to the Internet, but is connected to a machine that has Internet access), the folder can be on a Web server. You can enter an HTTP or HTTPS address, or a location on the disk on which Update Manager is installed. HTTPS addresses are supported without any authentication. **IMPORTANT** You cannot use folders located on a network drive as a shared repository. Update Manager does not download patch binaries, patch metadata, and notifications from folders on a network share either in the Microsoft Windows Uniform Naming Convention form (such as \Computer\_Name\_or\_Computer\_IP\Shared), or on a mapped network drive (for example, Z:\).

4 Click Validate URL to validate the path. **IMPORTANT** If the patch binaries, patch metadata, and notifications in the folder you specify are downloaded with a UMDS version that is not compatible with the Update Manager version you use, the validation fails and you receive an error message. Make sure that the validation is successful. If the validation fails, Update Manager reports a reason for the failure. You can use the path to the shared repository only when the validation is successful.

5 Click Apply.

6 Click Download Now to run the VMware vCenter Update Manager Update Download task and to download the patches and notifications immediately. The shared repository is used as a source for downloading patches and notifications. Example 11-1. Using a Folder or a Server as a Shared Repository You can use a folder or a Web server as a shared repository. When you use a folder as a shared repository, repository\_path is the top-level directory where patches and notifications exported from UMDS are stored. For example, export the patches and notifications using UMDS to F:\, which is a drive mapped to a plugged-in USB device on the machine on which UMDS is installed. Then, plug in the USB device to the machine on which Update Manager is installed. On this

machine the device is mapped as E:\. The folder to configure as a shared repository in the Update Manager is E:\. n When you use a Web server as a shared repository, repository\_path is the top-level directory on the Web server where patches exported from UMDS are stored. For example, export the patches and notifications from UMDS to C:\docroot\exportdata. If the folder is configured in a Web server and is accessible from other machines at the URL [https://umds\\_host\\_name/exportdata](https://umds_host_name/exportdata), the URL to configure as a shared repository in Update Manager is [https://umds\\_host\\_name/exportdata](https://umds_host_name/exportdata).

### **Configure smart rebooting**

From the [vCenter Update Manager Installation and Administration Guide](#).

Smart rebooting selectively reboots the virtual appliances and virtual machines in the vApp to maintain startup dependencies and possibly reboots the appliances that are not remediated. You can enable and disable smart rebooting of virtual appliances after remediation.

Smart rebooting is enabled by default. If you disable smart rebooting, the virtual appliances are restarted according to their individual remediation requirements and disregard any startup dependencies.

To disable smart rebooting:

- 1 Connect the vSphere Client to a vCenter Server system with which Update Manager is registered, and select Home > Solutions and Applications > Update Manager in the navigation bar. If your vCenter Server system is a part of a connected group in vCenter Linked Mode, specify the Update Manager instance to configure, by selecting the name of the corresponding vCenter Server system in the navigation bar.
- 2 Click the Configuration tab.
- 3 Under Settings, click vApp Settings.
- 4 Deselect Enable smart reboot after remediation to disable smart rebooting.

### **Manually download updates to a repository**

You can manually download updates and import them to update manager as an offline bundle.

From the [vCenter Update Manager Installation and Administration Guide](#).

#### **Prerequisites**

The patches and extensions you import must be in ZIP format.

To import patches and extensions, you must have the Upload File privilege. For more information about managing users, groups, roles, and permissions, see vSphere Datacenter Administration Guide. For a list of Update Manager privileges and their descriptions, see “Update Manager Privileges,” on page 80.

Connect the vSphere Client to a vCenter Server system with which Update Manager is registered, and click Update Manager under Solutions and Applications on the Home page. If your vCenter Server system is part of a connected group in vCenter Linked Mode, you must specify the Update Manager instance to use, by selecting the name of the corresponding vCenter Server system in the navigation bar.

#### **Procedure**

- 1 On the Configuration tab, under Settings, click Patch Download Settings.
  - 2 Click Import Patches at the bottom of the Patch Download Sources pane.
  - 3 On the Select Patches page of the Import Patches wizard, browse to and select the .zip file containing the patches you want to import.
  - 4 Click Next and wait until the file upload completes successfully.
- In case of upload failure, check whether the structure of the .zip file is correct or whether the Update Manager network settings are set up correctly.
- 5 Click Next.
  - 6 On the Confirm Import page of the Import Patches wizard, review the patches that you import into the Update Manager repository.
  - 7 Click Finish.

### **Perform orchestrated vSphere upgrades**

From the [vCenter Update Manager Installation and Administration Guide](#).

#### **Orchestrated Upgrades of Hosts and Virtual Machines**

You can perform orchestrated upgrades of the hosts or virtual machines in your vSphere inventory. Orchestrated upgrades allow you to upgrade all hosts in the inventory using a single host upgrade baseline that is attached to a

container object in the vSphere inventory. You can use orchestrated upgrade to upgrade the virtual machine hardware and VMware Tools of all the virtual machines in the vSphere inventory at the same time, using baseline groups containing the following baselines:

- n VM Hardware Upgrade to Match Host

- n VMware Tools Upgrade to Match Host

You can perform an orchestrated upgrade at the cluster, folder, datacenter, or individual object level. Upgrading the virtual hardware of the virtual machines exposes new devices and capabilities to the guest operating systems. You must upgrade VMware Tools before upgrading the virtual hardware version so that all required drivers are updated in the guest. Upgrading the virtual hardware of the virtual machines is impossible if VMware Tools is not installed, is out of date, or is managed by third-party vendors.

### **Create and modify baseline groups**

From the vCenter Update Manager Installation and Administration Guide.

Baselines contain a collection of one or more patches, extensions, service packs, bug fixes, or upgrades, and can be classified as upgrade, extension, or patch baselines. Baseline groups are assembled from existing baselines.

Baseline groups might contain a number of patch or extension baselines, and only one upgrade baseline per upgrade type (like VMware Tools, virtual machine hardware, virtual appliance, or host).

When you scan hosts, virtual machines, and virtual appliances, you evaluate them against baselines and baseline groups to determine their level of compliance.

Update Manager includes four default patch baselines and four upgrade baselines. You cannot edit or delete the default baselines. You can use the default baselines, or create patch, extension, and upgrade baselines that meet the criteria you want. Baselines you create, as well as default baselines, can be combined in baseline groups. For more information about baselines and baseline groups, see “Using Baselines and Baseline Groups,” on page 19 and Chapter 12, “Working with Baselines and Baseline Groups,” on page 83.

### **Troubleshoot Update Manager problem areas and issues**

I have not seen a ton of information out there specifically on troubleshooting Update Manager, but installing it and playing around with it will go a long way.

You can also check out these two links for a little more information. Additionally pg 161 of the admin guide starts a troubleshooting section specific to Update Manager.

<http://blog.michaelburger.de/Virtuozity.php/2009/02/25/troubleshooting-vmware-update-manager>

<http://www.yellow-bricks.com/2009/02/02/vmware-update-manager-sql/>

### **Generate database reports using MS Excel or MS SQL**

Pg 159 and 160 of the vCenter Update Manager Installation and Administration Guide.

### **Upgrade vApps using Update Manager**

Attach an upgrade baseline to the vApp just as you would a folder, cluster, or datacenter.

### **Tools**

#### **VMware vCenter Update Manager Installation and Administration Guide**

#### **Product Documentation**

#### **vSphere Client**

#### **vmware-umds**

On the machine you have installed Update Manager on (Windows box) you can do the following with the vmware-umds command

To set up a download of all ESX/ESXi host updates, run the following command:

```
vmware-umds --set-config --enable-host 1 --enable-win 0 --enable-lin 0
```

To set up a download of all Windows updates, run the following command:

```
vmware-umds --set-config --enable-host 0 --enable-win 1 --enable-lin 0
```

To set up a download of all Linux updates, run the following command:

```
vmware-umds --set-config --enable-host 0 --enable-win 0 --enable-lin 1
```

To set up a download of all available updates, run the following command:

```
vmware-umds --set-config --enable-host 1 --enable-win 1 --enable-lin 1
```

Change the patch repository directory by running the command:

```
vmware-umds --setup-config --patch-store your_new_patchstore_folder
```

## Section 6 – Perform Advanced Troubleshooting

### Objective 6.1 – Configure, Manage and Analyze vSphere Log Files

#### Knowledge

- Identify vCenter Server log file names and locations
- Identify ESX/ESXi log files names and locations
- Identify tools used to view vSphere log files

#### Skills and Abilities

- Generate vCenter Server and ESX/ESXi log bundles
- Use vicfg-syslog to configure centralized logging on ESX/ESXi Hosts
- Test centralized logging configuration
- Configure the VMA appliance as a log host
- Use vilogger to enable/disable log collection on the VMA appliance
- Use vilogger to configure log rotation and retention
- Analyze log entries to obtain configuration information
- Analyze log entries to identify and resolve issues

#### Tools

- vSphere Management Assistant Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- vSphere Datacenter Administration Guide
- Product Documentation
- vSphere Client
- vicfg-syslog
- vilogger

## Notes

### Identify vCenter Server log file names and locations

- <http://www.vmwarewolf.com/which-virtual-center-log-file/>

### Generate vCenter Server and ESX/ESXi log bundles

- vCenter Server  
[http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=1011641](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1011641)
- ESX/ESXi  
[http://kb.vmware.com/selfservice/microsites/search.do?cmd=displayKC&docType=kc&externalId=1010705&slicId=1&docTypeId=DT\\_KB\\_1\\_1&dialogID=91626659&stateId=1%200%2091634051](http://kb.vmware.com/selfservice/microsites/search.do?cmd=displayKC&docType=kc&externalId=1010705&slicId=1&docTypeId=DT_KB_1_1&dialogID=91626659&stateId=1%200%2091634051)

### Use vicfg-syslog to configure centralized logging on ESX/ESXi Host

- vicfg-syslog <conn\_options> -i  
Displays the syslog server configuration.
- vicfg-syslog <conn\_options> -s mysyslogserver  
Makes mysyslogserver the syslog server for the server specified in <conn\_options>.
- vicfg-syslog <conn\_options> -p <port>  
Sets the port number used by the syslog server.
- From the GUI  
[http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=1016621](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1016621)

### Configure the vMA appliance as a log host

- It is still unclear to me at this time if the test will be on 4.1, or rather how soon it will be so it is important to study the new features with AD integration. Research the command for domain joining of the vMA, domainjoin-cli
- Great blog on setting up for AD authentication and connecting <http://geeksilver.wordpress.com/2010/07/22/how-to-use-vma-4-1-installation-configuration/>
- Great blog on setting up your vMA appliance as a log host <http://www.simonlong.co.uk/blog/2010/05/28/using-vma-as-your-esxi-syslog-server/>

### Use vilogger to enable/disable log collection on the vMA appliance

#### Use vilogger to configure log rotation and retention

- To add a server: Sudo vifp addserver <FQDN ESX host>
- To enable logging: Vilogger enable --server fqdn servername --numrotation xx --maxfilesize xx --collectionperiod xx
- To disable logging: Vilogger disable --server fqdn servername
- To list the servers added : Vifp listservers
- To specify the current target for commands entered in the vMA: Vifptarget --s systemname



- Analyze log entries to obtain configuration information
- Analyze log entries to identify and resolve issues

- Very good blog entry on logs here <http://www.simonlong.co.uk/blog/2010/06/03/vmware-esxi-4-log-files/>

ESX logs

under /var/log

vmkernel- VMKernel Messages

vmkwarning- VMKernel Warnings

messages- Service Console Log

Under /var/log/vmware

hostd- ESX Service Log

aam- HA Log

Under /var/log/vpx

vpxa- vCenter Agent log

ESXi logs under /var/log

hostd- ESXi Service log

messages- Syslog(vmkernel/hostd)

vpxa- vCenter Agent Log

## Objective 6.2 – Troubleshoot CPU and Memory Performance

### Knowledge

- Identify resxtop/esxtop metrics related to memory and CPU
- Identify vCenter Server Performance Chart metrics related to memory and CPU

### Skills and Abilities

- Troubleshoot ESX/ESXi Host and Virtual Machine CPU performance issues using appropriate metrics
- Troubleshoot ESX/ESXi Host and Virtual Machine memory performance issues using appropriate metrics
- Use Hot-Add functionality to resolve identified Virtual Machine CPU and memory performance issues

### Tools

- vSphere Resource Management Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- resxtop/esxtop

## Notes

### Identify resxtop/esxtop metrics related to memory and CPU

- Esxtop does not exist in vMA, you must use resxtop
- One limitation of resxtop is the lack of replay mode.
- You must specify the remote server –server=

### Identify vCenter Server Performance Chart metrics related to memory and CPU

This can be checked at the cluster or server level and you will have more granular options to check at the server level.

