VCAP5 – DCA Command Line Study Notes

Resources:

The notes herein are compiled from my own testing as well as below references:

- VMware Documentation – CLI Getting Started & CLI Concepts & Examples
- http://www.valcolabs.com/vcap5-dca/
- http://www.virtuallanger.com/vcap-dca-5/
- Other References used are noted in the Section/Objective it's used in

SECTION 1

1.1 – Implement & Manage Complex Storage

Understand & Apply VMFS Re-Signaturing (pg. 120-121 Storage Guide)

- Resignature – ESXi assigns a new UUID & label to the copied datastore & mounts it distinctly from the orig
  1. Find the snapshotted LUN: `esxcli storage vmfs snapshot list`
  2. Mount w/o resignature: `esxcli storage vmfs snapshot mount -l LUN_Name` (use either volume label or UUID of Datastore/LUN)
  3. Mount with resignature: `esxcli storage vmfs snapshot resignature -l LUN_Name`
  4. Straightline Example

     `esxcli storage vmfs snapshot list`
     `esxcli storage vmfs snapshot mount -l LUN_Name` OR
     `esxcli storage vmfs snapshot resignature -l LUN_Name`

Understand & Apply LUN Masking Using PSA-Related Commands (pg. 162-168 Storage Guide & http://kb.vmware.com/kb/1009449)

- Masking – prevents Hosts from accessing certain LUNs or paths to LUNs; this is done by creating a Claim Rule that assigns the `MASK_PATH` plug-in to a specified path
- Procedure
  1. Find device name of the Datastore wanting to hide:
     `esxcfg-mpath` `-L` OR **`esxcfg-scsidevs -m`**
  2. Check available Claim Rules:
     `esxcli storage core claimrule list`
  3. Create a new Claim Rule for each path used by the HBA (4 total) since it's probably redundant & associate the path to the `MASK_PATH` Plug-in, for example on `vmhba33` and `vmhba34` ; but this ex only shows 1 path for 1 HBA:
     `esxcli storage core claimrule add -r 500 -t location -A vmhba33 -C 0 -T 1 -L 1 -P MASK_PATH`
  4. Load Claim Rule:
     `esxcli storage core claimrule load`
  5. Verify Claim Rule was added:
     `esxcli storage core claimrule list`
  6. Unclaim Plug-in the device is currently using & associate with newly created Claim Rules:
     `esxcli storage core claiming reclaim -d naa.UUID`
  7. Run the path Claim Rules:
     `esxcli storage core claimrule run`
  8. Verify Mask applied: Host > Configuration tab > Storage > Refresh the view, then Rescan
     a. Verify via Shell: `esxcfg-scsidevs -m` ; to see all Masked LUNs: `esxcfg-scsidevs -c`
     b. Also can check if it's active: `esxcfg-mpath -L | grep naa.UUID`
  9. To delete a Claim Rule:
     `esxcli storage core claimrule remove -r 500`

10. Straightline Example given on pg. 168 (& below)

```
esxcfg-scsidevs -m
esxcli storage core claimrule list
esxcli storage core claimrule add –r 500 –t location –A vmhba33 –C 0 –T 1 –L
1 –P MASK_PATH (run for each path, e.g. the 2nd rule (-r 501) would have -C1 -T 1 -L 1)
esxcli storage core claimrule load
esxcli storage core claimrule list
esxcli storage core claiming reclaim –d naa.UUID
esxcli storage core claimrule run
esxcli storage core adatper rescan –A vmhba33
```

11. To fully unclaim

```
esxcli storage core claimrule remove 500
esxcli storage core claimrule remove 501
esxcli storage core claimrule load
esxcli storage core claiming unclaim –t location –A vmhba33 –C 0 –T1 –L 1
esxcli storage core claiming unclaim –t location –A vmhba33 –C 1 –T1 –L 1
esxcli storage core adatper rescan –A vmhba33
```

Analyze I/O Workloads to Determine Storage Performance Requirements

- `vscsiStats` – via Shell access
  1. Start a capture by gathering VM 'world ID': `vscsiStats -l`
  2. Run against the VM using the WID captured above: `vscsiStats –w ID`
  3. Print the output to screen & specify output type: `vscsiStats –p all` (or latency, seekDistance, outstandingIOs, etc.)
  4. Redirect output to a file: `vscsiStats –p latency > c:\vm01.txt`
  5. Stop the capture: `vscsiStats –x`
  6. Reset vscsiStats: `vscsiStats –r`
  7. Straightline Example

```
vscsiStats –l
vscsiStats –w ID
vscsiStats –p all OR vscsiStats –p latency > c:\vm01.txt
vscsiStats –x
vscsiStats –r
```

Identify & Tag SSD Devices (pg. 142-146 Storage Guide)

- Identify device to be tagged: `esxcli storage nmp device list` (note the SATP of the device)
- Add a PSA claim rule to mark device as SSD (specifying device [i.e. the 'naa.###' name], vendor/model, protocol, driver)
  1. `esxcli storage nmp satp rule add –s SATP –d naa.UUID –o enable_SSD`
  2. `-V vendor_name -M model_name; --transport transport_protocol; --driver driver_name`
  3. Unclaim the device (by device, vendor, driver, etc.): `esxcli storage core claiming unclaim -t device –d naa.UUID`
  4. Load then Run ClaimRule: `esxcli storage core claimrule load` then `esxcli storage core claimrule run`
  5. Verify "tag" took: `esxcli storage core device list –d naa.UUID` and verify if `Is SSD` is shown as `true`

```
esxcli storage core device list
esxcli storage nmp device list
esxcli storage nmp satp rule add –s VMW_SATP_DEFAULT_AA -d naa.UUID –o
 enable_SSD
esxcli storage core claiming unclaim –t device –d naa.UUID
esxcli storage core claimrule load
esxcli storage core claimrule run
```

Administer Hardware Acceleration for VAAI (pg. 174- Storage Guide)

- Display VAAI plugin: **`esxcli storage core plugin list –c VAAI`**
- Display VAAI filters: **`esxcli storage core plugin list -c Filter`**
- If VAAI is listed, can display its status: **`esxcli storage core plugin list –N Filter`**
- Display whether a device supports VAAI: **`esxcli storage core device list –d naa.UUID`**
  1. VAAI details: **`esxcli storage core device vaai status get –d naa.UUID`**
- Create Claim Rule for VAAI Filter: **`esxcli storage core claimrule add –c Filter –P VAAI_FILTER –t Vendor –V vLabs –u`**
- Create Claim Rule for VAAI Plugin: **`esxcli storage core claimrule add –c VAAI –P VMW_VAAI_VLABS –t vendor –V vlabs –u –f`**
- Load Filter: **`esxcli storage core claimrule load –c Filter`**
- Load Plug-in: **`esxcli storage core claimrule load –c VAAI`**
- Run Filter Claim Rules: **`esxcli storage core claimrule run –c Filter`**
- Run Plug-in Rules: **`esxcli storage core claimrule run –c VAAI`**

Perpare Storage for Maintenance

- To perform VMFS maintenance
  1. Unmount if VMs are pwr'd off: **`esxcli storage filesystem unmount –l datastore_name`**

Upgrade VMware Storage

- **`esxcli storage vmfs upgrade -l datastore_name`**

1.2 – Manage Storage Capacity in vSphere

Identify Storage Provisioning Methods

- Create a VMFS: **`vmkfstools -C vmfs5 -S datastore_name /vmfs/volumes/naa.UUID`**
- Create a NFS:
  1. **`esxcli storage nfs list`**
  2. **`escxli storage nfs add –H 10.100.1.5 –s /nfs/volume_name –v datastore_name`**
- Inflate VMDK from Thin to Thick: **`vmkfstools –j path_to_vmdk_to_inflate`**
- Create a virtual disk: **`vmkfstools –c 10G –d thin –a lsilogic_sas /vmfs/volumes/datastore_name/vm_name/vmdk.name`**
  1. Great `vmkfstools` examples on pg. 202-210 of the Storage Guide

Apply Space Utilization Data to Manage Storage Resources

- Cmd Line displays: **`df -h`** OR **`df -h | awk '/VMFS*/ || /NFS/'`**

1.3 – Configure & Manage Complex Multipathing & PSAs

Install & Configure PSA Plug-Ins

- Shell (Putty, vMA, vCLI):
  1. Download 3rd Party Bundle (zip file), extract the contents, then copy to Host (i.e. in the `/tmp` directory) using tool like WinSCP
  2. Migrate VMs off Host & place Host in Maintenance Mode
  3. Install the Bundle: `esxcli software vib install –d /tmp/file.xml`
  4. Reboot the Host
- Set new default PSA
  1. List current PSAs: `esxcli storage nmp satp list`
  2. Change default PSP for a given SATP: `esxcli storage nmp satp set –s VMW_SATP_CX –P VMW_PSP_RR`
  3. Reboot Host

- Change SATP for a device
    4. Create Claim Rule: `esxcli storage nmp satp rule add –s VMW_SATP_CX –d naa.ID`
    5. List Claim Rules to be sure it was added: `esxcli storage nmp satp rule list –s VMW_SATP_CX`
- Straightline Example

  cd to directory where Bundle is downloaded onto Host
  esxcli software vib install –d /tmp/file.xml
  Reboot Host

  esxcli storage nmp satp list
  esxcli storage nmp satp set –s VMW_SATP_CX –P VMW_PSP_RR
  Reboot Host

  esxcli storage nmp satp rule add –s VMW_SATP_CX –d naa.UUID
  esxcli storage nmp satp rule list –s VMW_SATP_CX

