VMWare 6.5 Foundations Exam Objectives

# Section 1 – Install and Configure vCenter Server 6.x and ESXi 6.x Hosts

## Objective 1.1 – Identify vSphere Architecture and Solutions for a given use case

* **Explain available vSphere editions and features**
  + <http://planetvm.net/blog/?p=2931>
  + Standard
    - Base edition
    - Contains
      * vMotion
      * Storage vMotion
      * HA
      * DP
      * Fault Tolerance
      * vShied Endpoint
      * vSphere Replication
      * Hot Add
      * vVols
      * Storage Policy Based management
      * Content Library
      * Storage APIs
  + Enterprise
    - Contains
      * Standard Plus
      * Reliable mem
      * Big Data Extensions
      * VirtualSerial port concentrator
      * DRS
      * SRM
  + Enterprise Plus
    - Contains
      * Enterprise Plus
        + Storage DRS
        + SIOC
        + NIOC
        + SR-IOV
        + Flash read cache
        + Video Grid vGPU
        + dvSwitcvh
        + Host profiles
        + Auto deploy
  + Standard with Operations management
    - Contains
      * Standard Plus
      * Operations Visibility and management
      * Performance Monitoring and predictive analytics
      * Capacity management and optimization
      * Change Configuration and Compliance Management
      * vSphere security hardening
  + Enterprise with Operations management
    - Contains
      * Enterprise Plus
      * Operations Visibility and management
      * Performance Monitoring and predictive analytics
      * Capacity management and optimization
      * Change Configuration and Compliance Management
      * vSphere security hardening
  + Remote Office/Branch Office Standard
    - Contains
      * Adds VM Capacity to existing Std, ent, ent+ system
      * Packs of 25 VMs
      * Feature set equivalent to standard
  + Remote Office/Branch Office Advanced
    - Contains
      * Adds VM Capacity to existing Std, ent, ent+ system
      * Packs of 25 VMs
      * Feature set equivalent to Ent plus
  + Essentials Standard
    - Contains
      * Very small enterprises
      * Vcenter with less features
      * Up to 3 servers with 2CPUs each
  + Essentials Advanced
    - Contains
      * Essentials Standard plus
      * vMotion
      * HA
      * DP
      * vShield Endpoint
      * vSphere replication
  + ESXi Hypervisor Free
    - Contains
      * Basic hypervisor
      * No central management
      * No advanced Features
* Explain the various data center solutions that interact with vSphere
  + VMWare Addin Products
    - Horizon
      * Extends vsphere into virtual desktop
    - Site Recovery manager
      * Gives active / passive DR capabilities with the ability to fail your virtual infrastructure to remote locations
    - VRealize
      * Operations management and insight along with orchestration
    - vCloud Suite
      * Gives the ability to create mulit tenant private clouds
    - NSX
      * Gives fine grained network virtuaization with distributed routing and fire-walling along with data protection
    - VSAN
      * Moves storage closer to computer by implementing a virtual SAN in your ESXi hosts
    - Airwatch
      * Enterprise mobility and builds on Horizon
* Explain ESXi and vCenter Server architectures
  + ESXi Standalone
    - ESXi Free hypervisor
    - Single server with no vCenter
    - Harder to manage
    - Does not scale well
  + Single Cluster
    - Essentials minimum
    - vCenter and shared storage
    - live migration and manageability
    - scalable to 64 hosts per cluster
  + many Specialised Clusters
    - most scalable
    - cloud enbironments
    - large deployments
    - VDI
    - Work, VDI, Management, etc are all separate clusters
    - Multiple vCenter Servers each managing diff cluster
  + Multiple vCenter Systems
    - Multiple vcenter servers in diff datacenters.
* Explain new solutions offered in the current version
  + <https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/whitepaper/vsphere/vmw-white-paper-vsphr-whats-new-6-5.pdf>
  + <https://blogs.vmware.com/vsphere/2016/10/introducing-vsphere-6-5.html>
  + New features
    - vCenter Server
      * installs on MAC, Windows or Linux without plugins
      * Appliance
        + Migration Tool

Support for vCenter 5.5 and 6.0

* + - * + Improved appliance management

Stats now in tool no need to used command line

Better monitors DB to prevent crashes due to lack of space

Gracefull shutdown when DB is 95% to prevent corruption

Syslog settings

* + - * + Native high availability

Active/passive/witness nodes cloned from existing vCenter Server instance

Replication between nodes

PostgreSQL sync replication

Async file replication for data outside DB

* + - * + Native backup and restore

Backup restore from VAMI or API

Streamed over SCP, HTTP(s) or FTP(s)

* + - * + Update manager now part of Appliance
      * vSphere Web Client
        + inventory tree is now default view
        + home screen reorganized
        + manage tab renamed to configure
        + less reliance on plugins for many admin tasks
        + enhanced authentication plug-in available for Windows passthru or smartcard login
      * vSphere Client
        + HTML5
        + Not as full featured yet as the web client
      * Content Library
        + Can now mount ISO directly from library
        + Apply guest os customization specification during vm deployment
        + Update existing templates
    - vSphere Host Lifecycle management Enhancements
      * vSphere Update manager
        + fully integrated with Vshpere Appliance
      * VMWare Tools and virtual Hardware upgrades
        + Update manager can be used to update
        + Linux VMWare tools (tar tools) updates no longer require reboot
      * Host Profiles
        + Profile management Improvements

Updated graphical interface

Hierarchy possible by coping settings from one profile to one or many others

Host Customizations can now be managed via CSV

* + - * + Operational Enhancements

More informative Compliance checks

* + - Security
      * VM-Level Disk Encryption regardless of OS
      * Encryted vMotion
      * Secure boot model
        + Host and VM
        + Prevents images from being tampered with
    - Universal App Platform
      * Integrated containers
* Determine appropriate vSphere edition based on customer requirements
* Deploy a vSphere 6.x Content Library
  + Content Library
    - Storage location that can be used to hold VM Templates, ISOs and files
    - Deploy
      * VCenter inventory list
      * Content Libraries
      * Create New Library
      * Enter Name
      * Enter Type
        + Local Content Library

Accessible only in the vCenter Server

* + - * + Published Content Library

Availiable to other vCenter Servers

* + - * + Optimized Published Content Library

Optimized for lower CPU usage and faster streaming of content over HTTP

Cannot deploy VMs from optimized library

Use when library resides on remote server and Enhanced link Mode is not used.