### Memory

You must first have a firm understanding of terminology when it comes to memory in the VMware world. This [blog from Scott Sauer](#) is a must read if you are not familiar with the below terms.

- Transparent Page Sharing
- Memory Overcommitment
- Memory Overhead
- Memory Balloon Driver

With the ability to overcommit memory you will want to make sure excessive swapping is not occurring at both the host and virtual machine level.

Use memory reservations cautiously. Memory that is reserved cannot be used by another virtual machine that may need it.

Memory ballooning relies on drivers installed in the guest with VMware tools. No VMware tools means potential performance impacts to your server.

### CPU

There are many counters that can be added and checked including core usage and reservations. Again reservations should be used cautiously.

Watch out for virtual machines that are consistently using a large percentage of cpu resources. A typical server is idle most of the time so check and see if something out of the ordinary is occurring. If in fact the server is using these resources then allocate another vCPU.

High CPU ready times are a dead giveaway for other issues that may be going on.

Virtual machines that have multiple CPU's installed but the incorrect HAL will not help the virtual guest out.

### Troubleshoot ESX/ESXi Host and Virtual Machine CPU performance issues using appropriate metrics

From the [blog of Duncan Epping](#), these are four commonly needed values to look at when taking into account CPU performance issues. His blog entry is one that is updated over time based on the community so read the comments there and check if any of these thresholds are changed over time. Ultimately performance is relative to the environment so some of this may not always apply.

CPU	%RDY	10	Overprovisioning of vCPUs, excessive usage of vSMP or a limit(check %MLMTD) has been set. See Jason's <a href="#">explanation</a> for vSMP VMs
CPU	%CSTP	3	Excessive usage of vSMP. Decrease amount of vCPUs for this particular VM. This should lead to increased scheduling opportunities.
CPU	%MLMTD	0	If larger than 0 the world is being throttled. Possible cause: Limit on CPU.
CPU	%SWPWT	5	VM waiting on swapped pages to be read from disk. Possible cause: Memory overcommitment.

If you want to move historical data over to a gui based format you can use esxplot or Windows' Perfmon to interpret the data. To gather this data you would use batch mode as shown below.

```
esxtop -b -d delay in seconds -n iterations > capturefile.csv
```

### Troubleshoot ESX/ESXi Host and Virtual Machine memory performance issues using appropriate metrics

Again from the [blog of Duncan Epping](#), five commonly needed values to look at when troubleshooting memory performance. Same applies as above.

MEM	MCTLSZ (I)	1	If larger than 0 host is forcing VMs to inflate balloon driver to reclaim memory as host is overcommitted.
MEM	SWCUR (J)	1	If larger than 0 host has swapped memory pages in the past. Possible cause: Overcommitment.
MEM	SWR/s (J)	1	If larger than 0 host is actively reading from swap(vswp). Possible cause: Excessive memory overcommitment.
MEM	SWW/s (J)	1	If larger than 0 host is actively writing to swap(vswp). Possible cause: Excessive memory overcommitment.
MEM	N%L (F)	80	If less than 80 VM experiences poor NUMA locality. If a VM has a memory size greater than the amount of memory local to each processor, the ESX scheduler does not attempt to use NUMA optimizations for that VM and "remotely" uses memory via "interconnect".

### **Use Hot-Add functionality to resolve identified Virtual Machine CPU and memory performance issues**

A couple of good blogs by [David Davis](#) and [Jason Boche](#) outline what and how to use Hot-Add/Hot-Plug. The ability to use this without having to reboot the guest virtual machine is extremely limited. ON the Microsoft side Windows 2008 Server Datacenter is necessary to support both features without a reboot while Windows 2008 Server Enterprise edition does not require a reboot for Hot Adding memory. When it comes to removing either hot added memory or hot plugged cpu's a reboot is required for all Windows guest operation systems.

### **Other relevant blogs and websites related to this section**

<http://communities.vmware.com/docs/DOC-10352> <http://communities.vmware.com/docs/DOC-11812><http://www.boche.net/blog/index.php/2009/01/28/esxtop-drilldown/http://www.vreference.com/public/vReference-esxtop1.2.pdf> <http://labs.vmware.com/flings/esxplot><http://www.simonlong.co.uk/blog/2010/03/24/using-esxtop-with-vmware-esxi/>  
[http://pubs.vmware.com/vsp40u1\\_i/resmgmt/c\\_using\\_the\\_esxtop\\_utility.html#1\\_7\\_6\\_22\\_1](http://pubs.vmware.com/vsp40u1_i/resmgmt/c_using_the_esxtop_utility.html#1_7_6_22_1)  
<http://www.boche.net/blog/index.php/2009/05/10/vsphere-memory-hot-add-cpu-hot-plug/>  
[http://searchvmware.techtarget.com/tip/0,289483,sid179\\_gci1367631\\_mem1,00.html](http://searchvmware.techtarget.com/tip/0,289483,sid179_gci1367631_mem1,00.html)  
<http://www.virtualizationadmin.com/articles-tutorials/vmware-esx-articles/general/understanding-and-customizing-vmware-esx-server-performance-charts.html>  
<http://www.virtualinsanity.com/index.php/2010/02/19/performance-troubleshooting-vmware-vsphere-memory/>  
<http://www.virtualinsanity.com/index.php/2010/02/15/performance-troubleshooting-vmware-vsphere-cpu/>

<http://www.yellow-bricks.com/esxtop/>

## Objective 6.3 – Troubleshoot Network Performance and Connectivity

### Knowledge

- Identify virtual switch entries in a Virtual Machine's configuration file
- Identify virtual switch entries in the ESX/ESXi Host configuration file
- Identify CLI commands and tools used to troubleshoot vSphere networking configurations
- Identify logs used to troubleshoot network issues

### Skills and Abilities

- Utilize net-dvs to troubleshoot vNetwork Distributed Switch configurations
- Utilize vicfg-\* commands to troubleshoot ESX/ESXi network configurations
- Configure a network packet analyzer in a vSphere environment
- Troubleshoot Private VLANs
- Troubleshoot Service Console and VMkernel network configuration issues
- Troubleshoot DNS and routing related issues
- Use esxtop/resxtop to identify network performance problems
- Use CDP and/or network hints to identify connectivity issues
- Analyze troubleshooting data to determine if the root cause for a given network problem originates in the physical infrastructure or vSphere environment

### Tools

- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-\*
- net-dvs
- resxtop/esxtop

## Notes

### Identify virtual switch entries in a Virtual Machine's configuration file

- Best thing to do here is open up a vmx file and learn what is configured. Below is a trimmed down vmx from my lab with just the network setting showing.

```
virtualHW.version = "7"

ethernet0.present = "true"
ethernet0.wakeOnPcktRcv = "true"
ethernet0.networkName = "VM Network"
ethernet0.addressType = "vpx"
ethernet0.generatedAddress = "00:50:56:a4:52:92"
ethernet1.present = "true"
ethernet1.virtualDev = "e1000"
ethernet1.networkName = "VM Network"
ethernet1.addressType = "vpx"
ethernet1.generatedAddress = "00:50:56:a4:34:04"
ethernet2.present = "true"
ethernet2.virtualDev = "e1000"
ethernet2.networkName = "VM Network"
ethernet2.addressType = "vpx"
ethernet2.generatedAddress = "00:50:56:a4:74:e9"
ethernet0.startConnected = "true"
ethernet2.startConnected = "false"
ethernet0.pciSlotNumber = "32"
ethernet1.pciSlotNumber = "33"
ethernet2.pciSlotNumber = "35"
ethernet0.virtualDev = "e1000"

ethernet1.startConnected = "false"
```

### Identify virtual switch entries in the ESX/ESXi Host configuration file

- load up /etc/vmware/esx.conf and check it out

### Utilize net-dvs to troubleshoot vNetwork Distributed Switch configurations

- There is not a ton of information out there on using the net-dvs command. One blog that contains some relevant information can be found at <http://geeksilver.wordpress.com/2010/05/21/vds-vnetwork-distributed-switch-my-understanding-part-2/>
- Something I did not know, this command is listed as an unsupported command. It will not run (to my knowledge) from the vMA and I ran it when locally logged into the host. The syntax of the command can be found below

Warning: This is an unsupported command. Use at your own risk.

```
net-dvs -a [ -P maxPorts ] switch_name
net-dvs -d switch_name
net-dvs [ -A | -D ] -p port switch_name
net-dvs [ -s name=value | -u name ] -p port switch_name
net-dvs -l [ switch_name ]
net-dvs -i (init database)
net-dvs [-S | -R | -G ]
net-dvs -T
net-dvs -v "vlanID[t|p[0-7]][;min-max,min-max...]"
```

```

net-dvs -V "primaryVID,secondaryVID,i|c|p;primaryVID,secondaryVID,i|c|p..."
net-dvs -m
"sid;dname;snaplen;[oiveld];encapvlan;wildcardsIn,wildcardsOut;dstPort1,dstPort2,...;srcInPort1,srcInPort
2,...;srcOutPort1,srcOutPort2,...;sid2;dname2..."
net-dvs dvs switch -k "respool1_id;respool2_id;..."
net-dvs dvs switch -p dvport -K "respool1_id:shares:limit;respool2_id:shares:limit;..."
net-dvs dvs switch -p dvport -z "respool_id"
net-dvs dvs switch -j [activate|deactivate]
net-dvs -L uplink_name1,uplink_name2,...] -t team_policy_type -p port switch_name
net-dvs dvs switch -H "red|yellow|green:some message" switch_name
net-dvs -o "depth,param|classname;depth,param|classname;... -p port|globalPropList switch_name
net-dvs -mtu mtu_value [-p dvport] switch_name
net-dvs -x 0|1 -p dvport switch_name
net-dvs -vlan vlanID -p dvport switch_name
net-dvs -reset -p dvport switch_name
net-dvs -cap cap_value -p dvport switch_name
net-dvs -states -p dvport switch_name
net-dvs -miscInfo ;# Dumps cpu/meminfo
net-dvs -vmknicIp <vmknic> ;# Displays IPv4 address on <vmknic>

```

#### Utilize vicfg-\* commands to troubleshoot ESX/ESXi network configurations

- Below are the commands I'd consider relevant for troubleshooting in this section. You can use the [vSphere Command Line Reference](#) to gain more information on each of these commands and others.
- vicfg-authconfig(4.1 only) Manages Active Directory authentication.
- vicfg-dns.pl Specifies an ESX/ESXi host's DNS (Domain Name Server) configuration.
- vicfg-ipsec Supports setup of IPSec.
- vicfg-nics Manages the ESX/ESXi host's NICs (uplink adapters).
- vicfg-ntp Specifies the NTP (Network Time Protocol) server.
- vicfg-route Lists or changes the ESX/ESXi host's route entry (IP gateway).
- vicfg-snmp Manages the Simple Network Management Protocol (SNMP) agent.
- vicfg-vmknic Adds, deletes, and modifies virtual network adapters (VMkernel NICs).
- vicfg-vswitch Adds or removes virtual switches or vNetwork Distributed Switches, or modifies switch settings.