Perform Command Line Configuration of Multipathing Options

- List device details: **esxcli storage nmp device list –d naa.UUID**
- Change a device PSP: **esxcli storage nmp device set –d naa.UUID –P VMW_PSP_FIXED**
- List Claim Rules: **esxcli storage core claimrule list**
- Display PSA Plugins: **esxcli storage core plugin list**
- Display PSPs: **esxcli storage nmp psp rule list**
- Display SATPs: **esxcli storage nmp satp list**
- Set a preferred path on a device: **esxcli storage nmp psp fixed deviceconfig set –d naa.UUID –p vmhba32:C:0T:1:L1**
    1. Verify the change took: **esxcli storage nmp psp fixed deviceconfig get –d naa.UUID**
- Customize RR plugin: **esxcli storage nmp psp roundrobin deviceconfig set –d naa.UUID –I 2500 –t iops**
    1. Change back to default: **esxcli storage nmp psp roundrobin deviceconfig set –d naa.UUID –t default**
    2. NOTE: items that can be changed are → -B for bytes, -I for IOPS, -U to allow RR to use an active non-optimal path
- @joshcoen has a nice video at valcolabs.com/vcap5-dca on Obj 1.3 going over cmd line MPP options

Configure Software iSCSI Port Binding (pg. 78 Storage Guide)

- Port Bind: **esxcli iscsi networkportal add -A vmhba33 -n vmk4**

SECTION 2

2.1 – Implement & Maintain Complex Virtual Networks

Configure SMNP

- Host – can only be configured via cmd-line (pg. 135 of CLI Concepts & Examples Guide)
    1. Straightline Example:

```
vicfg-snmp –show
vicfg-snmp –c public
vicfg-snmp –p 162
vicfg-snmp –t 192.168.199.5@162/public
vicfg-snmp –E
vicfg-snmp –show
vicfg-snmp –test
```

***NOTE – there is a `.pl` extension part of the `vicfg` command that must be used when vCLI is run directly on Windows. Also, to prevent the use of clear text username/pwd, a session file can be used in place of the `--username --password` parameters. See the CLI Getting Started Guide for procedures to create a session file. The `.pl` is not needed if using vMA…just `cd` to `/sbin`**

Determine Use Case For & Apply VMDirectPath I/O

- Check if IOMMU is enabled by running the following cmd in vCLI: **`vicfg-module –l`**

Configure vSS & vDS via Command-Line (pg. 112-123 CLI Concepts & Examples)

- Use `esxcli network` and `vicfg-<vswitch, snmp, ntp, dns, vmknic>.pl` tools
- Examples:
  1. NOTE: Commands using `esxcli` assume Putty directly to a Host; if using vMA `<conn options>` may need to be used to target a Host
  2. List interfaces (i.e. vmk's), MAC, & MTU size: **`esxcli network ip interface list`**
  3. List individual interface char's (IP): **`esxcli network ip interface ipv4 get –i vmk0`**
  4. Add VMkernel interface: **`esxcli network ip interface add –I vmk5 –p VMotion`**
  5. List vSS(s) & their properties: **`esxcli network vswitch standard list`**
  6. List vDS: **`esxcli network dvs vmware list`**
  7. Add/Delete a vSS (substitute add with remove): **`esxcli network vswitch standard add –v vSwitch2 --ports 128`**
  8. Set MTU for vSS: **`esxcli network vswitch standard set --mtu=9000 –v vSwitch2`**
  9. Set CDP: **`esxcli network vswitch standard set --cdp-status=both –v vSwitch2`**
  10. List PortGroups: **`esxcli network vswitch standard portgroup list`**
      a. Add PG: **`esxcli network vswitch standard portgroup add –p VMotion –v vSwitch2`**
  11. Set a PG VLAN: **`esxcli network vswitch standard portgroup set –p VM01 –v 101`**
  12. List pNIC info: **`esxcli network nic list`**
      a. Get individual vmnic info: **`esxcli network nic get –n vmnic#`**
      b. Bring down an adapter (or `up`): **`esxcli network nic down –n vmnic#`**
      c. Change adapter settings: **`esxcli network nic set -<option> –n vmnic#`**
  13. Add uplink to a PG (use `del-pg` for removing PG): **`vicfg-vswitch <conn options> --add-pg-uplink vmnic3 --pg NFS vSwitch2`**
  14. vDS CLI commands are limited; most configurations need to be done using the GUI
      a. Add/remove uplink port: **`vicfg-vswitch --add-dvp-uplink vmnic5 --dvp FT_dvPortGroup Lab_dvSwitch`**

Analyze Command-Line Output to Identify vSS & vDS Details

- Two commands that list vSS & vDS info:
  1. **`esxcli network vswitch standard list`**
  2. **`esxcli network dvs vmware list`**

Determine Appropriate Discovery Protocol

- CDP is the only protocol available for vSS and is in "listen" mode by default
- View current CDP configuration: **`vicfg-vswitch –b vSwitch0`**
- Change CDP config (options = `both`, `advertise`, `listen`): **`vicfg-vswitch –B both vSwitch0`**S
- View current CDP using `esxcli` : **`esxcli network vswitch standard list`**
- Change CDP using `esxcli` : **`esxcli network vswitch standard set –c both –v vSwitch2`**

2.2 – Configure & Maintain VLANs & PVLANs & Settings

Use Command-Line Tools to Troubleshoot & Identify VLAN Configurations

- Use `esxcli network` and `vicfg-vswitch.pl` tools
- Examples (from previous section):
  1. Enable: **`esxcli network vswitch standard portgroup set –p IPStorage1 –v 101`**
  2. Disable: **`esxcli network vswitch standard portgroup set –p IPStorage1 –v 0`**

2.3 – Deploy & Maintain Scalable Virtual Network

Identify Network Protocols (see: http://kb.vmware.com/kb/1012382)

- Most common:
  1. 21 – FTP
  2. 22 – SSH
  3. 23 – Telnet
  4. 53 – DNS
  5. 80 – HTTP
  6. 88 – Kerberos
  7. 123 – NTP
  8. 161 – SNMP (UDP)
  9. 389 – LDAP
  10. 443 – HTTPS; vSphere Client to vCenter & Host; vCenter to Host
  11. 902 – Host to Host; Client to VM Console
  12. 903 – Client to VM Console
  13. 1234 – vSphere Replication
  14. 2049 – NFS
  15. 3260 – iSCSI
  16. 5989 – CIM
  17. 8000 – vMotion
  18. 8100 – FT
  19. 8182 – HA
  20. 9000 – Update Manager

2.4 – Administer vDS Settings

Understand the Use of Command-Line Tools to Configure Appropriate vDS Settings on a Host

- The use `esxcli network` and `vicfg-<vswitch, snmp, ntp, dns, vmknic>.pl` tools were discussed in previous sections…review them

SECTION 3

3.1 – Tune/Optimize vSphere Performance

3.2 – Optimize Virtual Machines

Calculate Available Resources

- Cluster Resources: Summary tab > vSphere DRS box > Resource Distribution link to view CPU & RAM in % or MHz/MB
- Host > Summary tab > Resources box to view CPU & RAM Host utilization
  1. Can also use ESXTOP
  2. CPU Metrics:
     a. %PCPU USED –% of each physical core utilized by the logical core multiplied by “turbo mode”
     b. %PCPU UTIL – % utilization of logical cores
     c. %USED – % of pCPU core cycles used by a group of ‘worlds’ (processes)

d. %SYS – % of time spent in the VMkernel processing requests
e. %RDY – % of time the group was ready to run but CPU resources not available to handle requests
f. %WAIT – % of time the group was in a clocked or wait state

3. RAM Metrics:
   a. PMEM/MB – amount of pMEM installed; PMEM represents amt of RAM actively used by the Host; vmk represents amt of RAM used by the VMkernel; Free = how much Host RAM free to service requests
   b. VMKMEM/MB – rsvd & ursvd (reserved/unreserved)
   c. NOTE: PMEM `free` should be higher than VMKMEM `ursvd`
4. VM Resources: VM > Resource Allocation tab; Allocated, Consumed, Ballooned, & Active utilization

3.3 – Implement & Maintain Complex DRS

3.4 – Utilize Advanced vSphere Performance Monitoring Tools

Identify Hot Keys & Fields Used With `resxtop/esxtop`

- **C** = CPU, **D** = Disk Adapter, **M** = Memory, **N** = Network, **P** = Pwr Mgmt, **U** = Disk Device, **V** = Disk VM
  1. NOTE: **F** = modify columns used; **O** = modify column order; **S** = modify refresh time in sec's
  2. When in a 'mode' (CPU, Adapter, etc.), you can sort by certain headings (READ, WRITE, etc.) by using a capital or small **R**/**r** (read) or **T**/**w** (write); default sort can be returned by capital **N**
  3. **s** for refresh interval in seconds & **q** to quit

Identify Fields Used With `vscsiStats`

- See below ('Using `vscsiStats`' item)