* + - * + Subscribed Content Library

Library subscribed to another published content library

Sync contents

Read Only version of Published library

* + - * Select Data store
        + Path to local or remote storage where the contents will be located
* Differentiate Update Manager deployment options
  + Installed on windows
    - Can only be associated with vCenter installed on Windows
    - Requires DB server
  + Installed with vCenter on Windows
    - Can be installed on same windows server as vCenter
    - Requires DB Server
  + Installed with vCenter Appliance
    - Built in as a service on the vCenter Appliance
    - Uses the PostgreSQL DB server bundled with VCA
    - Much more configurable via the vSphere Web Client

## Objective 1.2 – Install and Configure vCenter Server 6.x

* Deploy the vCenter Appliance (vCSA)
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vcsa.doc/GUID-223C2821-BD98-4C7A-936B-7DBE96291BA4.html>
  + Linux VM
  + Can be installed with
    - embedded platform Service Controller ( PSC)
    - external PSC
  + only RAM, CPU and Disk space can be customized
  + Deploy
    - Mount ISO on workstation
    - Run installer or setup
    - Stage 1
      * Deploy OVA
        + Select what type of Platform Services controller installation
        + Target server is ESXi server to deploy VM to
        + Select deployment size
        + Select storage size
        + Configure network settings
    - Stage 2
      * Setup vCSA and start services
        + Application configuration

NTP and SSH config

* + - * + SSO Config
* Install vCenter Server onto a virtual machine
  + Deploy
    - Mount ISO on workstation
    - Can use embedded postreSQL or external SQL DB
    - Follow stage 1 and stage2 instructions
    - <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-452504EC-3EAA-4D68-9DA4-120A59B57031.html#GUID-452504EC-3EAA-4D68-9DA4-120A59B57031>
* Create an ODBC Connection to a vCenter Server
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-E83D153B-F6DB-4355-8806-357C8E1F01CF.html>
  + DSN = Data Source Name
  + On machine where you will or did install vCenter Server
    - Start – Administrative Tools- ODBC
  + Create new SQL Server ODBC connection
  + Enter Name of ODBC DDSN
  + Enter IP info of connection
  + Select authentication method
  + Select DB
* Differentiate vCenter Server deployment modes
  + vCenter Enhanced link mode
    - allows you to log into a single vcenter and manage any vcenter server in the group
    - can join up to 10
    - must be created during install
    - can be for windows or appliance
  + vCenter Embedded linked mode for vCSA with Embedded Platform Service Controller
    - join multiple vCSA with Embedded PSC toghther
    - not for windows install
    - upto 15 vCSA
* Differentiate Platform Services Controller deployment options
  + vCenter with embedded platform Services Controller
    - All services are installed with vCenter on same server whether physical or virtual
    - Advantages
      * No connectivity issues between the two
      * Fewer virtual machines or physical machines
  + Platform Services Controller
    - Only the services are installed on the server
    - Can handle more than one vCenter Server instance
  + Vcenter with external platform services controller
    - Only vCenter installed on server. PSC must be installed elsewhere
  + Mixed Operating System Environments
    - Appliance can be paired with windows server
* Given a scenario, select and size the vCenter Database based on requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Deployment Size** | **vCPUs** | **Memory(GB)** | **Storage(GB)** | **Hosts** | **VMs** |
| Tiny | 2 | 10 | 250 | 10 | 100 |
| Small | 4 | 16 | 20 | 100 | 1000 |
| Medium | 8 | 24 | 425 | 400 | 4000 |
| Large | 16 | 32 | 640 | 1000 | 10000 |
| X-Large | 24 | 48 | 980 | 2000 | 35000 |

* Install additional vCenter Server Components
* Install and configure vSphere Client / vSphere Web Client
  + Client
    - HTML5
    - Not all functionality yet
    - Login
      * https;// vcenter\_server\_ip\_address\_or \_FQDN/ui
  + Web Client
    - Login
      * https://vcenter\_server\_ip\_address\_or \_FQDN/vshpere-client
* Install/Remove vSphere Client plug-ins
  + Plugins allow for extending vCenter Server functionality and allow 3rd party and even VMWare applications to operate more fluidly
  + Delete
    - <https://www.virtualizationhowto.com/2017/08/managing-disabling-deleting-vmware-vcenter-server-plugins/>
    - Navigate to Managed Object Reference (MOB) manager
    - Choose content under properties
    - Select ExtensionManager
      * This will show all registered extensions
    - We need the Key String to unregister
    - Go back to MOB screen
    - Choose UnregisterExtension
    - Paste the key string in the extensionkey value and select invoke method
* **Enable/Disable vSphere Client plug-ins**
  + <https://www.virtualizationhowto.com/2017/08/managing-disabling-deleting-vmware-vcenter-server-plugins/>
  + Administration – Solutions – Client Plugins
  + Right click and enable / disable plugin
* **License vCenter Server using the Web Client** 
  + Administration – Licensing
  + Each license must have a license object
    - A container for a license key of a VMWare Product
    - Once the object is create and a license key associated with it. The license can be assigned
  + Licenses can be assigned to multiple servers ( as long as there are cpus left on the license)
* **Determine availability requirements for a vCenter Server in a given vSphere implementation**
  + vCenter Server Appliance
    - <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.avail.doc/GUID-4A626993-A829-495C-9659-F64BA8B560BD.html>
    - Three nodes
      * Active
        + Uses public IP for management interface
        + Vcenter HA network for replication to passive
        + Vcenter HA network for communication to witness
      * Passive(clone)
        + Updates and syncs state from active
        + Automatically takes over if Active has failure
      * Witness(Clone)
        + Lightweight clone
        + Quorum for cluster
    - Each node can run on separate host
  + PSC
    - <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.avail.doc/GUID-F08F7501-FC06-4A83-806D-89CA489FA3AF.html>
    - vCenter HA with Embedded PSC
      * each node has its own PSC
    - vCenter HA with External PSC
      * PSC on two external servers behind a load balancer
  + Network requirements
    - Management network
      * Static Public IP
      * Serves client requests
    - vCenter HA Network
      * replicates data between nodes
      * monitors heartbeat
      * must be static IPs
      * latency less than 10 ms
      * no gateway
  + vCenter on Windows
    - windows cluster
      * shared nothing
      * two nodes in a cluster
        + one active o
        + one passive
      * can not use appliance
      * must be running vsphere 6.5