#### Configure a network packet analyzer in a vSphere environment

- Too much to put in words on this one. Check out the blog below for assistance. I'd recommend using Wireshark as this is what was used in the troubleshooting course offered by VMware.
- <http://itknowledgeexchange.techtarget.com/it-consultant/packet-sniffing-is-your-best-friend/>
- <http://www.petri.co.il/wireshark-ethereal.htm>

#### Troubleshoot Private VLANs

- Great source of PVLAN information at <http://professionalvmware.com/2010/04/private-vlan-resources/>
- Free video(nearly 40 minutes!) detailing PVLAN's from Eric Sloof at <http://www.ntpro.nl/blog/archives/1465-Online-Training-Configure-Private-VLAN-IDs.html>
- Complete definition of what is a PVLAN from [VMware](#)
- How to configure PVLAN's from [VMware](#)

#### Troubleshoot Service Console and vmkernel network configuration issues

- Using [VMware's Resolution Paths](#) a good starting point is the [KB](#) for troubleshooting service console issues.



### Troubleshoot DNS and routing related issues

- [This VMware KB](#) is probably a good start for troubleshooting DNS/routing.
- To change/update dns use the Vicfg-dns command

### Use esxtop/resxtop to identify network performance problems

- Run esxtop and hit 'n' to enter the networking view
- Again the best resource I've found so far on troubleshooting using esxtop as a whole is [Duncan Epping's Blog](#) and I've included the two counters for networking in the table below.
- Two key performance counters you will need to know when troubleshooting network issues are below for both received and transmitted dropped packets. This goes without saying, but you are looking for no dropped packets here.
- The default view for networking will also show current and peak transmission stats to assist in your troubleshooting.

NETWORK	%DRPTX	1	Dropped packages transmitted, hardware overworked. Possible cause: very high network utilization
NETWORK	%DRPRX	1	Dropped packages received, hardware overworked. Possible cause: very high network utilization

### Use CDP and/or network hints to identify connectivity issues

- [Cisco Discovery Protocol CDP Information via the ESX Command Line and Virtual Center](#) (note replace vmware-vim-cmd with vim-cmd)
- The command `vim-cmd hostsvc/net/query_networkhint` will query and show network hints

## Objective 6.4 – Troubleshoot Storage Performance and Connectivity

### Knowledge

- Recall vicfg-\* commands related to listing storage configuration
- Recall vSphere 4 storage maximums
- Identify logs used to troubleshoot storage issues
- Describe the VMFS file system

### Skills and Abilities

- Use vicfg-\* and esxcli to troubleshoot multipathing and PSA-related issues
- Use vicfg-module to troubleshoot VMkernel storage module configurations
- Use vicfg-\* and esxcli to troubleshoot iSCSI related issues
- Troubleshoot NFS mounting and permission issues
- Use esxtop/resxtop and vscsiStats to identify storage performance issues
- Configure and troubleshoot VMFS datastores using VMkfstools
- Troubleshoot snapshot and resignaturing issues
- Analyze log files to identify storage and multipathing problems

### Tools

- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-\*
- esxcli
- resxtop/esxtop
- vscsiStats
- VMkfstools

## Notes

### Recall **vicfg-\*** commands related to listing storage configuration

Refer to the [vSphere Command-Line Interface Reference](#) for more information on the below commands.

vicfg-iscsi	vicfg-iscsi supports configuration and property retrieval for software or hardware iSCSI initiators.
vicfg-mpath	The vicfg-mpath command supports listing information about Fibre Channel or iSCSI LUNs and changing a path's state.
vicfg-mpath35	vicfg-mpath35 provides an interface to configure multipath settings for Fibre Channel or iSCSI LUNs on ESX/ESXi version 3.5 hosts.
vicfg-nas	The vicfg-nas command manipulates NAS file systems associated with ESX/ESXi hosts.
vicfg-rescan	Perform a rescan operation each time you reconfigure your storage setup
vicfg-scsidevs	The vicfg-scsidevs command displays information about available LUNs on ESX/ESXi 4.x hosts.
vicfg-volume	The vicfg-volume command supports resignaturing a snapshot volume and mounting and unmounting the volume.
vicfg-module	The vicfg-module command supports setting and retrieving VMkernel module options.

### Recall **vSphere 4 storage maximums**

- Refer to the storage section of the [vSphere Configuration Maximums guide](#).

### Use **vicfg-\*** and **esxcli** to troubleshoot multipathing and PSA-related issues

- Use the vicfg-mpath command to list information about FC or iSCSI luns. Refer to [vSphere Command-Line Interface Reference](#) for further detail and description of the command syntax.

```
vicfg-mpath [<conn_options>]
```

```
[--help |
```

```
--list [--path <path> | --device <device>] | --list-compact [--path <path> | --device <device>] |
```

```
--list-map [--path <path> | --device <device>] |
```

```
--list-paths [--device <device>] | --list-plugins |
```

```
--state [active|off] ]
```

- You use the `esxcli` command to to set path policy like below, where `VMW_PSP_xxx` will either be Fixed, Fixed\_AP, MRU, or RR

*esxcli <connection options> nmp device setpolicy -device naa.xxx -psp VMW\_PSP\_xxx*

To check the preferred path:

*esxcli <connection options> nmp fixed getpreferred -device naa.xxx*

To change the preferred path:

*esxcli <connection options> nmp fixed setpreferred -device naa.xxx vmhbax:Cx:Tx:Lx*

To retrieve and set round robin path options on a device controlled by the roundrobin psp

*esxcli <connection options> nmp roundrobin*

To retrieve path selection settings for a device using the roundrobin PSP

*esxcli <connection options> nmp roundrobin getconfig -device na.xxx*

To specify when the path should change(for load balancing)

*esxcli <connection options> nmp roundrobin setconfig -type "bytes" -B 12345 -device naa.xxx*

*Switches after 12345 bytes have been sent along the current path.*

*esxcli <connection options> nmp roundrobin setconfig -type=iops -ipos 4000 -device naa.xxx*

*switches after 4000 I/O operations have been performed*

- You can use the Mask\_Path plugin to mask paths. To view current list of rules

*esxcli corestorage claimrule list*

To Add

*esxcli corestorage claimrule add -plugin MASK\_PATH -rule <ruleid> -type xxx -A <adapter>*

To Load path claiming rules

*esxcli corestorage claimrule load*

To release a device from the current plugin

*esxcli corestorage claiming unclaim -t location -A vmhba0 -C 0 -T 0 -L 149*

To run the path claiming rules

*esxcli corestorage claimrule run*

To delete a claimrule

*esxcli corestorage claimrule delete -r rule#*

Also refer to the KB on masking a lun from ESX and ESXi 4.0 [using Mask Path plug-in.](#)

### Use vicfg-module to troubleshoot VMkernel storage module configurations

- The vicfg-module command supports setting and retrieving VMkernel module options. Refer to [vSphere Command-Line Interface Reference](#) for further detail and description of the command syntax.

```
vicfg-module [<connection_options>]

[--get-options <module_name> |

--help |

--list |

--set-options "<option> <value>" <module_name> |

--vihost <esx_host> ]
```

### Use vicfg-\* and esxcli to troubleshoot iSCSI related issues

```
vicfg-iscsi [<connection_options>] [option] [suboption] [parameter] [<adapter_name>]
```

Option is one of --discovery, --static, --authentication, --phba, --target, --lun, --network (Hardware iSCSI only), --pnp (Hardware iSCSI only), --iscsiname, --parameter, --swiscsi, --adapter.

Suboption is one of --list, --add, --remove.

Parameters differ depend on the suboption used.

<adapter\_name> is required unless you specify the [--help](#), --swiscsi, or --adapter option.

A couple of examples.

Enable software iSCSI

```
vicfg-iscsi --swiscsi --enable
```

Determine HBA Type/Retrieve ID

```
vicfg-iscsi --adapter --list
```

Check Status of software iSCSI

```
vicfg-iscsi --swiscsi --list
```

Add Dynamic or static discovery

```
vicfg-iscsi --static --add --ip --name <iscsi name> <adapter name>
```

```
vicfg-iscsi --discovery --add --ip --name <iscsi name> <adapter name>
```

To setup ports for iSCSI Multipathing.

List available uplinks for use with iSCSI adapters

```
esxcli swiscsi vmnic list -d <vmhba>
```

Connect iSCSI initiator to the VMkernel ports

```
esxcli swiscsi nic add -n <port_name> -d <vmhba>
```

To disconnect iSCSI initiator from VMkernel ports

```
esxcli swiscsi nic remove -n <port_name> -d <vmhba>
```

To list all sw iSCSI sessions at the adapter level or target level

```
esxcli swiscsi session list -d <iscsi_adapter>
```

```
esxcli swiscsi session list -d vmhba36
```

Remove iSCSI sw sessions

```
esxcli swiscsi session remove -d
```

#### Troubleshoot NFS mounting and permission issues

- Refer to [vSphere Command-Line Interface Reference](#) for further detail and description of the command syntax.

```
vicfg-nas [<conn_options>]

[--add --nasserver <server_name> --share <share_name> |
--delete <share_name> |
--help |
--list |
--nasserver <server_name> |
--readonly |
--vihost <esx_host> ]
```

#### Use esxtop/resxtop and vscsiStats to identify storage performance issues

- 'd' for disk adapter view
- 'u' for disk device view
- 'v' for disk VM view

From [Duncan Epping's ESXTOP section](#) on his blog, the following counters are critical to troubleshooting performance specifically related to storage.

DISK	GAVG (H)	25	Look at "DAVG" and "KAVG" as the sum of both is GAVG.
------	----------	----	---

DISK	DAVG (H)	25	Disk latency most likely to be caused by array.
DISK	KAVG (H)	2	Disk latency caused by the VMkernel, high KAVG usually means queuing. Check "QUED".
DISK	QUED (F)	1	Queue maxed out. Possibly queue depth set to low. Check with array vendor for optimal queue depth value.
DISK	ABRTS/s (K)	1	Aborts issued by guest(VM) because storage is not responding. For Windows VMs this happens after 60 seconds by default. Can be caused for instance when paths failed or array is not accepting any IO for whatever reason.
DISK	RESETS/s (K)	1	The number of commands reset per second.

#### Configure and troubleshoot VMFS datastores using vmkfstools

- You can do a lot with this command so refer to [vSphere Command-Line Interface Reference](#) for further detail and description of the command syntax.

```
vmkfstools <conn_options> <options> <target>
```

If <target> is a file system, <options> can be one of the following:

```
--createfs [blocksize]kK|mM --setfsname <fsname> --queryfs --extendfs <span_partition> <head_partition>
```

If <target> is a virtual disk, <options> can be one of the following:

```
--clonevirtualdisk --createdrm --createdrmpassthru --createvirtualdisk <size>kK|mM|gG --adapertype <type> --diskformat <format> <location> --deletevirtualdisk --diskformat --extendvirtualdisk --geometry --inflatedisk --querydrum --renamevirtualdisk <oldName> <newName> --writezeros
```

#### Troubleshoot snapshot and resignaturing issues

- The vicfg-volume command supports resignaturing a snapshot volume and mounting and unmounting the volume. Refer to [vSphere Command-Line Interface Reference](#) for further detail and description of the command syntax.

```
vicfg-volume [<connection_options>]
```

```
[--help |
```

```
--list |  
  
--persistent-mount <VMFS-UUID|label> |  
  
--resignature <VMFS-UUID|label> |  
  
--umount <VMFS-UUID|label> |  
  
--vihost <esx_host>]
```

Check out [this blog](#) for some more information and a discussion on using the vicfg-volume command.