Configure `resxtop/esxtop` Custom Profiles (pg. 60 Monitor & Perf Guide)

- SSH to Host, go through each display (c, d, m, etc.) and modify the view as desired; when done type **W**, then type the path & name of the modified config/views (i.e. `/tmp/.vcap5conf`)
- To run the custom profile, type: **`esxtop -c /path/to/filename.conf`**

Determine Use Cases For & Apply `resxtop/esxtop` Interactive, Batch, & Replay Modes

- Interactive Mode – (default Mode) Real-time Host monitoring; typing `esxtop` is all that's required (pg. 46 Monitor & Perf Guide)
- Batch Mode – Used to track metrics over time (history) down to 2second intervals (vCenter = 20sec's); (pg. 60 Monitor & Perf Guide)
  1. `-b` = batch mode, `-d` = delay in seconds, `-n` = number of iterations (x delay = total), `>` = export filename
  2. Sample command: **`esxtop -b -d 2 -n 400 > vcap5dcabatch.csv.gz`**
- Replay Mode – Capability to use a vm-support generated "bundle" to run `esxtop` against (pg. 61 Monitor & Perf Guide)
  1. `-p` = collect performance snaps, `-i` = collection interval in secs, `-d` = duration
  2. Generate a Support Bundle: **`vm-support -p -i 10 -d 60`** (see: http://kb.vmware.com/kb/1967)
  3. The path of the bundle will be displayed when the task is completed (i.e. `/var/tmp/….`)
  4. `cd` to path displayed & unpack the newly created file: **`tar -xzf /var/tmp/NameOfFile.tgz`**
  5. Reconstruct files if needed:
     a. **`cd /var/temp/<path of bundle>`**
     b. **`./reconstruct.sh`**
  6. Enter Replay Mode: **`esxtop -R /var/tmp/<path of bundle>`**

Use `vscsiStats` to Gather Storage Performance Data (see: http://communities.vmware.com/docs/DOC-10095)

- Get worldGroupID of the VM wanting to collect data against: `vscsiStats -l`
- Start the collection: `vscsiStats -w 811625 -s` (runs on ALL VMDKs of the VM with ID 811625)

1. `vscsiStats -w 811625 -i 8422 -s` (runs on specific VMDK of the VM; can get ID in 1st step)
2. To view onscreen: `vscsiStats -w 811625 -i 8422 -p all` (or ioLength, seekDistance, latency, instead of 'all')
3. To export to a file: `vscsiStats -w 811625 -i 8422 -p all -c > /tmp/vcap5vscsiStats.csv`
4. To stop `vscsiStats` collection on ALL VM disks: `vscsiStats -w 811625 -x`
5. See here: http://www.vmdamentals.com/?p=722, for a tool to import the stats in a 3D chart
6. Straightline Example

```
vscsiStats -l
vscsiStats -w 811625 -s
vscsiStats -w 811625 -i 8422 -s
vscsiStats -w 811625 -i 8422 -p all
vscsiStats -w 811625 -i 8422 -p all -c > /tmp/vcap5vscsiStats.csv
vscsiStats -w 811625 -x
vscsiStats -w 811625 -r
```

Use `resxtop/esxtop` to Collect Performance Data

- Using Batch Mode, run a 5-second interval collection for 10mins – determine the "iteration" (i.e. `-n`) by using this formula: ([minutes x 60] / delay) → ([10 x 60] / 5) = 120, so:
  `esxtop -b -d 5 -n 120 > /tmp/vcap5dcabatch.csv`

Given `resxtop/esxtop` Output, Identify Relative Performance Data for Capacity Planning Purposes

- Interpreting CPU metrics → see: http://kb.vmware.com/kb/1017926
  1. PCPU UTIL% - Avg below 60%
- Memory
  1. State – High (> 6% Memory Free), Soft (4-6% Free), Hard (2-4% Free), Low (< 2% Free)
     a. High = good…sufficient free memory to where Host not under contention
     b. Low = bad…minimal amt of free memory left; Host is in contention
  2. MEMCTL/MB – if above 0, ballooning is going on; some ballooning is normal…consistent is not
  3. SWAP/MB – if above 0, swapping is going on (State is typically at Hard or Low)
     a. r/s and w/s should be close to 0
- Disk
  1. Determine IOPS per VM by looking at READS/s & WRITES/s
  2. DAVG (latency ouside the guest/hypervisor) – typically > 15ms
  3. KAVG (VMkernel) – typically > 1ms
  4. GAVG (guest; DAVG + KAVG)

SECTION 4

4.1 – Implement & Maintain Complex HA Solutions

Configure Customized Isolation Response Settings

- Typically for each VM
- Cluster > Edit Settings > vSphere HA > Virtual Machine Options, select Host Isolation Response from the drop-down (Use Cluster, Leave Powered On, Power Off, Shut Down)
- Advanced Settings: Cluster > Edit Settings > vSphere HA > Advanced Options button
  1. das.isolationaddress(#) – can add up to 10 (i.e. '#') gateway addresses
  2. das.usedefaultisolationaddress – true (1) or false (0)
  3. das.isolationshutdowntimeout – specifies amount of time (in sec's) to wait for a guest shutdown process before HA forceably power's off a VM

4.2 – Deploy/Test FT

SECTION 5

5.1 – Implement & Maintain Host Profiles

5.2 – Deploy/Manage Complex VUM Environments

Identify Firewall Access Rules for Update Manager

- Ports (see: http://kb.vmware.com/kb/1004543):
  1. 80 – VUM connects to vCenter
  2. 443 – Outbound from VUM Server to obtain metadata
  3. 902 – Push patches from VUM to ESXi Hosts
  4. 1433 - VUM SQL DB
  5. 1521 – VUM Oracle DB
  6. 8084 – VUM Client Plug-In to VUM SOAP
  7. 9084 – ESXi Host to VUM Web Server
  8. 9087 – VUM Client Plug-In to VUM Web Server (uploading host upgrade files)
  9. 9000-9100 – alternative to 80/443 for outbound connection

Install & Configure Update Manager Download Service (pg. 56 Install/Administer Update Mgr Guide)

- After the GUI install, open a CMD prompt and `cd` to the UMDS directory
  1. **`C:\Program Files (x86)\VMware\Infrastructure\Update Manager`**
  2. Specify Host & Virt Appliance Updates: **`vmware-umds -S --enable-host --enable-va`**
  3. Specify Host & no Virt Appliance Updates: **`vmware-umds -S --enable-host --disable-va`**
  4. Specify Virt Appliance & no Host Updates: **`vmware-umds -S --disable-host --enable-va`**
  5. Specify Only ESXi5.x Updates:
     `vmware-umds -S --disable-host vmware-umds -S -e embeddedESX-5.0.0`
  6. Change the download path folder location: **`vmware-umds -S --patch-store C:\new\Download\Path`**
  7. Download updates/patches: **`vmware-umds -D`**

Utilize Update Manager PowerCLI to Export Baselines for Testing (pg. 155-158 Install/Administer VUM Guide; it is 1 long script!)

- Basically, create a Fixed patch Baseline then scan/remediate Hosts
- Use the CLI script on pg. 156 to export the patch Baseline from VUM to another VUM (i.e. a test environment VUM server)

SECTION 6

6.1 – Configure, Manage, Analyze vSphere Logs

Indentify vCenter Server Log File Names & Locations (see: http://kb.vmware.com/kb/1021804)

- Location: **`C:\ProgramData\VMware\VMware VirtualCenter\Logs`**
- Names:
  1. `vpxd-##.log` – main vCenter log (highest # = most current)
  2. `vpxd-profiler-##.log` – vCenter operations profiled metrics; can be viewed in VOD dashboard site (https://vctr/vod/index.html)
  3. `cim-diag.log` & `vws.log` – Common Interface Model info
  4. drmdump – in its own folder; DRS info

Indentify ESXi Log File Names & Locations (see: http://kb.vmware.com/kb/2004201)

- `/var/log/auth.log` – ESXi Shell authentication success & failure
- `/var/log/dhclient.log` – DHCP client service
- `/var/log/esxupdate.log` – ESXi patch & update installation logs
- `/var/log/hostd.log` – Host Mgmt service logs including VM & Host Tasks/Events, communication with vSphere Client & vCenter `vpxa` agent
- `/var/log/shell.log` – ESXi Shelll usage logs, including every command entered & enable/disable
- `/var/log/sysboot.log` – VMkernel startup & module loading
- `/var/log/boot.gz` – Compressed file containing boot log info
- `/var/log/syslog.log` – Mgmt service initialization, watchdogs, sched tasks, & DCUI use
- `/var/log/usb.log` – USB device arbitration events (discovery & pass-through)
- `/var/log/vob.log` – VMkernel Observation events
- `/var/log/vmkernel.log` – Core VMkernel logs including device discovery, storage, networking, driver events, & VM startup
- `/var/log/vmkwarning` – Summary of Warning & Alert msgs (excerpted from vmkernel log)
- `/var/log/vmksummary` – Summary of ESXi Host startup & shutdown, hourly heartbeating, # of VMs running, & service resource consumption
- `/var/log/vpxa.log` – vCenter Server agent logs
- `/var/log/fdm.log` – vSphere HA logs produced by fdm service