## Objective 1.3 – Install and Configure ESXi 6.x Hosts

* **Given a scenario, validate if an ESXi configuration meets given requirements**
* **Perform a scripted installation of ESXi** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-870A07BC-F8B4-47AF-9476-D542BA53F1F5.html#GUID-870A07BC-F8B4-47AF-9476-D542BA53F1F5>
  + Prereq
    - Script must be stored where server can access
      * HTTP
      * HTPS
      * FTP
      * NFS
      * CDROM
      * USB
  + One script for all machines with variables or one script per server
  + Start install or upgrade script by entering commands at boot options during boot
    - SHIFT+O
  + Kixstart file
* **Perform an interactive installation of ESXi using media or PXE** 
  + PXE
    - <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-B9DB94CA-4857-458B-B6F1-6A688726AED0.html>
* **Configure NTP on an ESXi Host** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vcenterhost.doc/GUID-9FD3A5E3-6C2D-4161-9270-4BF57FADCE6D.html>
  + enter time servers.
  + All vSphere components should be synced
* **Configure DNS and routing on an ESXi Host**
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-D69AB84A-84DA-4AD0-851B-3964CAB53E36.html>
  + either DHCP or Static
  + Use the direct console
* **Configure SSH and Shell access on an ESXi Host** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-F9234F4A-FD6A-477B-B7BA-28EB6B08CE82.html>
  + Use the direct console
  + Troubeshooting
  + Enable ESXi Shell and/or Ssh
  + Configure availability timeot
    - Number of minutes that can elapse before you must log in
    - If you are logged in when the timeout elpses your session persists but others cannot log in.
* **Configure logs to be sent to a syslog server** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-58D496FD-BB6E-4E2D-A68B-E6533B9193DE.html>
  + syslog service ( vmsyslogd )
    - writes messages from the VMKernel and other sytem componnets to log files
  + vmware web client
    - select host
    - Configure
    - Advanced system settings
    - syslog
  + CLI
    - Esxcli system syslog
  + Settings
    - Syslog.global.defaultRotate
      * Maximum number of archives to keep
      * Can be set globally or on individual host
    - Syslog.global.defaultSize
      * Default size of log (KB) before system rotates ogs
      * Can be set globally or indivual host
    - Syslog.global.logdir
      * Directory where logs are stored
    - Syslog.global.logdirUnique
      * Subdirectory with the name of the ESXi host under the specified location
      * Useful if more than one host uses the same NFS directory
    - Syslog.global.logHost
      * Remote host to where messages are forwared
* **License an ESXi host using the Web Client** 
  + Administration – Licensing
  + Each license must have a license object
    - A container for a license key of a VMWare Product
    - Once the object is create and a license key associated with it. The license can be assigned
  + Licenses can be assigned to multiple servers ( as long as there are cpus left on the license)
* **Backup/Restore vCenter Server Virtual Appliance files** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.install.doc/GUID-8C9D5260-291C-44EB-A79C-BFFF506F2216.html>
  + use Vcenter Server Appliance Management interface
    - musthave FTP,FTPS,HTTP,HTTPS,or SCP server
    - separate folder for each file-based backup
    - Backup
      * https://Appliance\_IP\_Address \_or\_FQDN:5480
      * log in as root
      * summary
      * Backup
      * Enter protocol and backup location / info
      * Select what is to be backed up
    - Restore
      * Use the vCenter Server Appliance GUI installer
      * Stage 1
        + Install vCSA
      * Stage 2
        + Restore data from backup
        + Perform post restore recovery

vCenter Server Appliance with an external platform services controller

log in to Appliance Bash Shell

run /user/bin/vcenter-resotre

Platform Services Controller Appliance

Log in to Appliance Bash Shell

Run the script /usr/bin/vcenter-restore

vCenter Server Appliance with embedded Platform Services Controller

post restore recover is not required

* **Migrate a vCenter Server to vCenter Server Virtual Appliance**
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.upgrade.doc/GUID-9A117817-B78D-4BBE-A957-982C734F7C5F.html>
  + Can migrate from 5.5 or 6.0 to 6.5
  + Migrate update manager from windows to appliance
    - Can use gui or cli method
  + Preparing for migration
    - Sync clocks
      * Can cause auth and SSL Cert problems
    - Prepare DBs for migration
      * Verify passwords wont expire soon
      * Reduce DB size
      * Run cleanup scripts for vCenter 5.5
      * Backup DB
      * Verify vCenter can communicate with local DB
    - Preparing to migrate the content library
      * Vcenter 6.0 and earlier
        + All esxi hosts must be supported by destination vCenter 6.5 server
        + Source content libraries cannot be on local datastores
        + All datastore locations must be accessible at the time of the migration
      * vCener 6.0 UR1 no action required
    - Prepare ESXi Hosts For Migration
      * Source and dest ESXi servers
        + 5.5 or greater
        + Not in lockdown or maintenance mode
    - Download and mount the vCenter Server Appliance ISO
    - Download and run VMWare Migration Assistant on source windows machine
      * Performs the following tasks
        + Discovers the source deployment type
        + Runs pre-checks on the source
        + Reports errors that must be addressed before starting the migration
        + Provides information for the next steps in the migration process
  + Gui Migration of vCenter Server with an embedded vCenter Sing Sing-on or PSC to an appliance
    - Run Gui
      * Deploys new target appliance
      * Exports the required files from the source
      * Copies the required files t the new vCenter server
      * Runs the migration process on the new CSA
      * Imports and updates the files and settings
  + GUI Migration of vCenter Server with an external vCenter Single Sign on or PSC to an appliance

# Section 2 – Configure and Manage vSphere 6.x Networking

## Objective 2.1 – Configure vSphere Standard Switches (vSS)

* **Explain vSphere Standard Switch (vSS) capabilities**
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-350344DE-483A-42ED-B0E2-C811EE927D59.html>
  + Can bridge traffic internally between VM in the same VLAN and link to external networks
  + Host physical nics connect to uplink ports on virtual standard switch
  + VMs virtual NICs are connected to a virtual switch Port Group.
  + Port Groups
    - Identified by network label. Unique on each Host
    - Should be named the same on diff hosts if connected to same broadcast network domain
    - Port groups can use one or more physical NICs
  + Number ports on a virtual switch is dynamically scaled up or down.
* **Create/Delete a vSphere Standard Switch** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-DAF824CD-104D-4ED7-8BA3-D769DF688CEB.html>
  + Navigate to host
  + Configure tab
  + Networking
  + Virtual Switches
  + Add Host Networking
  + Connection type
    - VMKernael Network Adapter
    - Physical Network Adapter
    - VM Port Group for Standard Switch
  + Select new standard switch
  + Add physical network adapters
* **Add/Configure/Remove vmnics on a vSphere Standard Switch** 
  + Physical NICs are called Uplink Adapters
  + Uplink Adapters connect to VMNICs to interface with virtual switch
* **Configure vmkernel ports for network services** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-8244BA51-BD0F-424E-A00E-DDEC21CF280A.html>
  + VMKernel ports provide connectivity to hosts and handles the standard system traffic of
    - vMotion
    - IP Storage
    - Fault Tolerance
    - vSAN
* **Add/Edit/Remove port groups on a vSphere Standard Switch** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-0BBDC715-2F93-4460-BF07-5778658C66D1.html>
  + Port groups provide connectivity and common network configurations for VMs
  + Add Port Group
    - Navigate to host
    - Right click host and select Add Networking
    - Select Connection type
    - Select Virtual Machine Port Group for Standard Switch
    - Select Target Device
      * Existing Virtual Standard Switch or create one
    - Network Label
    - VLAN ID if tagging.
  + Edit Port Group
    - Navigate to host
    - Configure tab
    - Networking
    - Virtual Switches
    - Select Standard Switch
    - Click name of port group
    - Edit settings
  + Remove Port Group
    - Navigate to host
    - Configure tab
    - Networking
    - Virtual Switches
    - Select standard switch
    - Click the label of the port group you want to remove
    - Remove selected port group
* **Determine use case for a vSphere Standard Switch** 
  + You don’t have enterprise licensing
  + Inbound Traffic shaping is not required
  + Networking vMotion not available
    - Network state migrate with VM