#### **Other relevant blogs and websites related to this section**

##### VMware Storage Resolution Paths

<http://www.virtualinsanity.com/index.php/2010/03/16/performance-troubleshooting-vmware-vsphere-storage/>

Ton of Troubleshooting Links at <http://vsphere-land.com/tag/troubleshooting>

<http://www.vcritical.com/2009/10/easy-recovery-from-a-full-vmware-esx-datastore/>

<http://www.virtuallyghetto.com/2010/06/esxcli-part1-what-is-esxcli.html>

<http://www.yellow-bricks.com/2009/03/18/iscsi-multipathing-with-esxcliexploring-the-next-version-of-esx/>

<http://www.punchingclouds.com/?p=965>

<http://professionalvmware.com/2010/02/manage-vmfs-file-systems-using-the-cli-vcdx-prep/>



## Objective 6.5 – Troubleshoot vCenter Server and ESX/ESXi Host Management

### Knowledge

- Identify CLI commands and tools used to troubleshoot management issues

### Skills and Abilities

- Troubleshoot vCenter Server service and database connection issues
- Troubleshoot the ESX Service Console firewall
- Troubleshoot ESX/ESXi server management and connectivity issues
- Determine the root cause of vSphere management or connectivity issue

### Tools

- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-\*

## Notes

### Troubleshoot vCenter Server service and database connection issues

- Troubleshooting vCenter server and db issues can be at times frustrating, but it is important to note as [this blog entry](#) did that your virtual center issue may not be like all the others you are reading about. Be cautious and check all the little things including the SQL server backend.
- A good KB on this is for [Troubleshooting the Virtual Center Server Service when it fails to start](#).

### Troubleshoot the ESX Service Console firewall

From the man pages for the esxcfg-firewall command:

esxcfg-firewall provides an interface to query and modify the service console firewall settings.

#### OPTIONS

-q -query

Displays the current firewall settings.

-q -query service name

Displays the state of the specified service.

-q -query incoming|outgoing

Displays the whether or not incoming/outgoing ports are blocked by default.

-s -services

Lists the known firewall services.

-l -load

Load the current firewall settings.

-r -resetDefaults

Resets all firewall parameters to their default values.

-blockIncoming

Block all incoming connections on non-required ports. This is the default.

-blockOutgoing

Block all outgoing connections on non-required ports. This is the default.

-allowIncoming

Allow incoming connections on all ports.

-allowOutgoing

Allow outgoing connections on all ports.

-e -enableService service

Opens the ports in the firewall required by the specified service.

-d -disableService service

Closes the ports in the firewall required by the specified service.

-o -openPort -AR -port,tcp|udp,in|out,name

Opens a port in the firewall. Closes a port previously opened by -openPort.

-h -help

Print a brief usage message.

#### EXAMPLES

esxcfg-firewall -query sshClient

esxcfg-firewall -openPort 873,tcp,in,"rsync"

esxcfg-firewall -enableService sshClient

### Troubleshoot ESX/ESXi server management and connectivity issues

- This VMworld presentation from last year goes through some good vCenter troubleshooting <http://www.vmworld.com/docs/DOC-3969>
- **Determine the root cause of vSphere management or connectivity issue**  
Again you may see many issues that appear the same but are different than others. Refer to the [resolution paths](#) for some great information and troubleshooting steps on this.

### Other relevant blogs and websites related to this section

<http://communities.vmware.com/servlet/JiveServlet/previewBody/9880-102-2-7747/SysMan.htm>

<http://myvirtualcloud.net/?p=163>

Lot's of good links for vCenter server here: <http://vsphere-land.com/tag/vcenter-server>

<http://vmware-land.com/esxcfg-help.html>

<http://www.yellow-bricks.com/2010/03/10/changing-the-directory-of-your-vsphere-vcenter-log-files/>

<http://answers.oreilly.com/topic/1627-how-to-open-and-close-a-firewall-port-via-the-console-on-a-vmware-server/>

## Section 7 – Secure a vSphere Environment

### Objective 7.1 – Secure ESX/ESXi Hosts

#### Knowledge

- Identify configuration files related to network security
- Identify virtual switch security characteristics

#### Skills and Abilities

- Add/Edit Remove users/groups on an ESX Host
- Customize SSH settings for increased security
- Enable/Disable certificate checking
- Generate ESX Host certificates
- Enable ESXi lockdown mode
- Replace default certificate with CA-signed certificate
- Configure SSL timeouts
- Secure ESX Web Proxy
- Enable strong passwords and configure password policies
- Identify methods for hardening virtual machines
- Analyze logs for security-related messages

#### Tools

- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-user
- vifs

## Notes

### Add/Edit Remove users/groups on an ESX Host

- You can manage this through the gui as shown [here](#) or using the vicfg-user command as shown below.

```
vicfg-user <conn_options> -e <user | group> -o <add | modify | delete | list> [options]
```

### Customize SSH settings for increased security

- Disabled by default for root. You can use SU to elevate to root privileges and should never allow root access via SSH.
- If needed you can enable root access as shown [here](#).

### Enable/Disable certificate checking

- You can follow the guide from VMware [here](#) for enabling/disabling certificate checking.

### Generate ESX Host certificates

- Read the below section on Replacing the default certificate to get guidance on generating a host certificate.

### Enable ESXi lockdown mode

- Can be enabled during host addition to vCenter
- Can be set by going to Configuration—>Software—Security Profile
- A good read on the topic of ESXi lockdown can be found [here](#).

### Replace default certificate with CA-signed certificate

- Check out [this article from vm-help.com](#) for an in depth instruction on replacing the default certificate with a CA signed one.

### Configure SSL timeouts

#### [From the ESX Configuration Guide](#)

Timeout periods can be set for two types of idle connections:

- The Read Timeout setting applies to connections that have completed the SSL handshake process with port 443 of ESX.
- The Handshake Timeout setting applies to connections that have not completed the SSL handshake process with port 443 of ESX.
- Both connection timeouts are set in milliseconds. Idle connections are disconnected after the timeout period. By default, fully established SSL connections have a timeout of infinity.

- 1 Log in to the service console and acquire root privileges.
- 2 Change to the directory `/etc/vmware/hostd/`.
- 3 Use a text editor to open the `config.xml` file.
- 4 Enter the `<readTimeoutMs>` value in milliseconds.

For example, to set the Read Timeout to 20 seconds, enter the following command.

```
<readTimeoutMs>20000</readTimeoutMs>
```

- 5 Enter the `<handshakeTimeoutMs>` value in milliseconds.

For example, to set the Handshake Timeout to 20 seconds, enter the following command.

```
<handshakeTimeoutMs>20000</handshakeTimeoutMs>
```

- 6 Save your changes and close the file.
- 7 Enter the following command to restart the `vmware-hostd` process.

```
service mgmt-vmware restart
```

#### From ESXi config guide

Use the `vifs` command to get a copy of the `config.xml` file to edit.

- For Linux systems, use this command.

```
vifs --server <hostname> --username <username> --get /host/config.xml <directory>/config.xml
```

- For Windows systems, use this command.

```
vifs --server <hostname> --username <username> --get /host/config.xml <directory>\config.xml
```

- 2 Use a text editor to open the `config.xml` file.
- 3 Enter the `<readTimeoutMs>` value in milliseconds.

For example, to set the Read Timeout to 20 seconds, enter the following command.

```
<readTimeoutMs>20000</readTimeoutMs>
```

- 4 Enter the `<handshakeTimeoutMs>` value in milliseconds.

For example, to set the Handshake Timeout to 20 seconds, enter the following command.

```
<handshakeTimeoutMs>20000</handshakeTimeoutMs>
```

- 5 Save your changes and close the file.

- 6 Use the `vifs` command to put a copy of the `config.xml` file on the ESXi host.

- For Linux systems, use this command. `vifs --server <hostname> --username <username> --put <directory>/config.xml /host/config.xml`
- For Windows systems, use this command.

```
vifs --server <hostname> --username <username> --put <directory>\config.xml /host/config.xml
```

7 Use the Restart Management Agents operation through the direct console to have the settings take effect.

### **Secure ESX Web Proxy**

- Check the sections for both the ESX(i) config guides for configuring the web proxy.

### **Enable strong passwords and configure password policies**

- For ESX you will issue the command like shown below.  
`esxcfg-auth -maxpassdays=90 -minpassdays=30 -passwarnage=75`
- This blog article is also another good read on the topic of password complexity  
[http://www.vm-help.com/esx40i/password\\_complexity.php](http://www.vm-help.com/esx40i/password_complexity.php)

### **Identify methods for hardening virtual machines**

The [vSphere security hardening guide](#) is a great resource for this section. It is very detailed and has a lot of options. Here are just a few from the document below.

- Prevent Virtual Disk Shrinking-Readily inducing this from within the guest could cause a DOS attack.
- Prevent other users from viewing remote console session(multiple at a time)
- *RemoteDisplay.maxConnections=1*
- Disable VM to VM communication through VMCI

### **Analyze logs for security-related messages**

Some log file description here.

<http://www.vadapt.com/2010/03/vsphere-securitylog-files/>

## Objective 7.2 – Configure and Maintain the ESX Firewall

### Knowledge

- Identify vicfg-firewall commands
- Explain the three firewall security levels
- Identify ESX firewall architecture with/without vCenter Server

### Skills and Abilities

- Enable/Disable pre-configured services
- Configure service behavior automation
- Open/Close ports in the firewall
- Create a custom service
- Set firewall security level

### Tools

- ESX Configuration Guide
- ESXi Configuration Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Client
- vSphere CLI
- vicfg-firewall



## Notes

### Enable/Disable pre-configured services

- `esxcfg -e service`
- `esxcfg -d service`

### Configure service behavior automation

????????????????????

### Open/Close ports in the firewall

- Allow syslog outgoing traffic:
- `esxcfg-firewall -o 514,udp,out,syslog`
- Close a port
- `esxcfg-firewall -c 514,udp,out,syslog`

### Create a custom service

[http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=1001081](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1001081)

<http://www.yellow-bricks.com/2007/12/31/howto-adding-a-firewall-service-on-esx/>

### Set firewall security level

- View security level
- `esxcfg-firewall -q incoming`  
  
`esxcfg-firewall -q outgoing`
- Set medium security
- `esxcfg-firewall --allowOutgoing --blockIncoming`
- Set low security
- `esxcfg-firewall --allowIncoming --allowOutgoing`
- Set high security (default)
- `esxcfg-firewall --blockIncoming --blockOutgoing`
- Setting the level requires a restart of vmware-hostd
- `service mgmt-vmware resetart`

## Objective 7.3 – Deploy and Administer vShield Zones

### Knowledge

- Identify vShield Zones components
- Identify the four CLI command modes

### Skills and Abilities

- Configure vShield Zones
- Backup and restore vShield Manager Data
- Backup CLI Configuration
- Create/Delete Layer 2/3/4 firewall rules using VM Wall
- Install/Uninstall a vShield manually and from template
- Configure vShield Manager plug-in capability
- Configure VM Flow charts
- Update vShield Zones
- Add/Edit/Delete User Accounts
- Assign rights to a user
- Add/Delete Application-Port Pair mapping
- Execute/Schedule Execution of virtual machine discovery
- Utilize vShield Zones CLI commands to configure and monitor vShield Zones
- Analyze traffic using VM Flow to determine root cause of network related issues

### Tools

- vShield Zones QuickStart Guide
- vShield Zones Administration Guide
- Introduction to vShield Zones
- Product Documentation
- vShield Manager
- vShield CLI
- vSphere Client

## Notes

### Identify vShield Zones components

vShield Zones consist of two main components

- vShield manager-management center for all distributed vShield instances. Provides monitoring, configuration, and software updating for your vShields.
- vShield-The active security component of vShield zones. A vShield is installed on each ESX host you want to protect. It will monitor traffic between hosts as well as between virtual machines on the host.