Identify Tools Used to View vSphere Logs

- vCenter – Home > Administration > System Logs , or a txt editor (Notepad/Wordpad)
- Putty
- vMA

Generate vCenter Server & ESXi Log Bundles

- Simply open Putty & type **`vm-support`** to generate a report in the current working directory; to change the working directory where bundle is saved: **`vm-support -w /tmp`**

Use `esxcli system syslog` to Configure Centralized Logging on ESXi Hosts (see: http://kb.vmware.com/kb/2003322)

- Also, see last item below

Test Centralized Logging Configuration

- SSH to a Host and run: **`esxcli system syslog mark --message="vcap5-test-configuration"`**
- Open `syslog.log` on vCenter & check to see if msg is entered (Syslog Collector path = `C:\ProgramData\VMware\VMware Syslog Collector\Data\192.168.199.11\syslog.log` (IP is of originating ESXi Host)

Analyze Log Entries to Obtain Configuration Information

- SSH to Host, `cd` to `/var/log` and then either `more` or `vi name.log` to view information
  1. NOTE – if `vi` into log, type `:q` or `:q!` to exit the editor without saving; use Page Up or Down to scroll

Analyze Log Entries to Identify & Resolve Issues

- Enter log as described above, then search for items in `vi` by typing **`/<KeyWordForSearch>`**
  1. The forward slash is needed but don't use a space after it nor the brackets

Install & Configure VMware Syslog Collector & ESXi Dump Collector (pg. 214-215 & pg. 86-88 vSphere Install & Setup Guide)

- ESXi Dump Collector (2 parts) – See: http://youtu.be/GtCxmZi_xas & http://youtu.be/AvN7DcD2_ps , as well as VMware blog: http://blogs.vmware.com/vsphere/2011/07/setting-up-the-esxi-50-dump-collector.html

1. Install ESXi Dump Collector from vCenter Server Install
2. After the install, SSH (Putty) to each Host
3. **`esxcli system coredump network get`**
4. **`esxcli system coredump network set -i 192.168.199.5 –v vmk0 –o 6500`**
5. **`esxcli system coredump network set -e true`**
6. **`esxcli system coredump network get`** to verify settings

- Syslog Collector – See: http://www.boche.net/blog/index.php/2011/07/23/configure-a-vcenter-5-0-integrated-syslog-server/ as well as VMware blog: http://blogs.vmware.com/vsphere/2011/07/setting-up-the-esxi-syslog-collector.html
  1. Install VMware Syslog Collector from vCenter Server Install
  2. After the install, SSH (Putty) to each Host
  3. **`esxcli system syslog config get`**
  4. **`esxcli system syslog config set --loghost=192.168.199.5`**
  5. **`esxcli system syslog config reload`**
  6. **`esxcli system syslog config get`** to verify settings
- Other syslog settings can be configured (rotation size, # of rotations) as well; see pg. 134 CLI Examples
- In vCenter, select Host > Configuration tab > Software box > Security Profile link, Firewall then Properties hyperlink and enable (check) outgoing "syslog" traffic
  1. Or, using `esxcli` type: **`esxcli network firewall ruleset set --ruleset-id=syslog --enabled=true`** **then** **`esxcli network firewall refresh`**

6.2 – Troubleshoot CPU & Memory Performance

Identify `resxtop/esxtop` Metrics Related to Memory & CPU

- CPU
  1. %RDY (> 5-10) – amt of time a VM vCPU was 'ready' to perform an operation but couldn't get scheduled by the Host pCPU
  2. %USED – percentage of the Host's pCPU cycles being 'used' by a VM. If high along with queueing, then probably an issue (not a high value itself). %RDY & %USED high indicative Host is overcommitted
  3. %WAIT – amt of time VM spent in a blocked or busy 'wait' state, likely waiting for a VMkernel operation; this amt also includes idle time
  4. %MLMTD (> 0) – idle time due to a configured vCPU limit; usually suggests to disable the limit if able
  5. %CTSP (> 3) – amt of time a SMP VM was ready to run but experienced delay due to vCPU contention
  6. PCPU UTIL% (> 90-95%)
  7. %SWPWT (> 3) – amt of time a 'world' spends waiting on vmkernel memory swapping
- Memory
  1. PMEM/MB – total amt of phys memory installed in the Host
  2. VMKMEM/MB – amt of phys memory actively being used by the VMkernel
  3. PSHARE/MB – amt of memory being saved utilizing TPS
  4. SWAP/MB – amt of aggregate memory being swapped by all VMs
  5. MEMCTL/MB – memory ballooning stats for the Host; cure = current amt being reclaimed, target = how much Host would like to reclaim, max = max amt of aggregate memory the Host can reclaim
     a. MCTLSZ (> 0) – amt of VM phys memory actually reclaimed by balloon driver
     b. MCTLTGT – amt of VM phys memory that can be reclaimed
        1) NOTE: If MCTLTGT > MCTLSZ then balloon inflates; if MCTLTGT < MCTLSZ then balloon deflates
     c. MCTL – Y or N (is balloon driver active)
  6. CACHEUSD – **amt > 0** means Host has compressed memory
  7. ZIP (> 0) – Host is actively compressing
  8. STATES = High, Soft, Hard, Low (i.e. Best, Ok, Not Good, Severely low free RAM)
  9. NOTE: Superb discussion on memory mgmt here: http://www.van-lieshout.com/2009/04/esx-memory-management-part-1/ (also has parts 2 and 3, which is the real 'meat' of the discussion IMO)

6.3 – Troubleshoot Network Performance/Connectivity

Identify vCLI Commands & Tools Used to Troubleshoot vSphere Networking Configurations

- 3 Types can be used with vCLI:
  1. **`esxcfg-`** : See all vicfg commands listed below
  2. **`esxcli`** `network` command
  3. **`vicfg-`** :
     a. –vswitch
     b. –vmknic
     c. –switch
     d. –snmp
     e. –route
     f. –ntp
     g. –nics

Identify Logs Used to Troubleshoot Network Issues

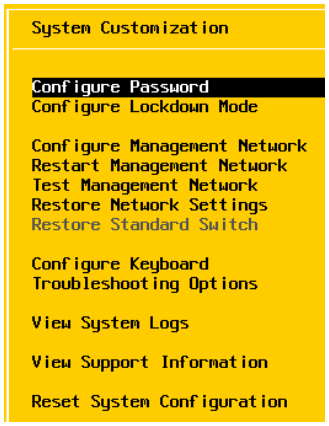
- DHCP issues: **`/var/log/dhclient.log`**
- Network driver/device issues: **`/var/log/hostd.log`**, & **`vmkernel.log`**
- vCenter issues: **`/var/log/vpxa.log`**

Utilize vCLI Commands to Troubleshoot ESXi Network Configurations

- Using **`esxcli network`** & the **`vicfg-`** & **`esxcfg-`** commands you can list & view & set networking items

Utilize DCUI & ESXi Shell to Troubleshoot, Configure, & Monitor ESXi Networking

- The DCUI can only be accessed directly at the host, or via iLO, IPMI, or via IP KVM to be able to do the following:



- Shell – type `busybox` to see some "high-level" commands that can be used in `/sbin` ; `esxcfg` & `esxcli` commands can be used
  1. For direct Shell (DCUI) access, press ALT+F1 then enter root credentials. Type 'exit' when done, then ALT+F2

6.4 – Troubleshoot Storage Performance/Connectivity

Identify Logs Used to Troubleshoot Storage Issues

- `/var/log/vkernel.log` directory

Use `esxcli` to Troubleshoot Multipathing & PSA-Related Issues (pg. 45-46 vCLI Concepts & Examples, pg. 160-170 Storage Guide)

- Don't know exactly what this could be, but you can use `esxcli` to list many storage & PSA items, some of which I have done so below; then, you can make changes to a device, add claimrules, or change the default PSP for a SATP (a lot of storage-related cmds were discussed in 1.1)
- **`esxcli storage fileystem list`**

```
~ # esxcli storage filesystem list
Mount Point                                       Volume Name  UUID                                 Mounted  Type          Size          Free
------------------------------------------------  -----------  -----------------------------------  -------  ------  ------------  ------------
/vmfs/volumes/91748839-209c9a9c                   Build        91748839-209c9a9c                       true  NFS     83195531264  68165804032
/vmfs/volumes/508a7a10-f32c2805-a21c-000c2987e7ac  iSCSI1       508a7a10-f32c2805-a21c-000c2987e7ac     true  VMFS-5  42681237504  34510733312
/vmfs/volumes/508a8807-993421f6-d262-000c29617fae  host1_Local  508a8807-993421f6-d262-000c29617fae     true  VMFS-5  37580963840  36562796544
/vmfs/volumes/508a7a1b-fede124d-c07c-000c2987e7ac  iSCSI2       508a7a1b-fede124d-c07c-000c2987e7ac     true  VMFS-3  10468982784   9874440192
/vmfs/volumes/508a7a26-e8e8251a-bfd2-000c2987e7ac  iSCSI3       508a7a26-e8e8251a-bfd2-000c2987e7ac     true  VMFS-3  10468982784   9874440192
/vmfs/volumes/508a8808-44d20ed8-958c-000c29617fae                508a8808-44d20ed8-958c-000c29617fae     true  vfat     4293591040   4272357376
/vmfs/volumes/4243cb7c-c50de5cc-024d-29fc9a8fd7b1                4243cb7c-c50de5cc-024d-29fc9a8fd7b1     true  vfat      261853184    129265664
/vmfs/volumes/38d52d71-935a3fa7-45ca-e060cb78f2f0                38d52d71-935a3fa7-45ca-e060cb78f2f0     true  vfat      261853184    115683328
/vmfs/volumes/508a87f0-32324f57-e08f-000c29617fae                508a87f0-32324f57-e08f-000c29617fae     true  vfat      299712512    111230976
```