## Objective 2.2 – Configure vSphere Distributed Switches (vDS)

<https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-375B45C7-684C-4C51-BA3C-70E48DFABF04.html>

* **Create/Delete a vSphere Distributed Switch** 
  + Create the switch in vCenter and it is propagated to all Host Servers
* **Add/Remove ESXi hosts from a vSphere Distributed Switch** 
  + Considerations
    - Create distributed port groups for VM Networking
    - Create distributed port groups for VMKernel services
    - Configure enough uplinks on the distributed switch for all physical NICs that you want to connect to the switch
    - Make sure that the configuration of the distributed switch is prepared or services with specific needs.
  + Add and Manage
  + Remove
    - Migrate to Different distributed switch
      * Must migrate network adapters that are in used to a different switch
        + Add and Manage wizard to migrate to different switch
      * Then remove hosts
    - Migrate to standard switch
      * Migrate in stages
      * Move all but one physical NIC to standard switches
      * Migrate VMKerenl and VMs
      * Migrate last physical NIC
      * Remove host
* **Add/Configure/Remove dvPort groups** 
  + Add
    - Navigate to distributed switch
    - Right click select distributed port group
    - New Distributed port group
    - Select Name
    - Configure settings
      * Port Binding
        + Static binding

Assign port when VM connects to group

* + - * + Dynamic binding

Assign port first time m powers on after it is connected to the port group

* + - * + Ephemeral – No binding

No port binding

* + - * Port Allocation
        + Elastic

Default number is 8. When they fill up an additional 8 ports assigned

This is the default

* + - * + Fixed

Default number is 8. No more ports are assigned when full

* + - * Number of Ports
      * Network Resource Pool
        + Assign port group to user defined network resource pool
      * VLAN
        + None

Do not use VLAN

* + - * + VLAN

Tag number of VLAN

* + - * + VLAN Trunking

Enter VLAN trunk range

* + - * + Private VLAN
    - Security Settings
      * Promiscuous mode
        + Reject

Placing an adapter in promiscuous mode from the guest operating system does not result in receiving frames for other virtual machines

* + - * + Accept

Switch allows promiscuous traffic

* + - * MAC Address Changes
        + Reject

If guest OS changes MAC, switch drops all inbound frames to the VM

* + - * + Accept

If the guest OS changes the MAC address the VM receives frames

* + - * Forged Transmits
        + Reject

Drops any outbound frame with a source MAC diff from the one in the config file

* + - * + Accept

Switch does not perform MAC filtering and allows all traffic

* + - Traffic Shaping
      * Load Balancing
        + Route based on originating virtual port

Choose uplink based on the virtual port where traffic entered the switch

* + - * + Route Based on IP Hash

Choose an uplink based on hash of the source and destination ip addresses

* + - * + Route based on source MAC Hash

Choose uplink based on has of source Ethernet

* + - * + Route based on physical NIC load

Choose uplink based on current pNIC loads

* + - * + Use explicit failover order

Always use the highest order uplink fro the list of active adapters

* + - * Network Failure Detection
        + Link status Only

Relies on link status

* + - * + Beacon Probing
      * Notify Switches
        + Sends a notification when a VM has traffic sent over different uplink
      * Failback
      * Failover order
        + How to distribute workloads on uplinks

Active uplinks

Continue to use the uplink when the network adapter is up

Standby links

Use the uplink if one of the active adapters is down

Unused uplinks

Do no use this link

* + Remove
    - Verify all VMs are not using port group
    - Verify all VMKernel adapters are migrated to other groups
    - delete
* **Add/Remove uplink adapters to dvUplink groups** 
  + Navigate to distributed switches
  + Actions
  + Add and Manage Hosts
  + Manage host networking
  + Select Hosts and attached hosts
  + Select Network Adapter Tasks
  + Manage physical adapters
  + Can either add un assigned NICs or migrate NICs that exist on other Distributed switch
  + Review impacted
    - No impact
      * ISCSI will continue to function as normal with the new config
    - Important Impact
      * Normal function of ISCSI might be disrupted if the new networking configuration is applied
    - Critical Impact
      * Normal Function of ISCSI will be interrupted if the new networking configuration is applied
* **Configure vSphere Distributed Switch general and dvPort group settings** 
  + General setting
    - <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-E0FED4AB-823D-4B61-B668-9400746D52E5.html>
    - Distributed switch
    - Configure
    - Settings
    - Properties
    - Edit
    - General
      * Name
      * Number of uplinks
      * Network IO Control
      * Description
    - Advanced
      * MTU(bytes)
      * Mulitcast Filtering Mode
      * Discovery Protocol
      * Administrator Conact
  + dvPort Group Settings
* **Create/Configure/Remove virtual adapters**
* **Migrate virtual adapters to/from a vSphere Standard Switch** 
  + Select Migrate VMs to another network
  + Select source network
    - Browse to network to select any VM whose adapter is connected to this network be migrated
    - No network to select any non connected VM be moved
  + Select destination
* **Migrate virtual machines to/from a vSphere Distributed Switch** 
  + See above
* **Configure LACP on Uplink port groups** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-0D1EF5B4-7581-480B-B99D-5714B42CD7A9.html>
  + Dynamic Link Aggregation
  + Link aggregation group
    - Two physical NICs bound together to increase bandwidth, redundancy, and load balancing
* **Determine use case for a vSphere Distributed Switch**