### Identify the four CLI command modes

From the vShield Zones Administration Guide

- Basic: Basic mode is a read-only mode. To have access to all commands, you must enter Privileged mode.
- Privileged: Privileged mode commands allow support-level options such as debugging and system diagnostics. Privileged mode configurations are not saved upon reboot. You must run the write memory command to save Privileged mode configurations.
- Configuration: Configuration mode commands allow you to change the current configuration of utilities on a vShield Zones virtual machine. You can access Configuration mode from Privileged mode. From Configuration mode, you can enter Interface configuration mode.
- Interface Configuration: Interface Configuration mode commands allow you to change the configuration of virtual machine interfaces. For example, you can change the IP address and IP route for the management port of the vShield Manager.

### Backup and restore vShield Manager Data

pg 19-21

### Backup CLI Configuration

pg 43-44

### Create/Delete Layer 2/3/4 firewall rules using VM Wall

pg 48-50

### Install/Uninstall a vShield manually and from template

pg 41

### Configure vShield Manager plug-in capability

page 18

### Configure VM Flow charts

pg 52-54

### Update vShield Zones

pg 21-22

### Add/Edit/Delete User Accounts

pg 23-25

### Assign rights to a user

pg 24

### Add/Delete Application-Port Pair mapping

pg 54-56

**Execute/Schedule Execution of virtual machine discovery**

pg 58-59

**Utilize vShield Zones CLI commands to configure and monitor vShield Zones**

pg 65

**Analyze traffic using VM Flow to determine root cause of network related issues**

pg 51

**Other Relevant Reading Related To This Section**

<http://kendrickcoleman.com/index.php?/Tech-Blog/testing-out-vshield-zones.html>

[http://searchvmware.techtarget.com/tip/0,289483,sid179\\_gci1363051\\_mem1,00.html](http://searchvmware.techtarget.com/tip/0,289483,sid179_gci1363051_mem1,00.html)

[http://kb.vmware.com/selfservice/microsites/search.do?cmd=displayKC&docType=kc&externalId=1022536&sliceId=1&docTypeID=DT\\_KB\\_1\\_1&dialogID=112324054&statId=1%200%20106992832](http://kb.vmware.com/selfservice/microsites/search.do?cmd=displayKC&docType=kc&externalId=1022536&sliceId=1&docTypeID=DT_KB_1_1&dialogID=112324054&statId=1%200%20106992832)

- [VCAP-DCA Objective 3.5 – Utilize Advanced vSphere Performance Monitoring Tools](#)
- [VCAP-DCA Objective 3.4 – Perform Capacity Planning in a vSphere Environment](#)

## Section 8 – Perform Scripting and Automation

### Objective 8.1 – Execute VMware Cmdlets and Customize Scripts Using PowerCLI

#### Knowledge

- Identify vSphere PowerCLI requirements
- Identify Cmdlet concepts
- Identify environment variables usage

#### Skills and Abilities

- Use VMRun to execute commands in a guest OS
- Install vSphere PowerCLI
- Install Update Manager PowerShell Library
- Use basic and advanced Cmdlets to manage VMs and ESX Hosts
- Use Web Service Access Cmdlets
- Use Datastore and Inventory Providers
- Given a sample script, modify the script to perform a given action

#### Tools

- vSphere PowerCLI Installation Guide
- vSphere PowerCLI Administration Guide
- Product Documentation
- vSphere PowerCLI commands
- vSphere PowerCLI Cmdlets

## Notes

I am still learning when it comes to Powershell and have been compiling a list of resources at <http://www.vfail.net/powercli/> as I discover them. One I found particularly useful was from virtualize planet. There is a [set of guides](#) that take you from the beginner level to someone who can play around a bit more and start utilizing Powershell to the fullest.

Additionally I highly recommend [Trainsignal's Powershell training](#), that comes as part of the first and second pro series. I still have some ways to go through the advanced topics in the second part of the pro series, but have found the first part to be an amazing resource when it comes to learning how to use Powershell and then apply that learning to automate more tasks in your environment. This training is led by Powershell guru Hal Rottenberg who also has authored a book on the topic if you are not familiar.

For full disclosure the link above to the Trainsignal training is an affiliate link.

### Use VMRun to execute commands in a guest OS

- Install VMware VIX(Windows or Linux)
- VMware Tools must be installed in Guest O/S
- C:\Program Files (x86)\VMware\VMware VIX\vmrun.exe
- [http://www.vmware.com/pdf/vix160\\_vmrun\\_command.pdf](http://www.vmware.com/pdf/vix160_vmrun_command.pdf)
- [http://www.virtuatopia.com/index.php/Controlling\\_VMware\\_Virtual\\_Machines\\_from\\_the\\_Command\\_Line\\_with\\_vmrun#The\\_Basics\\_and\\_Syntax\\_of\\_vmrun](http://www.virtuatopia.com/index.php/Controlling_VMware_Virtual_Machines_from_the_Command_Line_with_vmrun#The_Basics_and_Syntax_of_vmrun)
- <http://blogs.vmware.com/vix/2008/12/managing-vm-guests-using-vmrun.html>
- [http://www.virtuallyghetto.com/p/vmware-vix\\_29.html](http://www.virtuallyghetto.com/p/vmware-vix_29.html)

### Install vSphere PowerCLI

- Both the download and documentation can be found at [http://communities.vmware.com/community/vmttn/vsphere/automationtools/powercli?hl=en&rlz=&q=powercli&aq=f&aqi=g10&aql=&oq=&gs\\_rfai=](http://communities.vmware.com/community/vmttn/vsphere/automationtools/powercli?hl=en&rlz=&q=powercli&aq=f&aqi=g10&aql=&oq=&gs_rfai=)

### Install Update Manager PowerShell Library

- Pretty straight forward, You have two options here, standalone or as a plug-in.

### Use basic and advanced Cmdlets to manage VMs and ESX Hosts

- Refer to the links above to learn and get a grasp on Powershell. They do a great job of taking you from your basic Cmdlets all the way to more advanced options. As I mentioned above the Powershell training from Trainsignal was great as it was video led and led me to play around a bit more. The guides from Virtualizeplanet are also very good in getting you to understand the basics.

### **Use Web Service Access Cmdlets**

- vSphere PowerCLI Administration Guide pg 21
- The vSphere PowerCLI 4.0 list of cmdlets includes two Web Service Access cmdlets Get-View & Get-VIObjectByVIView

### **Use Datastore and Inventory Providers**

- From pg 24-26
- The Datastore Provider (VimDatastore) is designed to provide access to the contents of one or more datastores. The items in a datastore are files that contain configuration, virtual disk, and the other data associated with a virtual machine. All file operations are case-sensitive.

## Objective 8.2 – Administer vCenter Orchestrator

### Knowledge

- Identify vCenter Orchestrator requirements
- Identify default Orchestrator plug-ins

### Skills and Abilities

- Install and Configure vCenter Orchestrator
- Configure vCenter Orchestrator database
- Configure vCenter Orchestrator LDAP connection
- Configure vCenter Orchestrator vCenter server connections
- Run a Workflow
- Administer Actions, Tasks, Workflows and Policies
- Administer Packages
- Identify appropriate Workflow for a given management activity

### Tools

- vCenter Orchestrator Installation and Configuration Guide
- vCenter Orchestrator Administration Guide
- Product Documentation
- vCenter Orchestrator Web Configuration
- vCenter Orchestrator Client
- vSphere Client



## Notes

I am a newcomer to orchestrator and am still feeling my way around. I'd recommend you check out the vCenter Orchestrator team's blog at <http://www.vcoteam.info/>. Other than that you will want to pop open the installation and configuration guide and play around from there.

### Identify vCenter Orchestrator requirements

- Hardware
- 4 GB RAM, 2GB Disk, Static IP, 2.0 GHZ+ CPU
- Software
- Working LDAP server in your infrastructure
- Web browser(Firefox 3.0, 3.5 IE 7)
- DB recommended on separate machine from server.

### Identify default Orchestrator plug-ins

- Mail Plug-in
- SSH plug-in
- vCenter 4.x plugin
- vCO Library
- WebOperator
- Enumeration
- NET
- XML
- Database
- Non-Default(Microsoft,VI3,Perspectives)

### Install and Configure vCenter Orchestrator

- You can install Orchestrator with vCenter Server or as a standalone installation.
- Pg 19 of the [vCenter Orchestrator Installation and Configuration Guide](#)

### Configure vCenter Orchestrator database

- pg 46 of the [vCenter Orchestrator Installation and Configuration Guide](#)

### Configure vCenter Orchestrator LDAP connection

- Pg 39-45 of [vCenter Orchestrator Installation and Configuration Guide](#)

### Run a Workflow

- pg 31-32 of the [vCenter Orchestrator Administration Guide](#)

#### **Administer Actions, Tasks, Workflows and Policies**

- Chapter 6, pg 51 of the [vCenter Orchestrator Administration Guide](#)

#### **Administer Packages**

- Pg 55, Chapter 7 of the [vCenter Orchestrator Administration Guide](#)

#### **Identify appropriate Workflow for a given management activity**

- Chapter 3 of the [vCenter Orchestrator Administration Guide](#)

## Objective 8.3 – Administer vSphere Using the vSphere Management Assistant

### Knowledge

- Identify VMA prerequisites
- Identify VMA specific commands
- Determine when VMA is needed

### Skills and Abilities

- Install and Configure VMA
- Add/Remove target servers
- Perform updates to the VMA
- Use VMkfstools to manage VMFS datastores
- Use VMware-cmd to manage VMs
- Use esxcli to manage Storage Multipathing
- Troubleshoot common VMA errors and conditions

### Tools

- vSphere Management Assistant Guide
- vSphere Command-Line Interface Installation and Scripting Guide
- Product Documentation
- vSphere Management Appliance
- vifp (vifpinit has been replaced by vifptarget)
- vima-update
- vSphere CLI
- vicfg-\*
- VMkfstools
- esxcli
- VMware-cmd
- vSphere Client

## Notes

Another section of the VCAP covered here briefly. It's no secret as noted [here](#) that the service console is on its way out, so knowledge of command-line based administration and the vMA has become even more important. The vMA is a CentOS based virtual machine packaged with the vSphere CLI and vSphere SDK for Perl. It allows the ability to run scripts against ESX/ESXi as well as vCenter and now includes active directory authentication with the 4.1 release. The vMA can also be used as a syslog server, which is a necessity when using ESXi as the logs are not retained after a reboot.

Before reading through any of the blueprint outline below I would recommend giving the [vMA 4.1 guide](#) a quick read. It details all the steps to setup a working vMA appliance.

You can download the appliance [here](#)

You should also check out these two blog posts

1. [Blog](#) on setting up for AD authentication
2. [Blog](#) on setting up your vMA appliance as a log host (not necessarily relevant to this section of the blueprint but important nonetheless)

### Install and Configure vMA

- Pretty straight forward, import the .OVF and follow the prompts.
- Read the blogs mentioned above for setting up AD authentication, which can also be found in the admin guide. AD authentication is new to 4.1 so it is not currently on the blueprint but I imagine it will be added soon.