- **`esxcli storage core device list`**

```
t10.FreeNAS_FreeNAS________0
   Display Name: FreeNAS iSCSI Disk (t10.FreeNAS_FreeNAS________0)
   Has Settable Display Name: true
   Size: 40960
   Device Type: Direct-Access
   Multipath Plugin: NMP
   Devfs Path: /vmfs/devices/disks/t10.FreeNAS_FreeNAS________0
   Vendor: FreeNAS
   Model: FreeNAS
   Revision: 0
   SCSI Level: 5
   Is Pseudo: false
   Status: degraded
   Is RDM Capable: true
   Is Local: false
   Is Removable: false
   Is SSD: false
   Is Offline: false
   Is Perennially Reserved: false
   Thin Provisioning Status: unknown
   Attached Filters:
   VAAI Status: supported
   Other UIDs: vml.0200000003000000077c5843d467265654e41
```

- **`esxcli storage core adapter list`**

```
~ # esxcli storage core adapter list
HBA Name  Driver    Link State  UID                   Description
--------  --------  ----------  --------------------  -----------------------------------------------------------------------------
vmhba0    ata_piix  link-n/a    ide.vmhba0            (0:0:7.1) Intel Corporation PIIX4 for 430TX/440BX/MX IDE Controller
vmhba1    mptspi    link-n/a    pscsi.vmhba1          (0:0:16.0) LSI Logic / Symbios Logic 53c1030 PCI-X Fusion-MPT Dual Ultra320 SCSI
vmhba32   ata_piix  link-n/a    ide.vmhba32           (0:0:7.1) Intel Corporation PIIX4 for 430TX/440BX/MX IDE Controller
vmhba33   iscsi_vmk online      iqn.1998-01.com.vmware:host1  iSCSI Software Adapter
```

- **`esxcli storage core path list`** (about the same as 2nd item above)
- **`esxcli storage core path set –option –path vmhba#:C#:T#:L#`**
- Get list of PSPs for the Host: **`esxcli storage core plugin registration list --plugin-class="PSP"`**

```
~ # esxcli storage core plugin registration list --plugin-class="PSP"
Module Name     Plugin Name     Plugin Class  Dependencies  Full Path
--------------  --------------  ------------  ------------  ---------
vmw_psp_lib     None            PSP
vmw_psp_mru     VMW_PSP_MRU     PSP           vmw_psp_lib
vmw_psp_rr      VMW_PSP_RR      PSP           vmw_psp_lib
vmw_psp_fixed   VMW_PSP_FIXED   PSP           vmw_psp_lib
```

- Get list of SATPs for the Host: **`esxcli storage nmp satp list`**

```
~ # esxcli storage nmp satp list
Name                 Default PSP    Description
-------------------  -------------  ------------------------------------------
VMW_SATP_MSA         VMW_PSP_MRU    Placeholder (plugin not loaded)
VMW_SATP_ALUA        VMW_PSP_MRU    Placeholder (plugin not loaded)
VMW_SATP_DEFAULT_AP  VMW_PSP_MRU    Placeholder (plugin not loaded)
VMW_SATP_SVC         VMW_PSP_FIXED  Placeholder (plugin not loaded)
VMW_SATP_EQL         VMW_PSP_FIXED  Placeholder (plugin not loaded)
VMW_SATP_INV         VMW_PSP_FIXED  Placeholder (plugin not loaded)
VMW_SATP_EVA         VMW_PSP_FIXED  Placeholder (plugin not loaded)
VMW_SATP_ALUA_CX     VMW_PSP_FIXED  Placeholder (plugin not loaded)
VMW_SATP_SYMM        VMW_PSP_FIXED  Placeholder (plugin not loaded)
VMW_SATP_CX          VMW_PSP_MRU    Placeholder (plugin not loaded)
VMW_SATP_LSI         VMW_PSP_MRU    Placeholder (plugin not loaded)
VMW_SATP_DEFAULT_AA  VMW_PSP_FIXED  Supports non-specific active/active arrays
VMW_SATP_LOCAL       VMW_PSP_FIXED  Supports direct attached devices
```

- Get list of storage device characteristics for the Host: **`esxcli storage nmp device list`**

```
t10.FreeNAS_FreeNAS_________0_____________________________
   Device Display Name: FreeNAS iSCSI Disk (t10.FreeNAS_FreeNAS_________0_____________________________)
   Storage Array Type: VMW_SATP_DEFAULT_AA
   Storage Array Type Device Config: SATP VMW_SATP_DEFAULT_AA does not support device configuration.
   Path Selection Policy: VMW_PSP_FIXED
   Path Selection Policy Device Config: {preferred=vmhba33:C0:T0:L0;current=vmhba33:C0:T0:L0}
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba33:C0:T0:L0
```

- Add a claimriule: **`esxcli storage core claimrule add -r 500 -t vendor -V NewVend -M NewMod -P NMP`** , then load it: **`esxcli storage core claimrule load`**
  1. To remove a claimrule: **`esxcli storage core claimrule -r 500`** then load it: **`esxcli storage core claimrule load`**
- Set a new default PSP for a SATP
  1. List SATPs & the corresponding PSPs: **`esxcli storage nmp satp list`**
  2. Change the default PSP: **`esxcli storage nmp satp set -s VMW_SATP_CX -p VMW_PSP_RR`**
  3. Reboot the Host
- Assign a new SATP (usually 3rd Party) to a device/LUN: **`esxcli storage nmp satp rule add -s VMW_SATP_CX -d naa.UUID`**
- Change PSP for a device
  1. List device details: **`esxcli storage nmp device list -d naa.UUID`**
  2. Change PSP for the device: **`esxcli storage nmp device set -d naa.UUID -P VMW_PSP_RR`**
- View configurations for a device based on its PSP: **`esxcli storage nmp psp roundrobin deviceconfig get -d naa.UUID`**
  1. Cmd above I used `roundrobin` but can substitute `generic` or `fixed` depending on PSP used for the device
- Set a preferred path for a device
  1. Change to different "channel" or "target" or "LUN": **`esxcli storage nmp psp fixed deviceconfig set -d naa.UUID -p vmhba32:C0:T1:L0`**
  2. Verify change: **`esxcli storage nmp psp fixed deviceconfig get -d naa.UUID`**
  3. Reset the device "configured" preferred path back to default: **`esxcli storage nmp psp fixed deviceconfig set -d naa.UUID -E`**
  4. Verify change: **`esxcli storage nmp psp fixed deviceconfig get -d naa.UUID`**

Use `esxcli` to Troubleshoot VMkernel Storage Module Configurations

- I think this goes back to the management of MPPs, etc. (not much in Storage Guide pg. 147-149)
- Possibly use: **`esxcli system module list`** to list modules & see if loaded & enabled

Use `esxcli` to Troubleshoot iSCSI-Related Issues (pg. 57-58 & 62-80 CLI Concepts & Examples)

- Use `esxcli iscsi` namespace
  1. See if Software iSCSI is enabled: **`esxcli iscsi software get`**
  2. Enable Software iSCSI: `esxcli iscsi` software set `-e`
  3. List adapter associated with iSCSI: `esxcli iscsi adapter list`
- Use `esxcli network` namespace

Troubleshoot NFS Mounting & Permission Issues (pg. 49 CLI Concepts & Examples has a few general cmds)

- Use `esxcli storage nfs` command/namespace (`list`, `add`, `remove`)
- Also, see KB: http://kb.vmware.com/kb/1003967

Use `esxtop/resxtop` & `vscsiStats` to Identify Storage Performance Issues

- Reminder of metrics & values to look out for:
  1. DAVG – device latency (at the array); > 25
  2. KAVG – VMkernel latency; > 2
  3. GAVG – Guest latency, which is sum of DAVG & KAVG (i.e. DAVG + KAVG); > 25-30
  4. CONS/s – iSCSI Reservation Conflicts per second; > 20
- Refer back to 3.4 for procedure to run/gather data with `vscsiStats`
- Also, see again: http://thefoglite.com/2012/08/07/vscsistats/

Configure & Troubleshoot VMFS Datastores Using `vmkfstools` (pg. 201 Storage Guide)

- There are options for File Systems, Virtual Disks, & Devices
- Create a new VMFS: **`vmkfstools -C vmfs5 -b 1m -S my_vmfs /vmfs/devices/disks/naa.UUID:1`**
- Upgrade an existing VMFS from v3 to v5: **`vmkfstools -T /vmfs/volumes/UUID`**
- Create a Virtual Disk: **`vmkfstools -c 2048m /vmfs/volumes/myVMFS/win2k3-01_2.vmdk`** (or, just browse to the full VM VMFS path [i.e. /vmfs/volumes/iSCSI1/win2k3-01/] then run: **`vmkfstools -c 2048m win2k3-01_2.vmdk`** , which creates a 2nd hard disk named "win2k3-01_2.vmdk" for the VM)
- Rename Virtual Disk: **`vmkfstools -E --renamevirtualdisk OldName NewName`**
- Delete a Virtual Disk: **`vmkfstools -U win2k3-01_02.vmdk`**
- List a VMFS datastore attributes: **`vmkfstools -P /vmfs/volumes/iSCSI1 -h`**