## Objective 2.3 – Configure vSS and vDS features based on given requirements

* **Explain common vSS and vDS policies** 
  + Standard Switch
    - Teaming and Failover
      * Configure physical nics for failover and or load balancing
    - Security
      * Protection agaist MAC address impersonation and unwanted port scanning
    - Traffic Shaping
      * Restric bandwidth that is available to ports.
      * Allow burst traffic
      * Outbound on standard
    - VLAN
      * VLAN Tagging
        + External Switch tagging
        + Virtual Switch Tagging
        + Virtual Guest Tagging
  + Distributed switch
    - All standard except:
    - Traffic Shaping
      * Both outbound and inbound
    - Monitoring
      * Enables or disables NetFlow monitoring on a distributed switch or group
    - Traffic Filtering and marking
      * Applies QOS tag to certain traffic type
    - Resource allocation
      * Associate port or port group with network resource pool
        + Better controls the bandwidth
        + Used with vSphere Network I/O control v2 and V3
    - Port Blocking
      * Selectively block ports from sending and receiving data
* **Describe vDS Security Polices/Settings** 
  + Protection against MAC address impersonation and unwanted port scanning
    - Promiscuous mode
      * Reject
        + Placing an adapter in promiscuous mode from the guest operating system does not result in receiving frames for other virtual machines
      * Accept
        + Switch allows promiscuous traffic
    - MAC Address Changes
      * Reject
        + If guest OS changes MAC, switch drops all inbound frames to the VM
      * Accept
        + If the guest OS changes the MAC address the VM receives frames
    - Forged Transmits
      * Reject
        + Drops any outbound frame with a source MAC diff from the one in the config file
      * Accept
        + Switch does not perform MAC filtering and allows all traffic
* **Configure dvPort group blocking policies** 
  + Navigate to distributed switch
  + Right click switch
  + Select Distributed port group
  + Manage distributed port group
  + Miscellaneous
  + Select group
  + Block all ports drop down menu
  + Enable / disable
* **Configure load balancing and failover policies** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-4D97C749-1FFD-403D-B2AE-0CD0F1C70E2B.html>
  + Nic teaming Policy
    - Connect virtual switch to multiple physical NICs to increase bandwidth or redundancy
  + Load Balancing policy
    - Determines how traffic is distributed between NICs. VMware only balances outgoing. Incoming is handled by physical switch
  + Network FailureDetection
    - Link status Only
      * Relies on link status to determine if NIC is up
    - Beacon Probing
      * Sends out and listens for Ethernet probing frames or beacons
  + Failback policy
    - Enabled by default
  + Notify Switches Policy
  + Configure
    - Configure
    - Networking
    - Virtual Switches
    - Navigate to Teaming and Failover Policies
* **Configure VLAN/PVLAN settings** 
  + VLan Tagging on Distributed port group or Distributed port
    - Navigate to distributed switch
    - Navigate to VLAN policy on port group or port
  + VLAN Tagging on Uplink port group or uplink port
    - Navigate to distributed switch
    - Networks tab
    - Uplink port groups
    - VLAN policy for uplink port group or port
    - Type VLAN range
* **Configure traffic shaping policies**
  + Policy defined by
    - avg bandwidth,
      * num bits per second allowed across a port
    - peak bandwidth,
      * max number of bits per second when sending and receiving burst traffic
    - burst size
      * max number of bytes to allow in a burst
  + configure for standard switch
    - outbound only
    - navigate to host
    - configure tab
    - networking
    - select switch
    - entire switch or port group
  + Configure for distributed switch
    - Inbound and outbound
    - Distributed port or entire switch
* **Enable TCP Segmentation Offload support for a virtual machine** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-E105A601-9331-496C-A213-F76EA3863E31.html?hWord=N4IghgNiBcIC4GMAOACAzgUwOYFsMDs4w4BLAe3xTIDNqIywATEAXyA>
  + Used to improve network performance in workloads that have severe latency requirements by offloading network processes off of the CPU to the NIC
  + Enabled at
    - ESXi host
    - VMKernel
    - Guest OS
  + Enable on VMKernel
    - Esxcli network nic software set –ipv4tso=0/1 –n vmnicX
  + Enable or disable on ESXi Host
    - Navigate to host
    - Configure tab
    - Advanced system settings
    - Edit value of Net.UseHwTSO
      * 1 = enable; 0=disable
* **Enable Jumbo Frames support on appropriate components** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.networking.doc/GUID-53F968D9-2F91-41DA-B7B2-48394D997F2A.html?hWord=N4IghgNiBcIFYFcC2AjA9gAgGYCcxIFMBnEAXyA>
  + Allows hosts to send larger frames out onto the physical network if the network supports jumbo frames
  + Enable on distributed switch
    - Enable on distributed switch
      * Configure tab
      * Settings
      * Properties
      * Advanced
      * MTU greater than 1500 but less than 9000
    - Enable on Standard Switch
      * Configure tab
      * Settings
      * Properties
      * Advanced
      * MTU greater than 1500 but less than 9000
    - Enable VMKernel
      * Configure tab
      * Networking
      * VMKernel adapters
      * Edit adapter properties
      * MTU greater than 1500 but less than 9000
    - Enable for VM
      * Edit VM
      * Configure tab
      * Settings
      * VM hardware
      * Edit adapter type to VMXNet2 or VMXNET 3
      * Set MAC to Manual
      * Inside VM set OS to use Jumbo Frames
* **Given a scenario, determine appropriate VLAN configuration for a vSphere implementation**

# Section 3 –Configure and Manage vSphere 6.x Storage

## Objective 3.1 – Connect Shared Storage devices to ESXi 6.x Hosts

* **Explain storage naming conventions** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.storage.doc/GUID-A36810F4-00EC-4EA8-A242-2A0DBBF56731.html?hWord=N4IghgNiBcIM4BcD2AnMBzApgAgHZgFsBLXdbAYyVwDdNcEiqQBfIA>
  + SCSI
    - SCSI inquery page 83 to generate unique identifier
  + Path-based
    - Mpx.path
      * Path = first path todevice
      * Names are not unique or persistent
    - Vmhbadapter:CChanel:TTarget:LLUN
      * vmhbaDadpter = name of storage adapter
        + physical adapter name
      * CChannel = storage channel number
      * TTarget = target number
      * LLun = shows the position of the LUN within the target
  + Legacy identifier
    - ESX generates an alternative legacy name
    - Vml.number
      * Series of digits that are unique to the device
* **Explain hardware/dependent hardware/software iSCSI initiator requirements**
* **Configure FC/iSCSI/FCoE storage devices**
  + **FC**
    - HBA
      * Host Bus Adapter
      * Used to connect server to SAN network
    - Zone
      * Define which servers can access which storage array
      * Similar to LUN Masking
      * Devices outside of the zone are not visible
      * Has the following effects
        + Reduces number of targets and LUNs presented to a Host
        + Controls and isolates paths in a fabric
        + Can prevent non-ESXi systems from accessing a particular storage system and thus potientially corrupting VMFS data
        + Can be sued to separate different environments
    - WWPN
      * World Wide Port Name
      * Globally unique ID
      * Allow application to access port (connection between server and SAN)
    - Port\_ID (Port Address)
      * Each port in a SAN has a unique ID
      * Used to route data
      * Assigned when device is logged in
    - NPIV
      * N-Port ID Virtualization
      * Port can have multiple WWPN
      * Allows assigning WWPN to VMs within ESXi
  + **ISCSI**
    - ISCSI Initiator
      * Client
      * Software ISCSI Adapter
        + Vmware code built into the VMKernel
      * Hardware ISCSI Adapter
        + Third party adapter that offloads ISCSI and Network processing
      * Dependent Hardware ISCSI Adapter
        + Depends on VMWare Networking and ISCSI configuration and management interfaces provided by VMWare
      * Independent hardware ISCSI Adapter
        + Has its own networking and iscsi configuration and management interfaces
    - ISCSI Target
      * Server
    - Ports
      * Endpoints of an iscsi session
    - IP Address
      * Each node ( initiator or target ) has an IP
    - ISCSI Name
      * Worldwide unique name
      * IQN or Extedend identifier
    - ISCSI Alias
      * More manageable name for ISCSI device or port
    - Connection
      * Discovery
        + Returns a set of targets the initiator can access
        + Dynamic discovery