### Add/Remove target servers

- Sudo vifp addserver <FQDN ESX host>
- Sudo vifp remove <FQDN ESX host>
- Sudo vifp reconfigure <FQDN ESX host>

### Perform updates to the vMA

- sudo vma-update info
- sudo vma-update scan
- sudo vma-update

### Use vmkfstools to manage VMFS datastores

From the [vSphere Command-Line Interface Reference](#):

*You use the vmkfstools vSphere CLI to create and manipulate virtual disks, file systems, logical volumes, and physical storage devices on an ESX/ESXi host. You can use vmkfstools to create and manage a virtual machine file system (VMFS) on a physical partition of a disk and to manipulate files, such as virtual disks, stored on VMFS-3 and NFS. You can also use vmkfstools to set up and manage raw device mappings (RDMs).*

You will want to use this command extensively and go through all of its options.

```
vmkfstools <conn_options> <options> <target>
```

If <target> is a file system, <options> can be one of the following:

```
--createfs [blocksize]kK|mM --setfsname <fsname>

--queryfs

--extendfs <span_partition> <head_partition>
```

If <target is a virtual disk, <options> can be one of the following:

```
--clonevirtualdisk

--createdrm

--createdrmpassthru

--createvirtualdisk

    <size>kK|mM|gG

    --adaptype <type>

    --diskformat <format> <location>

--deletevirtualdisk

--diskformat

--extendvirtualdisk

--geometry

--inflatedisk

--querydrm

--renamevirtualdisk <oldName> <newName>

--writezeros
```

```
vmkfstools -C vmfs3 -b 2m vmhba1:3:0:1
```

#### Use `vmware-cmd` to manage VMs

- From the [vSphere Command-Line Interface Reference](#):
- *vmware-cmd provides an interface to perform operations on a virtual machine. You can retrieve information such as the power state, register and unregister the virtual machine, set configuration variables, and manage snapshots.*
- Again you will need to go through this command and the options extensively. A good example that every VMware admin has encountered at some point, resolving a stuck virtual machine, can be found [here](#).

```
vmware-cmd [--help | -q | -v]
```

## Server Operations

```
vmware-cmd -s <conn_option>
```

```
[-l |
```

```
-s register <config_file_path> [<datacenter>] [<resource_pool>] |
```

```
-s unregister <config_file_path> ]
```

## Virtual Machine Operations

```
vmware-cmd <conn_option> <config_file_path>
```

```
[answer |
```

```
connectdevice <device_name> |
```

```
createsnapshot <name> <description> quiesce [0|1] memory [0|1] |
```

```
disconnectdevice <device_name> |
```

```
getconfigfile |
```

```
getguestinfo <variable> |
```

```
getproductinfo [product|platform|build|majorversion|minorversion] |
```

```
getstate |
```

```
gettoolslastactive |
```

```
getuptime |
```

```
hassnapshot |
```

```
reset [soft|hard] |
```

```
removesnapshots
```

```
revertsnapshot |
```

```
setguestinfo <variable> <value> |
```

```
start |
```

```
suspend [soft|hard] ]
```

## Use esxcli to manage Storage Multipathing

- Use the vicfg-mpath and vicfg-mpath35(for esx 3.5 hosts) to configure and manage storage multipathing.
- [This blog](#) entry shows off a little powershell for setting a preferred path. Most of the reference for storage multipathing will be from the below. Additionally the [vSphere Troubleshooting course](#) is a good target for this type of exercise.

From the [vSphere Command-Line Interface Reference](#):

*The vicfg-mpath command supports listing information about Fibre Channel or iSCSI LUNs and changing a path's state.*

vicfg-mpath [<conn\_options>]

```
[--help |  
  
--list [--path <path> | --device <device>] |  
  
--list-compact [--path <path> | --device <device>] |  
  
--list-map [--path <path> | --device <device>] |  
  
--list-paths [--device <device>] |  
  
--list-plugins |  
  
--state [active|off] ]
```

## Troubleshoot common vMA errors and conditions

- Refer to the Troubleshooting vMA section of the [vMA Administration Guide](#)
- By far the best resource for vMA information can be found at the blog [virtuallyGhetto](#)

## Other relevant blogs and websites related to this section

- **vMA Setup**  
<http://communities.vmware.com/community/vmttn/vsphere/automationtools/vima>  
[http://www.vmware.com/support/developer/vima/vma41/doc/vma\\_41\\_guide.pdf](http://www.vmware.com/support/developer/vima/vma41/doc/vma_41_guide.pdf)  
<http://geeksilver.wordpress.com/2010/07/22/how-to-use-vma-4-1-installation-configuration/>  
<http://www.simonlong.co.uk/blog/2010/05/28/using-vma-as-your-esxi-syslog-server/>  
<http://www.virtuallyghetto.com/2010/05/getting-started-with-vma.html>
- **vmkfstools**  
[http://pubs.vmware.com/vi35/wwwhelp/wwhimpl/common/html/wwhelp.htm?context=server\\_config&file=sc\\_appb.21.1.html](http://pubs.vmware.com/vi35/wwwhelp/wwhimpl/common/html/wwhelp.htm?context=server_config&file=sc_appb.21.1.html)  
<http://www.vmware.com/support/developer/vcli/vcli41/doc/reference/vmkfstools.html>
- **vmware-cmd**  
<http://www.vmware.com/support/developer/vcli/vcli41/doc/reference/vmware-cmd.html>  
<http://www.vmware.com/support/esx2/doc/vmware-cmd.html>  
<http://www.yellow-bricks.com/2009/04/15/the-basics-how-to-kill-a-vm-thats-stuck-during-shutdown/>
- **vicfg-mpath**  
<http://www.vmware.com/support/developer/vcli/vcli41/doc/reference/vicfg-mpath.html>  
<http://virtuallynil.com/2010/02/12/setting-preferred-paths-in-esxi/>  
<http://photomission.co.uk/2010/10/04/vcap-dca-8-3/>

## Section 9 – Perform Advanced vSphere Installations and Configurations

### Objective 9.1 – Install ESX Server with custom settings

#### Knowledge

- Identify Service Console memory defaults and maximums
- Identify default and optional ESX partitions

#### Skills and Abilities

- Configure optional ESX partitions during installation
- Install/uninstall custom drivers
- Configure advanced bootloader options
- Configure kernel options
- Given a scenario, determine when to customize a configuration

#### Tools

- ESX and vCenter Server Installation Guide
- Product Documentation
- vSphere CLI
- vicfg-advcfg
- vicfg-module
- vSphere Client



## Notes

### Identify Service Console memory defaults and maximums

With vSphere 4.x the default is not exactly cut and dry. The default is 300mb, however with amounts of ram 16GB or larger the default will actually be more. The maximum is 800 MB regardless. As for answering this question in a lab I'm not sure it will really matter. Just be aware of these things and check out [this excellent blog article by Duncan Epping](#) on the topic.

### Identify default and optional ESX partitions

A default ESX installation will leave you with the below configuration. Note this was with a 40 GB disk so you will have more space on your vmfs volume with a bigger drive.

Service Console Partitions:	vmkcore	110 MB	
	vmfs3	39.75 GB	
	swap	600 MB	
	ext3	5.00 GB	/
	ext3	1.10 GB	/boot
	ext3	2.00 GB	/var/log

Additionally you may create other partitions.

/opt Some of the logging occurs here for HA and hardware agents so it may be best to move this partition out to it's own to prevent root from filling up. Read [Jason Boche's blog](#) to read more about this.

/tmp Another good one to move outside of root to prevent it from taking up space?

/home not necessarily needed anymore but again if its used you risk filling up root by not having a seperate mount point.

/var You may want to create the mount point here to dedicate more space to /var/log and /var/core and to prevent filling up your root directory.

### Install/uninstall custom drivers

- Can be done during ESX installation or post installation using vCenter Update manager or the vSphere CLI.
- Cannot be done using PXE

### Configure advanced bootloader options

- If you deselect the Configure boot loader automatically check box, the Bootloader Options page will appear.
- Enter bootloader kernel arguments. These arguments will be written to the grub.conf file and they will be passed to the ESX kernel every time ESX boots.
- An optional bootloader password of up to 30 characters can be entered.
- By default the GRUB bootloader is installed in the MBR. For legacy hardware that stores BIOS info in the MBR, click Install GRUB on the first partition of the disk instead.

### Configure kernel options

- In the advanced setup you can specify kernel arguments to be written to the grub.conf file and passed to the kernel every time ESX boots.

[http://www.vmware.com/pdf/vsphere4/r40/vsp\\_40\\_esx\\_vc\\_installation\\_guide.pdf](http://www.vmware.com/pdf/vsphere4/r40/vsp_40_esx_vc_installation_guide.pdf)

Given a scenario, determine when to customize a configuration

### **vicfg-advcfg**

- The vicfg-advcfg command offers a number of low-level advanced options.
- Most options are not intended for customer use. You might use this command when VMware Technical Support or a VMware Knowledge Base article instruct you to do so.
- You can use the vicfg-advcfg -s option to enable and disable CIM providers.

Set a VMkernel option:

```
vicfg-advcfg <conn_options> --set-kernel 1 assumeCommonBusClock
```

Set the value of a specific configuration item given its identifying path and the value to set:

```
vicfg-advcfg <conn_options> -s 1 VMkernel.Boot.xapicForce
```

### **vicfg-module**

- The vicfg-module command supports setting and retrieving VMkernel module options. This command is a vSphere CLI implementation of the esxcfg-module service console command, but it supports only some of the options esxcfg-module supports. The command is commonly used when VMware Technical Support, a Knowledge Base article, or VMware documentation instruct you to do so.

Configure a supported NIC to use NetQueue:

```
vicfg-module <conn_options> -s "intr_type=2 rx_ring_num=8" s2io
```

Verify that NetQueue has been configured:

```
vicfg-module <conn_options> -g s2io
```

List the set of modules on the host:

```
vicfg-module <conn_options> -l
```

### ***Other relevant blogs and websites related to this section***

<http://vmetc.com/2009/07/22/best-practices-for-vsphere-esx-4-service-console-partitions/>

<http://www.yellow-bricks.com/2009/05/27/partitioning-your-esx-host-part-ii/>

## Objective 9.2 – Plan and Execute Scripted Installations

### Knowledge

- Identify default installation scripts
- Identify boot options for scripted installation

### Skills and Abilities

- Perform a scripted ESX Host installation
- Perform a scripted ESXi Host installation
- Configure media repository
- Edit installation script parameters
- Configure pre/post script tasks
- Evaluate use cases for scripted installation

### Tools

- ESX and vCenter Server Installation Guide
- Product Documentation
- ks-first-safe.cfg
- ks-first.cfg

## Notes

Something on topic and cool is the ultimate deployment appliance mentioned by [Jeremy Waldrop](#) and [Mike Laverick](#). This appliance lets you install all types of base operating systems, now including VMware.

### Identify default installation scripts

- When you install using a default installation script, the default root password is mypassword.
- The installation media contains the following default installation scripts:

#### ESXi

ks.cfg Installs ESXi on the first detected disk

#### ESX

ks-first-safe.cfg -Installs ESX on the first detected disk and preserves the VMFS datastores on the disk.

ks-first.cfg- Installs ESX on the first detected disk.

Additionally, after your first interactive installation of ESX, the installer creates a /root/ks.cfg script in the ESX filesystem. This script reflects the choices you made in the interactive installation.

### Identify boot options for scripted installation

Scripted Install Option	Description
<b>ESX Scripted Install using USB ks.cfg and customize the ks= option in the boot options list.</b>	To specify a custom script that is not located on the USB: a Select the USB option as a template. b Customize the ks= option to specify the actual name and location of the custom script.  The script must be located at one of the supported locations. See <a href="#">Step 4</a> .
<b>ESX Scripted Install using USB ks.cfg</b>	Custom installation script located on a USB device attached to the machine. For this option, the script filename must be ks.cfg.
<b>ESX Scripted Install to first disk</b>	Default installation script included with the ESX media. You cannot customize this script. The default root password is mypassword.
<b>ESX Scripted Install to first disk (overwrite VMFS)</b>	Default installation script included with the ESX media. You cannot customize this script. The default root password is mypassword.