Troubleshoot Snapshot & Re-Signaturing Issues

- Refer back to 1.1
- Use: **`esxcli storage vmfs snapshot`** namespace (`list` , `mount` , `resignature`)

Analyze Log Files to Identify Storage & Multipathing Problems

- Probably find info in `/var/log/vmkernel.log`

6.5 – Troubleshoot vCenter & Host Mgmt

Identify CLI Commands & Tools Used to Troubleshoot Mgmt Issues

Troubleshoot vCenter Server Service & DB Connection Issues (For this, I used: http://kb.vmware.com/kb/1003926)

- Modify ODBC Connection DB Server Username/Pwd; verify correct DB is "connected"
  1. Cmd prompt to: `C:\Progam Files\VMware\Infrastructure\VirtualCenter Server` & run `vpxd.exe -p`
- "Critical" folders may be missing (i.e. /sysprep or /diagnostics); reinstall VC or recreate folders
- Look in vCenter Logs here: C:\Programdata\VMware\VMware VirtualCenter\Logs\

Troubleshoot the ESXi Firewall

- Use `esxcli network firewall` command/namespace to view & set rules, etc. (see KB: http://kb.vmware.com/kb/2005284)
  1. **`esxcli network firewall ruleset list`** to list all firewall rulesets
- Enable the firewall: **`esxcli network firewall set –enabled true`**

Troubleshoot ESXi Host Mgmt & Connectivity Issues

- Restart Host & vCenter services: **`service mgmt-vmware restart`** (hostd) and **`service vmware-vpxa restart`**
- Check the **`/var/log/hostd.log`**

- Run **`/etc/init.d/hostd status`** to check the `hostd` status
- Check the **`/var/log/vmware/vpxa.log`**

Utilize the DCUI & ESXi Shell to Troubleshoot, Configure, & Monitor an Environment

- This has already been covered in previous sections

SECTION 7

7.1 – Secure Hosts

Identify Configuration Files Related to Network Security

- **`/etc/vmware/esx.conf`** file has firewall services
- **`/etc`** has **`dhclient-#.conf`**, **`host.conf`**, **`nsswitch.conf`**, etc.

Customize SSH Settings for Increased Security

- See KB: http://kb.vmware.com/kb/1017910 , to enable TSM Local and Remote SSH via DCUI
- Or, via vSphere Client > Configuration tab > Software box, Security Profile link, Properties hyperlink by Services section, click SSH and ESXi Shell → Options button to Start the service(s)
- Cmd line: **`vim-cmd hostsvc/start_esx_shell`** and **`vim-cmd hostsvc/enable_ssh`** then **`vim-cmd hostsvc/start_ssh`**

Generate ESXi Host Certificates (pg. 72 Security Guide)

- Put Host in Maintenance Mode
- Log into ESXi Shell (DCUI or Putty, not vMA..gave me access denied errors upon chg'ing files)
- Rename & backup existing certs:
  1. **`cd /etc/vmware/ssl`**
  2. **`mv rui.crt orig.rui.crt`**
  3. **`mv rui.key orig.rui.key`**
- Generate Certificate: **`/sbin/generate-certificates`**
- Restart the Host
  1. Or place Host in Maintenance Mode, generate new Cert, then run: **`/etc/init.d/hostd restart`**
  2. vCenter will probably not recognize the Host's new cert and will 'disconnect' the Host; rt-click the Host > Connect, then re-enter credentials to re-add the Host back to vCenter
  3. Compare timestamps of new certs with the backed up ones to confirm new certs: **`cd /etc/vmware/ssl`** then **`ls -la`**
- Once Host is re-added, then Exit Maintenance Mode

Replace Default Certificate with CA-Signed Certificate (pg. 32-39 vSphere Examples & Scenarios Guide)

- Rename the original rui.cert & rui.key files as noted in the "Generate New Certs" section above
- CMD Prompt & `cd` to the openssl directory (i.e. `cd c:\openssl-win32\bin`)
- Edit the openssl.cfg file in C:\openssl\bin
  1. Modify `[ CA_Default ]: dir = .`
  2. Modify `[ req ] change: default_bits = 1024` (or `2048` if CA server requires it)
  3. Modify `[ req ] change: default_keyfile = rui.key`
- Generate Custom Cert
  1. Open OpenSSL via cmd prompt & `cd c:\openssl\bin` (NOTE: if not logged on as an admin, run cmd prompt "as" admin)
  2. Generate key: `openssl genrsa 1024 > rui.key`
  3. Generate Cert: `openssl req -new -nodes -out rui.csr -config openssl.cfg`
  4. Enter appropriate information as it's required
  5. Open the `.csr` with a text editor, copy it & submit to a CA

6. Once received back, rename the file as `rui.crt` file & generate the `.pfx` file: `openssl.exe pkcs12 -export -in rui.crt -inkey rui.key -name rui -passout pass:testpassword -out rui.pfx`

- Copy the new certs to the `/etc/vmware/ssl` directory and rename them `rui.crt` & `rui.key`
- See: http://kb.vmware.com/kb/1029944 , http://kb.vmware.com/kb/2015499 , & http://kb.vmware.com/kb/2015421

Configure SSL Timeouts (pg. 76-77 Security Guide)

- Via Shell (DCUI or Putty)
- `cd /etc/vmware/hostd`
- Edit the config.xml file: `vi config.xml`
  1. Enter the <readTimeoutsMs> in milliseconds
  2. Enter the <handshakeTimeoutMs> in milliseconds
  3. At the `<vmacore>` section, scroll to the headings (http & ssl) & press "I" to insert the below lines

```
…
<http>
<readTimeoutMs>20000</readTimeoutMs>
<http>
…
<ssl>
…
<handshakeTimeoutMs>20000</handshakeTimeoutMs>
…
</ssl>
….
<vmacore>
```

  4. Save changes: `wq!`
- Restart hostd – `/etc/init.d/hostd restart`

Enable Strong Passwords & Configure Password Policies (pg. 93 vSphere Security Guide)

- DCUI or Shell to a Host
- Edit password file: **`vi /etc/pam.d/passwd`**
  1. Edit: password requisite line: "…retry=# min=#,#,#,#,#" (min=N0,N1,N2,N3,N4)
  2. N0 = char's req'd for pwd using char's from 1 class
  3. N1 = char's req'd for pwd using char's from 2 classes
  4. N2 = words used for a passphrase, 8-40 char's long (ea word)
  5. N3 = char's req'd for pwd using char's from 3 classes
  6. N4 = char's req'd for pwd using char's from 4 classes

Identify Methods for Hardening VMs (pg. 87-91 Security Guide)

- Review Host logs the VM is on: `hostd`, `vmkernel`, `vmksummary`, `vmkwarning`

Analyze Logs for Security-Related Msgs

- See item just above, last bullet

7.2 – Configure & Maintain ESXi Firewall

Identify `esxcli` Firewall Configuration Commands

- This has been discussed elsewhere, but `esxcli network firewall` is the namespace to use
  1. Can use: `ruleset`, `get`, `load`, `refresh`, `set`, or `unload` namespaces

Create a Custom Service (pg. 36-37, Security Guide)

- See KB: http://kb.vmware.com/kb/2008226

Set Firewall Security Level

- Retrieve settings: **`esxcli network firewall get`**
- Enable: **`esxcli network firewall set --enable true`**
- Turn off: **`esxcli network firewall unload`**

SECTION 8

8.1 – Execute Cmdlets & Customize Scripts Using PowerCLI

Identify Cmdlet Concepts

- No real references; suggest viewing #vBrownBag session with @Josh_Atwell

Identify Environment Variables Usage

- No real references; I guess defining a variable is done using $, for example: $host = Cmdlets

Install & Configure PowerCLI (pg. 13-14 PowerCLI Guide)

- Download & install on a supported system (pretty basic…double-click the .exe, Next, Next….Install)
- Open and initially run: `Set-ExecutionPolicy RemoteSigned`

Install & Configure VUM Powerhell Library

- Download & Install (pretty basic…double-click the .exe, Next, Next, Install)
- List VUM Cmdlets to verify install: open PowerCLI & Run: **`Get-Command –PSSnapin VMware.VumAutomation`**