Returns list from storage system

* + - * + Static discovery

Can only see specified target

* + - * + Authentication

Authenticate by name and key pair

ESXi supports CHAP

* + - * + Access Control
  + **FCoE**
* **Describe zoning and LUN masking practices**
* **Configure/Edit hardware/dependent hardware initiator**
* **Connect/Configure NFS 3 and 4.1 datastores**
  + Cannot use different versions on different ESXi hosts to connect to the same datastore
  + Different versions cannot coexist on same host
  + Select Global Inventory Lists
  + Datastores
  + New Data store
  + Enter name and placement
  + Select type
  + Select version
  + Server IP and mount point
* **Enable/Disable software iSCSI initiator**
* **Configure/Edit software iSCSI initiator settings**
* **Configure iSCSI port binding**
* **Enable/Configure/Disable iSCSI CHAP**
* **Configure Dynamic and Static Target Discovery Addresses**

## Objective 3.2 – Configure and Manage Software Defined Storage

* **Explain Virtual SAN (VSAN) Architecture** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.virtualsan.doc/GUID-18F531E9-FF08-49F5-9879-8E46583D4C70.html>
  + vSAN aggregates local or direct attached devices of Host cluster and creates a single storage pool shared across all hosts in the vSAN cluster
  + disk group
    - unit of physical storage capacity on a host and a group of physical devices that provide performance and capacity to the vSAN cluster
  + consumed capacity
    - how much is used by VMs
  + Object based storage
    - Data stored in containers called objects.
    - Logical volume distributed across cluster
  + vSAN Datastore
    - single datastore created when enabling vSan on cluster
    - objects replicas and witness are stored on separate hosts for fault tolerance.
  + Compliance status
    - Compliant
    - Noncompliant
      * When one or more objects faile to meet the requirements of its storage policy
  + Component state
    - Degraded
      * vSAN detects a permanent component failure and determines that the failed component cannot return to its original state
    - absent
      * temporary component failure
      * restarting host example
  + witness
    - only metadata
  + Storage Policy-based management (SPBM)
* **Create/Delete VSAN Cluster** 
  + Vsan cluster can contain hosts with capacity and hosts without
  + Enable VMKernel for vSAN
    - Add vSAN traffic to VMKernel
  + Navigate to cluster
    - Configure tab
    - vSAN
    - general
    - configure
    - configure vSAN capabilities
    - VMKernel network validation
  + Disable
    - Deslect turn on check box
* **Manage VSAN disk groups** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.virtualsan.doc/GUID-88790522-2FA0-476F-B874-6FE4E8E5B908.html>
  + Create disk group on host
    - Specify each host and device to be used
    - Select devices for capacity and flash device
    - Configure tab
    - vSAN
    - Disk management
    - Create Disk Group
  + Claim Disks
    - Add more capacity
    - Claim for group
    - Configure tab
    - vSAN
    - Disk Management
    - Claim disks
* **Monitor VSAN storage** 
  + Navigate to vSAN cluster
  + Monitor
  + vSAN
  + Select physical disks
* **Add/Remove VSAN Nodes**
* **Explain benefits of NFS 4.1**
* **Determine use cases for Virtual SAN configurations**

## Objective 3.3 – Create and Configure VMFS and NFS Datastores

* **Compare/Contrast supported NFS versions** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.storage.doc/GUID-8A929FE4-1207-4CC5-A086-7016D73C328F.html>
  + VMs on NFS 4.1 support new Fault tolerance in vShpere 6.0 but not old system

|  |  |  |
| --- | --- | --- |
| **Characteristics** | **NFS 3** | **NFS 4.1** |
| Security mechanisms | Auth\_sys | Auth\_syss and kerberos |
| Encryption Algorithms with Kereberos | N/A | AES256-CTS-HMAC-SHA1-96 and AES128-CTS-HMAC-SHA1-96 |
| MultiPathing | Not Supported | Supported through the session trunking |
| Locking mechanism | Proprietary client-side locking | Server side locking |
| Hardware Acceleration | Supported | Supported |
| Thick Virtual Disks | Supported | Supported |
| IPv6 | Supported | Supported by Auth\_sys and Kerberos |
| ISO images presented as CDROMs to VMs | Supported | Supported |
| VM Snapshots | Supported | Supported |
| VM with VMDK larger than 2TB | Supported | Supported |
|  |  |  |
|  |  |  |

| **vSphere Features** | **NFS version 3** | **NFS version 4.1** |
| --- | --- | --- |
| vMotion and Storage vMotion | Yes | Yes |
| High Availability (HA) | Yes | Yes |
| Fault Tolerance (FT) | Yes | Yes |
| Distributed Resource Scheduler (DRS) | Yes | Yes |
| Host Profiles | Yes | Yes |
| Storage DRS | Yes | No |
| Storage I/O Control | Yes | No |
| Site Recovery Manager | Yes | No |
| Virtual Volumes | Yes | Yes |
| vSphere Replication | Yes | Yes |
| vRealize Operations Manager | Yes | Yes |

* **Configure NFS storage for VMDK formatting**
* **Configure storage multi-pathing** 
  + Requires NFS 4.1
* **Compare/Contract VMFS6 and VMFS5** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.storage.doc/GUID-7552DAD4-1809-4687-B46E-ED9BB42CE277.html>
  + All versions you can create and power on VMs
* **Configure Storage Distributed Resource Scheduler (SDRS)** 
  + Provides initial placement and on going balance recommendations
  + Rebalance happens periodically (8 hours by default) or when a datastore exceeds utilization threshold
  + Create
    - Create datastore cluster
  + Enable sDRS
    - Enables the following functions
      * Space load balancing among datastores in the cluster
      * I/O load balancing among datastores within a datastore cluster
      * Initial placement for virtual disks based on space and I/O workload
    - Click enable Storage DRS checkbox
* **Extend/Expand VMFS Datastores** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.storage.doc/GUID-D57FEF5D-75F1-433D-B337-E760732282FC.html?hWord=N4IghgNiBcIG4FsBmBnABAEzAFzC7A9gE4CmIAvkA>
  + Global Inventory List
  + DataStores
  + Select Device
  + Expand = has free space immediately after the extent (partition)
  + Extent = Separate partition
  + CLI
    - Expand
      * Increases size of the existing datastore
      * Vmkfstools –growfs | -G device device
    - Extent
      * Increase size by spanning across partition
      * Vmfstools –spanfs | -Z span\_partition Head\_partition
* **Place a VMFS Datastore in Maintenance Mode** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.resmgmt.doc/GUID-D229556E-C991-41BD-A378-363CC9D2B2CC.html?hWord=N4IghgNiBcICZgC5gM6IPYCcCmACAlgHa4C2YRi2hYhAxnienNiAL5A>
  + VMDK stored on a datastore entering maint mode must be migrated to another datastore. Either manually or with storage DRS
  + Prereqs
    - Storage DRS enabled
    - No CD-ROM Images stored on datastore
    - Two datastores in the datastore cluster
  + Browse to datastore
  + Right click and select Maintenance Mode
  + Enter Maintenance mode
  + Placement recommendations
    - VMDK stored on a datastore entering maint mode must be migrated to another datastore. Either manually or with storage DRS