(Optional) At the end of the boot options list, enter a ks= command.

ks= Option	Description
ks=cdrom:/ks.cfg	Installation script is located on the DVD-ROM drive attached to the machine.
ks=file://<path>/ks.cfg	Installation script is at <path> which resides inside the initial ramdisk image.
ks=ftp://<server>/<path>/ks.cfg	Installation script is located at the given URL.
ks=http://<server>/<path>/ks.cfg	Installation script is located at the given URL.
ks=nfs://<server>/<path>/ks.cfg	Installation script is located at <path> on a given NFS server.

## Perform a scripted ESX Host installation

- Use [this guide from VMware](#) to learn more about the syntax involved in creating scripted installation scripts.
- The installation script can reside in one of the following locations:

- Default installation script
- FTP
- HTTP/HTTPS
- NFS
- USB flash drive
- Local disk

## Perform a scripted ESXi Host installation

Check out VMware's guide for [Deploying ESXi 4.1 using the Scripted Install](#) feature.

Some important things to note from it:

- You can boot the scripted installation with a CD-ROM drive or over the network using PXE booting
- It supports scripted installations of ESXi to local and remote disks
- All configuration directives initiated by the installation script are logged in the `/var/log/weasel.log` file of the ESXi host
- Scripted Install is available only with the Installer version of ESXi and is not available in the Embedded version of ESXi
- You cannot use Scripted Install to install ESXi Installable to a USB device

Additionally you will want to check out the [ESXi installable and vCenter Server Setup Guide](#).

Scripted installations include the following steps:

- Create a script using the supported commands.
- Edit the installation script as needed to change settings that are unique for each host.
- Run the scripted installation.

The installation script can reside in one of the following locations:

- Default installation script
- FTP
- HTTP/HTTPS
- NFS

When creating the script there are two main approaches you can take

- Create multiple scripts, each containing unique network identification information. The unique network information includes the static IP address and host name of each ESXi host.
- Create one script (or use a default script) that uses DHCP to set up multiple ESXi hosts. After you complete a scripted installation, you can configure each ESXi host separately to assign a unique host name and IP address. VMware recommends that you use static IP addresses.

### **Configure media repository**

This [blog from Virtual Kenneth](#) goes through a lot of the above but additionally will give a good guide on setting up an ESXi source repository on a Windows box.

Another good set of blogs on the topic are from [Simon Long](#). The link is to the first of a three part series on rapid deployment of ESXi.

### **Configure pre/post script tasks**

For the above topics read the guides to learn the proper configuration options if you do not already know them. Additionally you can use the output of a ESX installation to give you a good example of what a scripted installation file will look like based on the configuration options you are choosing. This file will be found at `/root/ks.cfg`

### **Evaluate use cases for scripted installation**

Automating deployment which will save time and eliminate human error on the setup part.

### **Other relevant blogs and websites related to this section**

[http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=1022308](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1022308)

<http://vinternals.com/2009/07/unattended-esxi-installation/>

## Objective 9.3 – Configure vCenter Server Linked Mode

### Knowledge

- Identify Linked Mode Prerequisites
- Identify differences between Linked and non-linked vCenter Server Configurations
- Identify when a role requires reconciliation

### Skills and Abilities

- Reconcile Roles in a Linked Mode Configuration
- Create and Join a Linked Mode Group
- Determine use cases for vCenter Server Linked Mode
- Troubleshoot Linked Mode Configurations

### Tools

- ESX and vCenter Server Installation Guide
- vSphere Datacenter Administration Guide
- Product Documentation
- vSphere Client

## Notes

- Available with Standard licensing and above.
- Uses ADAM DB
- Supported amount of hosts/VMs is 3000/10,000

### Identify Linked Mode Prerequisites

Refer to the weblink below for more information about Linked Mode.

[http://pubs.vmware.com/vsp40\\_e/wwhelp/wwhimpl/js/html/wwhelp.htm#context=admin&file=c\\_using\\_vcenter\\_server\\_in\\_linked\\_mode.html](http://pubs.vmware.com/vsp40_e/wwhelp/wwhimpl/js/html/wwhelp.htm#context=admin&file=c_using_vcenter_server_in_linked_mode.html)

Linked Mode vCenter Servers must meet all the requirements of a standard build plus:

- Operational DNS for Linked Mode Replication
- Two way trust relationship if in different domain or the same domain for vCenter servers that are linked
- An account with admin privileges on both the existing and to be linked vCenter server system.
- Network time must be synchronized amongst servers

### Identify differences between Linked and non-linked vCenter Server Configurations

#### Identify when a role requires reconciliation

Reconciliation will happen automatically when configuring linked mode if any differences exist that you have not yet resolved. If conflicts occur the role on the joining system is renamed.

#### Reconcile Roles in a Linked Mode Configuration

Again, refer to [VMware's online documentation](#) for reconciling roles in a linked mode config.

#### Create and Join a Linked Mode Group

Again, refer to [VMware's online documentation](#) for direction on creating and joining a linked mode group.

Note that the first vCenter server will be configured as a standalone while the others can join a Linked Mode group.

#### Determine use cases for vCenter Server Linked Mode

Linked mode is geared towards larger environments where administration may become more difficult. Linked mode helps with this by providing a scalable architecture that allows visibility across multiple instances of vCenter server. Roles, permissions, and license are replicated.

#### Troubleshoot Linked Mode Configurations

Again, refer to [VMware's online documentation](#) for direction on how to troubleshoot Linked Mode config. A lot of the setup is going to rely on your DNS and AD infrastructure so keeping in mind that those two pieces are crucial to this running is your first step in troubleshooting issues.



## Appendix

### CLI Syntax

The following are a list and description of commands you will need to know for the exam.

#### ESXCLI

Unlike other CLI commands, esxcli is not a Perl script. Esxcli has many other command options and can be run against a esx(i) host remotely, but not against vCenter Server. Below is a list of command options separated by namespace

Refer to [http://www.vmware.com/pdf/vsphere4/r40/vsp\\_40\\_vcli.pdf](http://www.vmware.com/pdf/vsphere4/r40/vsp_40_vcli.pdf)

Page 20 of this guide has a good support matrix listing out the commands and the ESX(i) versions they are supported on.

#### ESXCLI NMP

esxcli nmp device list –device <device>	Lists devices controlled by NMP
esxcli nmp path list	Shows paths claimed by NMP
esxcli nmp device setpolicy	Sets the PSP for the specified device
--default	Sets PSP back to default for the SATP assigned to device
--device	Device to set the PSP for.
--psp	PSP to assign to specified device
esxcli nmp psp list	Displays all available PSPs
Esxcli nmp psp getconfig --path	Retrieves PSP config parameters
Esxcli nmp psp setconfig –device <x> --path <x> --config <x>	Sets PSP config parameter for 3 <sup>rd</sup> party extension.
esxcli nmp fixed getpreferred --device	Retrieves preferred path on a specified device using NMP and fixed PSP
Esxcli nmp fixed setpreferred –device <x> --path <x>	Sets preferred command
Esxcli nmp roundrobin getconfig –device <x>	Get Round Robin config
Esxcli namp roundrobin setconfig –bytes –device –iops –type –useANO	Sets Round Robin config
Esxcli nmp satp addrule	Add claim rule
Esxcli nmp satp deleterule	Delete a claim rule
Esxcli nmp satp getconfig	Get config per path or per device
Esxcli nmp satp setconfig	Sets config per path or per device
Esxcli nmp satp list	Lists SATPs that are currently loaded into the NMP
Esxcli nmp satp listrules –satp	Lists the claim rules for SATPs
Esxcli swiscsi nic add –adapter --nic	Adds software iSCSI NIC to specified adapter.
Esxcli swiscsi nic remove –adapter –nic	Removes software iSCSI NIC
Esxcli swiscsi nic list –adapter <x>	List existing sw iSCSI for specified adapter
Esxcli corestorage claiming reclaim	Attempts to unclaim all paths to a device. Then runs the loaded claim rules to

	reclaim those paths.
Esxcli corestorage claiming unclaim	Unclaims a path or set of paths and disassociates those paths from a PSA plugin.
Esxcli corestorage claimrule add	Adds a claim rule to the set of claim rules on the sytem
Esxcli corestorage claimrule convert	Converts LUN masks in ESX 3.5 format to claim rule format.
Esxcli corestorage claimrule delete	Deletes a claim rule from the set of claim rules on the system
Esxcli corestorage claimrule list	Lists all claim rules on the system
Esxcli corestorage claimrule load	Loads claim rules from the esx.config configuration file into the VMkernel
Esxcli corestorage claimrule move	Moves a claim rule from one rule ID to another.
Esxcli corestorage claimrule run	Runs path claiming rules. This is for troubleshooting and boot time configs.

## RESXTOP/ESXTOP

### Commands

--server	You must specify the remote server
--vihost	Specify when connecting to a vCenter server
--portnumber	Specify a port socket to connect to (default 443)
--username	Specify a username, otherwise will prompt
-help	Print helps menu
-v	Prints version
-b	Enables batch mode
-s	Enables secure mode
-a	Show all stats
-c	Set config file (default .esxtop41rc)
-d	Set update delay (in seconds)
-n	Sets number of iterations to run esxtop

### Hot Keys

c	CPU View
D	Disk adapter view
e	Stats broken down per world
f	Add and Remove Fields
i	Interrupts view
m	Memory view
n	Network view
o	Changes order
u	Disk device view
v	Disk VM view

W	Save changed settings
y	Powerstate view

### VICFG-ADVCFG

--default <option>	Sets the value of a config item to default defined by VMkernel.
--get <option>	Gets value of config item
--get-kernel <boot_param.	Gets value of a VMkernel boot parameter
--set <value> <option>	Sets value of config option
--set-kernel <value><boot param>	Set value of VMkernel boot param
--set-message <message>	Sets DCUI welcome message.
--list	Lists all VMkernel advanced config options

### VICFG-AUTHCONFIG

--curentdomain	Displays domain currently joined to
--authscheme AD --joindomain <domain>	Joins the specified AD domain
--adpassword –adusername	Used with –joindomain if you do not want to specify a password.
--leavecurrentdomain –force	Use this option to leave a domain, specifying –force to force removal .
--getremoteauthstore	Prints active authentication mechanisms
--listauthstores	Prints supported authentication mechanisms

### VICFG-CFGBACKUP

--load <backupfile> --force	Loads a configuration to restore. With the –force option a restore of the configuration is forced.
--save	Backs up the host configuration. Running from VMA backup is saved locally on vMA
--reset	Resets a host to factory settings
--quiet	Performs operations quietly

### VICFG-DNS

--dhcp (yes/no)	Specifies whether DHCP should be used to determine the DNS config automatically.
--dns	Dns servers(s) in comma-separated format, in order of preference.
--domain	The domain name portion of the DNS name.
--hostname	Host name portion of the DNS name.
--vnic	When DHCP is yes, this is required. Specify the virtual network adapter, which must be a SC adapter for ESX and a VMkernel adapter for ESXi.
--refresh	Refreshes the network system

### VICFG-DUMPPART

--activate	Makes the specified partition the current diagnostic partition.
--deactivate	Deactivates active diag partition.
--find	Print to screen all diagnostic partitions.
--get-active	Display active diagnostic partition for the system.
--get-config	List configured partitions on the system
--list	List all partitions that can be set as a diagnostic partition
--set	Sets and activates, just like using --activate
--smart-activate	Option is currently not supported????????????