Use Basic & Advanced Cmdlets to Manage VMs & ESXi Hosts

- Online reference: http://www.vmware.com/support/developer/PowerCLI/PowerCLI501/html/index.html
- Basic Cmdlets – review pg. 17-18, User Guide
  1. VMs
     a. List all VMs in vCenter: **`Get-VM`**
     b. Start a VM: **`Get-VM vmName | Start-VM`** (or **`Stop-VM`, `Suspend-VM`, `Restart-VM`**)
        1) Or simply: **`Start-VM vmName`**
     c. Shutdown Guest OS gracefully: **`Shutdown-VMGuest vmName`**
     d. Migrate a VM from Host1 to Host2: **`Get-VM -Name vmName –Location Host1 | Move-VM –Destination Host2`**
  2. Hosts
     a. List all Hosts in vCenter: **`Get-VMHost`**
     b. Add a standalone Host to Datacenter object: **`Add-VMHost -Name hostName -Location (Get-Datacenter Lab) -User root -Password VMware1!`**
     c. Place a Host in Maintenance Mode
        1) **`$host = Get-VMHost -Name hostName`**
        2) **`$hostCluster = Get-Cluster -VMHost $host`**
        3) **`$updateHostTask = Set-VMHost -VMHost $host -State "Maintenance" -RunAsync`**
           NOTE: the `-RunAsync` parameter migrates or powers down currently running VMs on Host
        4) **`Get-DRSRecommendation -Cluster $hostCluster | where {$.Reason -eq "Host is entering Maintenance Mode"} | Apply-DRSRecommendation`**
        5) **`$myUpdateHost = Wait-Task $updateHostTask`**
- Advanced Cmdlets – Pg. 19-27, User Guide
- `Get`, `Set`, `New`, `Remove` Cmdlets
  1. Can type `Get-Help Get-<object>` for more info on command & end with `-Examples` for usage
     To export a file use: **`Export-CSV "C:\Directory\filename.csv"`**

1. Or, for HTML: **| ConvertTo-HTML –Fragment**
2. Or: **Generate-Report > "$Folder\ReportName.html"**

Use Web Service Access Cmdlets (i.e. API Access Cmdlets; pg. 33 User Guide)

- Cmdlets: `Get-View` & `Get-VIObjectView`

Use Datastore & Inventory Providers

- Inventory – Pg. 35, User Guide
- Datastore – Pg. 36, User Guide

Given a Sample Script, Modify the Script to Perform a Given Action

- Really nothing to state here…it is what it is. Study the above items and be prepared to modify a script

8.2 – Administer vSphere Using vMA

Identify vMA Specific Commands

- Add target server: **vifp addserver fqdn**
- Remove target server: **vifp removeserver fqdn**
- List servers to verify add: **vifp listservers**
- Set target as default for use with fastpass: **vifptarget -s fqdn**
- Clear target server: **vifptarget -c**

Add/Remove Target Servers

- See above

Use `vmkfstools` to Manage VMFS Datastores

- Refer back to 6.4; some examples were presented there

Use `vmware-cmd` to Manage VMs (pg. 104-106 CLI Concepts & Examples)

- Run `vmware-cmd --help` on use case for this command
  1. List VM vmx files: **vmware-cmd -l**
  2. Get a VM state: **vmware-cmd /vmfs/volumes/UUIDofDatastore/vmFolder/vm.vmx getstate**
  3. Start/Stop/Suspend VM: **vmware-cmd /vmfs/……/vm.vmx start**
  4. Get a VM uptime: **vmware-cmd /vmfs/……/vm.vmx getuptime**
  5. Register VM: **vmware-cmd –s register <config_file_path> <datacenter> <resourc_pool>**

Use `esxcli` to Manage ESXi Host Configurations

- `esxcli` has been covered in previous sections; just set a target Host then run the appropriate commands

SECTION 9

9.1 – Install ESXi With Custom Settings

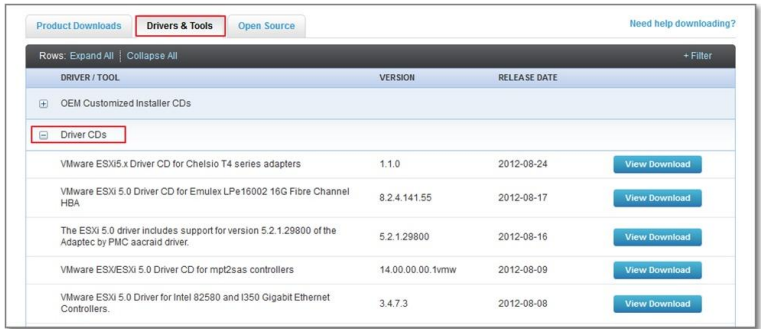
Create/Edit Image Profiles (pg. 129 vSphere Install & Setup Guide)

- Use PowerCLI
- Run `Get-Help Cmdlet` for more info on a command
- List Software Packages or Image Profiles: `Get-EsxSoftwarePackage` or `Get-EsxImageProfile`

- Procedure
  1. Add Software Depot: `Add-EsxSoftwareDepot C:\Support\Depot\ESXi51Install_BLD469512_Depot.zip`
  2. Verify the add: `Get-EsxImageProfile`
  3. Create the Image Profile: `New-EsxImageProfile –CloneProfile "ESXi-5.1.0-469512-Standard" –Name "FirstBoot"` (quotes aren't needed if there are no spaces in the names used)
     a. NOTE: if wanting to create a brand new image without cloning: `New-EsxImageProfile –NewProfile –ProfileName "New Profile" –Vendor MyOrg`
- Add more packages to current Image Profile as needed (pg. 131 vSphere Install & Setup Guide):
  1. `Add-EsxSoftwareDepot C:\Support\Depot\Name_bundle.zip`
  2. Verify the add & get pkg Name to add: `Get-EsxImageProfile | sort –Property Vendor`
     a. NOTE: the `sort` parameter isn't necessary but could be easier to find the pkg Name to add
  3. Add 3rd Party pkg to current (i.e. VCAP5-DCA) image: `Add-EsxSoftwarePackage –ImageProfile FirstBoot –SoftwarePackage net-bna` (or whatever the 3rd-party pkg Name was retrieved in Step 2)
  4. Verify add: `Get-EsxImageProfile FirstBoot | Select-Object –ExpandProperty VibList`, & find the 3rd-party pkg Name just added in Step 3
  5. To remove VIB (3rd-party pkg) just added: `Remove-EsxSoftwarePackage –ImageProfile FirstBoot –SoftwarePackage net-bna` (or again, whatever the 3rd-party pkg Name was retrieved in Step 2)
  6. Verify the removal (I added addt'l cmds to sort the list by Vendor to see the Brocade pkg at the top, if it were still installed; or, you can simply type: `Get-EsxImageProfile FirstBoot`): `Get-EsxImageProfile FirstBoot | Select-Object –ExpandProperty VibList | Select Name,Vendor | sort –Property Vendor`
  7. After you have the Image with all VIBs you want, export to ISO to place on a CD for install, or export as a "zip" bundle to use with VUM (pg. 132 vSphere Install & Setup Guide): `Export-EsxImageProfile –ImageProfile FirstBoot –ExportToISO –FilePath C:\Support\Depot\NewImage.iso` (Note: to export to zip, use the `–ExportToBundle` property)
     a. NOTE: Another good real-world sample of how to do this is shared by Duncan Epping in adding the HA agent to your ESXi Image; I added his blog URL on this topic in 9.2 below
  8. Straightline Example to create Custom Image
     a. **`Add-EsxSoftwareDepot "path"`**
     b. **`Get-EsxImageProfile`**
     c. **`New-EsxImageProfile -CloneProfile ESXi-5.0.0-469512-standard -Name NewProfile -Vendor VendorName -AcceptanceLevel PartnerAccepted`**
     d. **`Get-EsxSoftwarePackage`**
     e. **`Add-SoftwarePackage -ImageProfile NewProfile -SoftwarePackage pkgName`**
     f. **`Get-EsxImageProfile NewProfile | Select-Object –ExpandProperty VibList | ft -AutoSize`**
     g. **`Export-EsxImageProfile NewProfile -ExportToISO C:\Support\Name.ISO`**

Install/Uninstall Custom Drivers

- Some custom drivers can be downloaded on VMware's download site in the "Drivers & Tools" tab, Driver CDs section



- See previous section as it goes through adding 3rd Party drivers (pkg) to a Image Profile as well as removal
  1. Download the bundle zip
  2. Add the bundle as a Depot
  3. Get the bundle Name to add
  4. Add the bundle Name to Image Profile
  5. Verify bundle was added
- Also, see KB: http://kb.vmware.com/kb/2005205

Configure Advanced Boot Loader Options (pg. 46-47 vSphere Install & Setup Guide)

- The default "kickstart" file, `ks.cfg` , is located in the initial RAM Disk at `/etc/vmware/weasel/ks.cfg`
- At ESXi install, press Shift+O at bootloader, then enter commands to load a `ks.cfg` file
  1. Sample cmd: `ks=<location of install script> <boot command line options>`
  2. Example actual cmd: `ks=cdrom:/CustomKS.cfg nameserver=10.100.1.1 ip=10.100.2.21 netmask=255.255.255.0 gateway=10.100.2.252`
- When creating a 'ks' file, rename it to `customks.cfg` …can NOT use `ks.cfg`
- Script options located on pg. 49-54, Install & Setup Guide and KB: http://kb.vmware.com/kb/2004582