# Section 4 – Deploy and Administer Virtual Machines and vApps

## Objective 4.1 – Create and Deploy Virtual Machines

* **Place virtual machines in selected ESXi hosts/Clusters/Resource Pools**
* **Configure and deploy a Guest OS into a new virtual machine**
  + Start New VM Wizard
  + Select Name and folder
    - Folders allow you to group VM
  + Select a resource
    - Host, cluster, vApp or resource pool
  + Select Datastore
    - Physical storage location of VM files
  + Elect Virtual machine Compatibility
    - select the lowest level depending on what capabilities this machine requires
  + select guest OS
    - this sets up the recommended resources available for this machine. This is only a recommendation and can be changed
    - this does not need to match the OS
  + customize the VM
    - make any changes to the hardware
  + Finish
  + Install OS
* **Configure/Modify virtual hardware: o CPU o RAM o Disk o vNIC** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-4AB8C63C-61EA-4202-8158-D9903E04A0ED.html>
  + VM Compatibility
    - Choose what version of ESXi the VM will run on
  + CPU
    - CPU Socket
    - Cores
    - Corelet
      * Amd equivalent to logical processor
    - Thread
      * Hyperthreading
    - Resource sharing
      * More shares then more resources it can use
    - Virtual Symetric Multiprocessing
    - CPU Hot add
      * Hot add only
      * Version 7 and above (esx 4)
      * Guest OS must support
    - Allocate via
      * Limit
        + Places limit on consumption of CPU time for the VM
      * Reservation
        + Guaranteed minimum allocation for a VM
      * Shares
        + The more shares a VM has, the more often it receives a time slice of a CPU
        + Low, Medium, High Custom
    - Affinity
      * Allows you to control how VMs are distributed across hosts
      * Can assign VM to specific processor
      * Cannot use with DRS
    - CPUID
      * Controls features available to Vm
      * Masking can allow vm to migrate to older hosts
  + Memory
    - RAM Amount
    - Allocate via
      * Limit
        + Limit on consumption of memory for a VM
      * Reservation
        + Guaranteed minimum memory for a VM
      * Shares
        + Shares determine what VM gets memory more often
        + Higher shares get more memory it gets
    - Hot add
      * Allows you to add memory to running VM
      * ESXi 4 or higher
  + Network Config
    - Adapter types
      * E1000E
        + Default adapter for Windows 8 and Windows 2012
      * E1000
        + XP and later
        + Linux 2.4.19 and later
      * Flexible
        + Depends on if VM tools are installe
        + VLance without
        + VMXNet with
      * VLance
        + Older 32 bit legacy OS
      * VMXNet
        + Optimized for performance
        + Requires VMWare Tools
      * VMXNet 2 (Enhanced)
        + Provides high-performance used with jumbo frames and hardware offloads
      * VMXNet 3
        + paravirtualized
        + VMXNet 2 and more
      * PVRDMA
        + Paravirtualized
        + Supports Remote Direct Memory Access (RDMA) between VMs through OFED verbs API
        + All VMs must have this nic to utilize
        + Must use distributed switch
      * SR-IOV passthrough
        + VM and Physical adapter exchange data without using the VMKernel
        + Low latency
        + ESXi 5.5 and later
    - Disks
      * <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-90FD3678-AC9F-40CC-BB66-F499141E2B99.html>
      * Can be hot added
      * Changing size of hard disk
      * Large capacity drives
        + 2TB to max 62TB
        + Limitations

VM OS must support

ESXi 5.5 or later for move or clone

Datastore must be VMFS5 or later or NFS on a NAS

Virtual Flash Cache supports max 16TB

Fault Tolerance not supported

Buslogic parallel controllers not supported

* + - * Disk shares
        + Distinguish high priority from low priority
        + Relivant only within a given host
        + Compared to VMs on same host
        + Edit VM settings
        + Expand harddisks
        + Shares
      * Flash Read cache
        + Accelerate VM performance
        + Can reserve for any VMDK
        + Created when VM is powered on and discarded when VM is powered off or suspended
      * PCI Device
        + Can create direct connection to PCI device connected to host
      * USB Passthru from host to VM
        + Only one Vm at a time and only on that host
        + USB Arbitrator

Manages connection between VM and USB Device

* + - * + USB Controller

VM device

Must be installed before VM can use USB

* + - * USB Passthu from client to VM
        + Client is where vSphere Web Client is running and must be logged into vCenter that controls the VM
* **Create/Convert thin/thick provisioned virtual disks** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-B7CD0374-BC3B-4EB0-8F57-8AEF98CB0662.html>
  + Flat pre-initialzed = Thick
  + Allocate and commit space on demand = Thin
  + NFS datastores without hardware acceleration support Thin provisioned only
  + NFS Datastores with Hardware Acceleration and VMFS datasotes
    - Thick Provision Lazy Zeroed
      * Space for disk allocated when disk is created
      * Data remaining on the physical device at that location is not erased but is zeroed out on demand later on first write
    - Thick Provisioned Eager Zeroed
      * Space for disk allocated when disk is created
      * Supports clustering features
      * Remaining data on physical disk zeroed at time of creating
      * Takes longer to create because of the zeroing
    - Thin Provision
      * Disk grows as space is needed to max size
      * Only allocates what is used at time of creation
  + Storage vMotion can change format
  + Change
    - Browse datastore to VM files
    - Right click VMDK and INFLATE
* **Install/Upgrade VMware Tools and Virtual Hardware** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.html.hostclient.doc/GUID-28C39A00-743B-4222-B697-6632E94A8E72.html>
  + Vmware tools enhances performance of VM
  + Install
    - Select VM
    - Click actions]
    - Select Guest OS
    - Install VM
      * ISO gets mounted and setup autorun.
  + Upgrade
    - Select Vm
    - Click actions
    - Guest OS
    - Upgrade Vmwaretools
* **Configure PCI Passthrough and Direct I/O** 
  + Can create direct connection to PCI device connected to host
  + PCI Direct path I/O devices on VMs you can’t
    - Suspend
    - Migrate with vMotion
    - Take or restore snapshots
  + connect
    - edit VM Settings
    - virtual hardware
    - PCI Device
    - New PCI Device
    - Select from drop down
* **Configure virtual machine time synchronization**