### VICFG-HOSTOPS

--action <suspend/poweroff>	Poweroff or suspend VMs when hosts enter MM or are rebooted. Default is suspend.
--cluster	Append to action, shutdown all hosts in cluster.
--datacenter	Append to action, shutdown all hosts in datacenter
--force	Forces system to shutdown when not in MM
--operation <enter/exit/shutdown/reboot/info>	Perform action on a host

### VICFG-IPSEC (supports ipv6, not ipv4)

--action	Specify action, none to allow traffic, discard, or ipsec to use ipsec.
--add-sa	Add a security association
--add-sp	Add a security policy
--dir <in/out>	Specify Direction in or out.

### VICFG-ISCSI


### VICFG-MODULE

Supports setting and retrieving VMkernel module options

Supports only some of what esxcfg-module does

--get-options <module>	Returns the option string for a module
--list	Lists modules on host
--set-options <option=value> <module>	Set option string for a module

### VICFG-MPATH

--list --path<path> --device <device>	Detailed list for all paths or as specified
--list-compact --path <path> --device<device>	Compacted list for all paths or as specified
--list-map --path<path> --device<device>	All paths and corresponding adapter/device mappings
--list-paths --device <device>	All devices with corresponding paths or as specified
--list-plugins	Lists all multipathing plugins
--state [active/off]	Sets state of given LUN path to active or off

### VICFG-NAS

Configure NAS file systems

--add --nasserver <servername> --share<share name>	Adds new NAS filesystem and share
--delete <share>	Deletes a NAS file system
--list	Lists all known NAS file systems
--readonly	Append when adding to add as read only.

### VICFG-NICS

--list	Lists the NICs in the system along with PCI bus, driver, speed, duplex, mac address, and description.
--auto	Sets nic to auto negotiate
--duplex <full/half>	Sets nic to full or half duplex
--speed	Set to speed that Nic should run, 10, 100, 1000, or 10000

### VICFG-NTP

--add <name/ip>	Add NTP server
--delete <name/ip>	Delete NTP server
--list	Lists NTP servers
--start	Start NTP service
--stop	Stop NTP service

### VICFG-RESCAN

<adapter name>	Specify just the adapter name against which you are performing a rescan.
----------------	--

### VICFG-ROUTE

--add <route> <i>default</i>	Add route to VMkernel. <i>Default</i> will set to default route.
--del <route>	Delete a route
--list	List routes
--family <v4/v6>	Sets Address family, default v4

### VICFG-SCSIDEVS

--compact-list	Lists all logical devices in a compact format
--device	Specified to narrow down information to a specific device.
--hba-device-list	Print mapping between HBA and devices it provides paths for each HBA.
--hbas	Print HBA devices with adapter ID, driver ID, adapter UID, PCI, vendor, and model
--list	List device information for all logical devices on the system.
--query	Prints mappings in 2.5 compatibility mode
--uids	Lists primary UID for each device and other aliases for UID.
--vmfs	Print mappings for each VMFS volume to its corresponding partition, path to that partition, VMFS UUID, Extent number, and Volume names.

### VICFG-SNMP

--communities <comm_list>	Specify communities separated by commas.
--disable	Disables SNMP service on host
--enable	Enables SNMP service on host
--port <port_number>	Sets port used by SNMP agent, default listen UDP 161
--reset	Clears all communities and targets
--show	Displays current SNMP config
--targets <targets>	Sets destination for notification traps. Multiple targets can be separated by commas.

--test	Sends a test notification
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### VICFG-SYSLOG

--setserver <ip> --setport	Sets to syslog server
--show	Displays syslog server configuration

### VICFG-USER

-e < user> --addgroup <g1, g2, g3>	Add user to set of groups
-e <group> --adduser <u1,u2,u3>	Add users to a group

### VICFG-VMKNIC

Add, delete, modify VMkernel NICs

--add --ip <ipaddress netmask pgname> --mtu	Add vmknics
--delete	Delete vmknics
--delete --dvs-name "x" --dvport-id x	Delete vmknics DVS
--disable-vmotion <port_group> -u <port_group>	Disable vmotion for specified pg
--list	List all vmknics
--ip <ipaddress> -n <net_mask> "name"	Modify ip/netmask/name
--ip DHCP "name"	Set NIC to use DHCP
--enable-ipv6 true	Enable IPV6(requires reboot)
--enable-vmotion "pgname"	Enable vMotion for vmknics on specified pg
--tso	Disables TSO for the NIC upon creation

### VICFG-VOLUME

--help	Prints help
--list	Lists all volumes that have been detected as snapshots

	or replicas
--persistent-mount <VMFS-UUID   label>	Mounts a snapshot or replica volume persistently if its original copy is not online
--resignature <VMFS-UUID   label>	Resignatures a snapshot or replica volume
--umount <VMFS-UUID   label>	Unmounts a snapshot or replica volume
--vihost <esx_host>	When using the --server option to point to a vCenter system, use this to specify which ESX(i) host

## VICFG-VSWITCH

--add <switch name>	Add new virtual switch
--check <vswitch_name>	Check if a virtual switch exists, returns 1/0
--delete<vswitch_name>	Deletes a virtual switch(fails if any in use by default)
--get-cdp<vswitch_name>	Prints current CDP setting
--link<physical_nic> <vswitch_name>	Add Uplink adapter to a virtual switch
--list	Lists all virtual switches/port groups
--mtu <vswitch_name>	Set MTU of virtual switch
--set-cdp <vswitch_name>	Set CDP status for virtual switch(down,listen, advertise, or both)
--unlink <physical_nic> <vswitch_name>	Removes uplink adapter for a virtual switch
--add_pg <port_group> <vswitch_name>	Add a port group to a virtual switch
--check-pg <port_group><vswitch_name>	Check if a specified port group exists, returns 1/0
--del-pg <port_group><vswitch_name>	Delete a port group (fails if any in use by default)
--vlan -pg <port_group>	Set VLAN ID for a specific port group
--add-dvp-uplink <adapter_name> --dvp<DVPort><dvswitch>	Add an uplink adapter to a distributed virtual port
--del-dvp-uplink <adapter name> --dvp<DVPort><dvswitch>	Deletes an uplink adapter from a distributed virtual port
--add-pg-uplink<adapter name> --pg<port_group><vswitch>	Add uplink adapter to a port group(fails silently)
--del-pg-uplink<adapter name> --pg<port_group><vswitch>	Deletes uplink adapter for a port group

## VMKFSTOOLS

If <target> is a file system, <options> can be one of the following:



--createfs [blocksize]kK mM --setfsname <name> -C vmfs3	Creates a VMFS3 file system. Block size set to 1 MB when omitted by default.
--queryfs   -P <directory>	Lists attributes of file or directory on VMFS Volume.
--spanfs <span_partition> <head_partition>	Extends the VMFS file system by spanning it across partitions.

If <target is a virtual disk, <options> can be one of the following:

--createvirtualdisk   -c <size> --adaptertype <srcfile> --diskformat <location>	Creates
--clonevirtualdisk -i <src_file><dest_file> --diskformat <format> --adaptertype <type>	Clones
--deletevirtualdisk -U <disk>	Deletes
--renamevirtualdisk -E <oldname> <newname>	Renames
--extendvirtualdisk -X -d eagerzeroedthick	Extends
--createrdm -r <rdmfile>	Create RDM
--createrdmpassthru -z <device> <map_file>	RDM Passthru
--querydm	Not supported
--geometry	Returns geometry info
--writezeros	Initializes with zeros
--inflatedisk	Converts thin to eagerzeroedthick

## VSCSISTATS

/usr/lib/vmware/bin/vscsiStats -s -w <world_group_id>	Start vscsiStats Collection
/usr/lib/vmware/bin/vscsiStats -p <histo_type> -c	Display counters
/usr/lib/vmware/bin/vscsiStats -r	Reset all counters to zero
/usr/lib/vmware/bin/vscsiStats -l	List running VM IDs. This is where you get the world group id to start vscsiStats collection
/usr/lib/vmware/bin/vscsiStats -p seekDistance	Distance in LBNS between successive Write commands. Observe random access behavior by looking at this.
/usr/lib/vmware/bin/vscsiStats -p ioLength	Gauge I/O size of commands issued to disk.
/usr/lib/vmware/bin/vscsiStats -p latency	Gauge latency
/usr/lib/vmware/bin/vscsistats -x	Stop collection

**Table 1-5.** Platform Support for vSphere CLI 4.0 Commands

Command	ESXi 4.0	ESX 4.0	VC 4.0	ESXi 3.5 U2+	ESX 3.5 U2+
esxcli	Yes	Yes	No	No	No
resxtp	Yes	Yes	Yes	Yes	Yes
svmotion	No	No	Yes	No	No
vicfg-advcfg	Yes	Yes	Yes	Yes	Yes
vicfg-cfgbackup	Yes	No	No	Yes	No
vicfg-dns	Yes	Yes	Yes	Yes	Yes
vicfg-dumpart	Yes	Yes	Yes	Yes	Yes
vicfg-iscsi	Yes	Yes	Yes	No	No
vicfg-module	Yes	Yes	Yes	Yes	Yes
vicfg-mpath	Yes	Yes	Yes	Use vicfg-mpath35 instead.	
vicfg-nas	Yes	Yes	Yes	Yes	Yes
vicfg-nics	Yes	Yes	Yes	Yes	Yes
vicfg-ntp	Yes	Yes	Yes	Yes	Yes
vicfg-rescan	Yes	Yes	Yes	Yes	Yes
vicfg-route	Yes	Yes	Yes	Yes	Yes
vicfg-scsidevs	Yes	Yes	Yes	No	No
vicfg-snmp	Yes	Yes	No	Yes	Yes
vicfg-syslog	Yes	No	Yes	Yes	No
vicfg-user	Yes	Yes	No	Yes	Yes
vicfg-vmhbadevs	Not included in vSphere CLI 4.0. Use vicfg-scsidevs instead.				
vicfg-vmknic	Yes	Yes	Yes	Yes	Yes
vicfg-volume	Yes	Yes	Yes	No	No
vicfg-vswitch	Yes	Yes	Yes	Yes	Yes
vifs	Yes	Yes	No	Yes	Yes
vihostupdate	Yes	Yes	No	Use vihostupdate35 instead	No
vmkfstools	Yes	Yes	No	Yes	Yes
vmware-cmd	Yes	Yes	Yes	Yes	Yes

## VMWARE-CMD

### Server Operations

-l	List all registered VMs
-s register <config file path><datacenter><resource pool>	Register a VM
-s unregister	Unregister a VM

## Virtual Machine Operations

VMWARE-CMD <config\_file\_path> plus

answer	Prompt user to answer question
connectdevice <devname>	Connect a Device
Createsnapshot <name><description> quiesce <0/1> memory <0/1>	Create a snapshot
Disconnectdevice <devname>	Disconnect a Device
Getconfigfile	Get name of virtual machine config file
Getguestinfo <variable>	Returns GuestInfo variable
Getproductinfo<variable>	Returns ProductInfo variable
Getstate	Returns state of VM
Gettoolslastactive	Returns time since last heartbeat from VMware tools.
Getuptime	Returns uptime of guest OS
Hassnapshot	Returns 1 if VM has snapshot
Reset <soft/hard>	Shuts down and reboots VM
Removesnapshots	Removes snapshots
Revertsnapshot	Reverts VM to current snapshot
Setguestinfo <variable> <value>	Writes GuestInfo variable to memory
Start	Powers on a VM or resumes suspended
Suspend <soft/hard>	Suspends a VM.

## Other Commands to Know

VIFS

VIHOSTUPDATE

VIHOSTUPDATE35

SVMOTION

VIMA-UPDATE

VICFG-FIREWALL

NET-DVS

VMWARE-UMDS