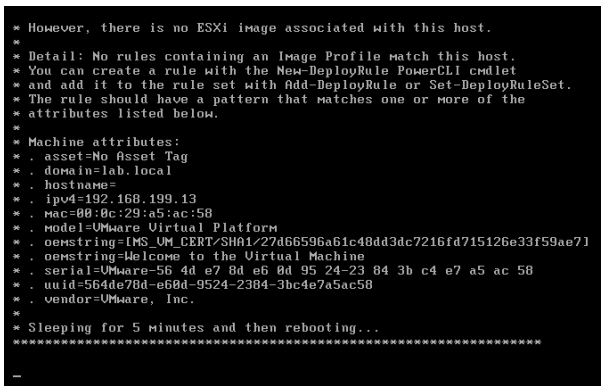
Configure Kernel Options (pg. 56-57 vSphere Install & Setup Guide)

- Not much really listed except that options are in the `boot.cfg` file & specifically the `kernelopt=` line

9.2 – Install ESXi With Auto Deploy

Install Auto Deploy Server (Good blog by Duncan Epping: http://www.yellow-bricks.com/2011/08/25/using-vsphere-5-auto-deploy-in-your-home-lab/)

- Install on vCenter (or other Host) using vCenter install media
  1. NOTE: On Destination Folder screen, change the repository location and max size
  2. Also, Auto Deploy is part of the vCenter Server Appliance; to configure, Log on > Services tab > Auto Deploy, Save settings
- Install a TFTP Server: free tool = Solarwinds TFTP Server
  1. In vCenter: Home > Administration > Auto Deploy, click Download TFTP Boot Zip to unzip the files, then place them in the Storage directory of the TFTP Server (open the TFTP server > General tab and place these files in the directory listed)
- Create DHCP Reservations for Hosts
  1. Modify Items #66 & #67 under DHCP Scope Options for IP of TFTP server and name given in vCenter AutoDeploy window (e.g. undionly.kpxe.vmw-hardwired)
  2. Create a DHCP reservation & DNS Host/PTR Records for Hosts (Duncan doesn't mention in his post to add a Reservation, but not doing so caused me issues in my VMware Workstation testing; I recommend doing so)
- At this point, you can probably boot the new Host & see it try to pick up an ESXi image but fail to do so



Utilize Auto Deploy Cmdlets to Deploy ESXi Hosts (Cmdlet reference is on pg. 70 vSphere Install & Setup Guide)

- Now, after doing the above initial Auto Deploy steps, PowerCLI is needed to create a Deployment Rule for the Hosts: `New-DeployRule -Name InitialHostBoot -Item FirstBoot –Pattern "model=VMware Virtual Platform"`
  1. This Rule creates a new Rule named `InitialhostBoot`; the `-Item` parameter is used to retrieve an Image Profile (custom/cloned) that I created earlier (see 9.1)
  2. After the `-Pattern` parameter above, IP Range, `"ipv4=192.168.199.11-192.168.199.21"`, can be used or use `-Allhosts` parameter and any Host will 'grab' & use the Rule
  3. If you want to fully remove/delete a Deploy Rule: `Remove-DeployRule -DeployRule DeployRuleName –delete`
     a. NOTE: I had a hard time figuring out how to fully delete Deploy Rules; if you do not use the `-delete` parameter, the Rules will not be fully removed & will continue to show if you type `Get-DeployRule`
- To verify the Rules were created: `Get-DeployRule`
- Once a Rule is created, it then needs to be "activated" for use: `Add-DeployRule InitialHostBoot` (do the same for any additional Rule created)
- Verify activation: `Get-DeployRuleSet`
- This post by Joe Keegan shows how to add Rules in a specific place set (order) as each rule is assigned a number (starting at 0) upon its activiation; knowing how to do this is useful if you have a `-Allhosts` Rule added already, but need to create a new Rule that needs to take place before this `-Allhosts` Rule: http://infrastructureadventures.com/2012/03/19/vmware-auto-deploy-rules-rule-sets/
- Boot up a Host and watch the magic! ☺
  1. Troubleshooting note – if using a different ESXi version for the Image will cause a 'timeout – wating for vpxa to start' error in vCenter & though the Host will get ESXi installed, it will fail to add to vCenter
- Straightline Example
  1. Install Auto Deploy
  2. Go into Auto Deploy with vSphere Client, copy the DHCP info, & download the TFTP files
  3. Modify DHCP options 66 & 67
  4. **`Add-EsxSoftwareDepot c:\path\zip`**
  5. **`Add-EsxSoftwareDepot http://IPofVCenter/vSphere-HA-depot`**
  6. **`Get-EsxImageProfile & Get-EsxSoftwarePackage`**
  7. **`New-EsxImpageProfile -CloneProfile ESXi-5.0.0-469512-standard -Name MyImageProfile`**
  8. **`Get-EsxImageProfile`**
  9. **`Add-EsxSoftwarePackage -ImageProfile MyImageProfile -SoftwarePackage pkgName`**
  10. **`New-DeployRule -Name FirstBoot -Item MyImageProfile –AllHosts`**
  11. **`Add-DeployRule -DeployRule FirstBoot`**
  12. Boot a Host
  13. Configure Host
  14. Create a Host Profile named ESXiHostProfile
  15. **`New-DeployRule -Name ProductionBoot -Item MyImageProfile, ESXiHostProfile, ClusterName -Pattern vendor=HWidentifier`**
  16. **`Add-DeployRule -DeployRule ProductionBoot`**
  17. **`Remove-DeployRule FirstBoot -delete`**
  18. Boot Hosts
  19. Assign Host Profile to Hosts
  20. Create Answer File by providing input
  21. Reboot Hosts
  22. **`Export-EsxImageProfile ProductionBoot –ExportToISO C:\Path\Name.ISO`** Or **`Export-EsxImageProfile ProductionBoot –ExportToBundle C:\Path\Name.zip`**

Configure Bulk Licensing (pg. 76 vSphere Install & Setup Guide)

- `Connect-VIServer vc.lab.local –user vi-admin –password VMware1!`
- `$licenseDataManager = Get-LicenseDataManager`
- `$hostContainer = Get-Datacenter –Name Lab`
- `$licenseData = New-Object VMware.Vim.Automation.License.Types.LicenseData`
- `$licenseKeyEntry = New-Object`
- `VMware.Vim.Automation.License.Types.LicenseKeyEntry`
- `$licenseKeyEntery.TypeID = "vmware-vsphere"`
- `$licenseKeyEntry.LicenseKey = "xxxxx-xxxxx-xxxxx-xxxxx-xxxxx"`
- `$licenseData.LicenseKeys += $licenseKeyEntry`
- `$licenseDataManager.UpdateAssociatedLicenseData($hostContainer.Uid, $licenseData)`
- `$licenseDataManager.QueryAssociatedLicenseData($hostContainer.Uid)`
- Provision a Host with Auto Deploy & assign them to the Datacenter or Cluster the license was assigned to
- Log into vCenter > Host > Configuration tab > License Features link and check for correct License

Provision/Re-Provision ESXi Hosts Using Auto Deploy

- Provision
  1. Configure Host Boot Order in BIOS to be Network for PXE Boot via TFTP
  2. Boot Host and it should deploy with an Image, using procedures noted above
- Re-Provision (pg. 82 vSphere Install & Setup Guide)
  1. Simple reboot of Host after it already used Auto Deploy
     a. Host uses initial Image as was created above
     b. Place Host in Maintenance Mode then Reboot the Host
  2. Reboot with answer file
  3. Reprovision with different Image Profile
     a. Create new Image with PowerCLI & Image Builder (see 9.1)
     b. Add the bundle: `Add-EsxSoftwareDepot C:\Directory\File.zip`
     c. Change the Rule assigned to Hosts: `Copy-DeployRule NewRuleName –ReplaceItem NewImageProfile`
     d. Test the Rule for compliance:
        1) `Copy-DeployRule -DeployRule TestRule -ReplaceItem MyNewProfile`
        2) `Get-VMHost -Name Host1` (Verify Host wanting to update is accessible)
        3) `$testRule = Test-DeployRuleSetCompliance Host1`
        4) `$testRule.itemList` (lists differences between new RuleSet and current/original RuleSet)
        5) `Repair-DeployRuleSetCompliance $testRule` (assign new RuleSet to Host upon Host reboot)
  4. Reprovision with different Host Profile
     a. If a Host required user input for attaining a Host Profile from a previous reboot, answers are saved in vCenter in an answer file. If new answers are needed, with vSphere Client re-Apply the Profile and input will again be asked for

Configure an Auto Deploy Reference Host (pg. 116-117 vSphere Install & Setup Guide)

- Once the first Host is deployed, configure settings – vSwitch(s), NTP, Syslogging, Dump Collection (not supported in environments running vDS), Security, etc. then create a 'base' (i.e. Reference) Host Profile to use with Auto Deploy
  1. Log into vCenter > Host Profiles and Export the Host Profile to be used
  2. Get Host Profile Name: `Get-VMhostProfile Host1 -user root -password VMware1!`
  3. Create a Rule with this Host Profile (`Host_Profile`) & assign to 'all' or IP Range of Hosts: `New-DeployRule -Name First-Time-Boot-Test –Item Host_Profile –Pattern "model=VMware Virtual Platform", "ipv4=192.168.199.11-192.168.199.21"`
  4. Add Rule to RuleSet (i.e. 'Activate' it): `Add-DeployRule First-Time-Boot-Test`

5. Boot up unprovisioned Hosts to get this new Rule with Host Profile, or run the Test Compliance procedures described above

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