## Objective 4.2 – Create and Deploy vApps

* <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-E6E9D2A9-D358-4996-9BC7-F8D9D9645290.html>
* vApp
  + allows packaging of multiple interoperating virtual machines and software applications that you can manage as a unit
  + any action taken on a VM in the vApp affects all VMs in the vApp
* **Create/Deploy/Clone a vApp**
  + Requires
    - ESXi 4.0 or greater
    - Cluster that is enabled for DRS
  + Create
    - Create new vApp
    - vApp Name
    - Location
    - Allocate CPU and Mem resources
      * Shares
        + Shares with respect to the parents total
        + Sibling vApps share resources according to their relative share values
      * Reservation
        + Guaranteed CPU/mem for his vApp
      * Reservation Type
        + Expandable

So the vApp can use more resources if needed

* + - * Limit
        + Upper limit for the vApps cpu/mem
        + Unlimited = no limit
  + Deploy
    - Actions
    - Create VM, Resource Pool, or child app
    - Or Deploy OVF template
  + Clone
    - Clones all VMs and child vApps
    - Create new vApp
    - Clone and existing vApp
    - Select
    - Select where to place clone
    - Name
    - Datacenter
* **Add objects to an existing vApp** 
  + Can either create VM or vApp or move an existing VM or vApp
  + Click and drag the existing object to the vApp
  + Or create VM
* **Edit vApp settings** 
  + Areas
    - Application Properties
      * Non editable product info
    - Deployment
      * Specify CPU and Memory Resources and configure IP allocation
    - Authoring
      * Controls the configurable options that are available
      * Defined properties
  + Startup and Shutdown Options
    - Order in which VMs and netsted vApps start up or shutdown
    - Delays and actions performed at startup and shutdown
* **Configure IP pools** 
  + Ip allocation policy
    - Only if allowed by the vApp
    - Static – manual
      * Manually configured
    - Transient – IP Pool
      * IP addresses allocated from pool when powered on.
      * Released when powered off.
    - DHCP
      * Assigned from DHCp
    - Static – IP Pool
      * IP Addresses allocated from pool when powered on.
      * Remain allocated when powered off.
* **Suspend/Resume a vApp** 
  + Powering on
    - All VMs are turned on
    - If on DRS cluster
      * DRS is then run in semiauto or auto mode for initial placement
  + Power Off
  + Suspend
    - Suspended in the reverse order of startup
    - Overwrites any VM specific suspend behavior
  + Resume
    - Resumed according to startup order

## Objective 4.3 – Manage Virtual Machine Clones and Templates

* **Explain Cloning and Template options** 
  + Cloning
    - Vm is a copy
    - All virtual hardware / software
  + Template
    - Template is a Copy of VM
    - Generalized so when Vm starts the first time it needs to go thru the start up wizard
* **Clone an existing virtual machine** 
  + Start the clone an existing machine task
    - Open from any object
      * Right click any object that is a parent to a VM
      * Select New VM
      * New VM Clone an existing VM
    - From a VM
      * Clone
      * Clone to VM
  + Select a VM to clone
    - You can customize new VM at this stage
  + Select VM Name and Folder
  + Select Resource
    - Host , clust, vApp , etc
  + Select DataStore
    - What storage will clone live on
  + Select Clone Options
    - Customize new clone
  + Customize Guest OS
* **Create a template from an existing virtual machine** 
  + Clone a VM to template
    - Keeps the original VM and makes a template
  + Clone a Template to Template
    - Create another Template with diff options and still keep the source template
  + Convert a VM
    - Power off VM
    - Right click
    - Template
    - Convert to template
* **Deploy a virtual machine from a template** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-8254CD05-CC06-491D-BA56-A773A32A8130.html>
  + Follow same process as cloning.
* **Update existing virtual machine templates** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-DAF319F7-6B48-4A10-9AB1-102F37637C1E.html>
  + Directly patch VM Template in content library
  + Select library content
  + Update item
  + Browse to where new item is store and overwrite.
* **Deploy virtual appliances and/or vApps from an OVF template** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-AFEDC48B-C96F-4088-9C1F-4F0A30E965DE.html>
  + OVF = Open Virtual Format
  + OVA = Open Virtual Appliance
  + Can be deployed from local disk or URL
  + Right click item that can be a VM parent
  + Deploy OVF File
  + Select an OVF Template
    - URL
    - Local File
  + Select name and folder
  + Select a computer resource
  + Review details
  + Select storage
    - Thick or thin provisioned disks
  + Select Network
* **Import an OVF template I think this should be export**
  + Power off
  + From VM Select Actions
  + Template
  + Export OVF Template
  + Name
  + Enable Advanced Options
    - Include additional information on the template
    - Limit portability
* **Create a Local Library** 
  + Used to store items in a single vCenter
  + vCenter Inventory lists
  + content libraries
  + objects
  + create new library
  + name
  + type of content library
    - local
    - published
      * publish externally to vCenter server
    - Optimized published content library
      * Optimized for syncing over HTTP
      * Cannot deploy VMs from an optimized library
    - Subscribed content library
      * Subscribes to published content library
* **Create a Remote Library with/without external storage** 
  + This is called Subscribed library
  + Publish local library and remote server subscribes
  + Can sync entire content or metadata only and download when needed
* **Publish/Subscribe/Share Content Library**
* **Deploy a virtual machine from a content library**

## Objective 4.4 – Administer Virtual Machines and vApps

* **Explain files used by virtual machines** 
  + <https://docs.vmware.com/en/VMware-vSphere/6.5/com.vmware.vsphere.vm_admin.doc/GUID-CEFF6D89-8C19-4143-8C26-4B6D6734D2CB.html>

| **File** | **Usage** | **Description** |
| --- | --- | --- |
| .vmx | *vmname*.vmx | Virtual machine configuration file |
| .vmxf | *vmname*.vmxf | Additional virtual machine configuration files |
| .vmdk | *vmname*.vmdk | Virtual disk characteristics |
| -flat.vmdk | *vmname*-flat.vmdk | Virtual machine data disk |
| .nvram | *vmname*.nvram or nvram | Virtual machine BIOS or EFI configuration |
| .vmsd | *vmname*.vmsd | Virtual machine snapshot descriptions |
| .vmsn | *vmname*.vmsn | Virtual machine snapshot data file |
| .vswp | *vmname*.vswp | Virtual machine swap file |
| .vmss | *vmname*.vmss | Virtual machine suspend file |
| .log | vmware.log | Current virtual machine log file |
| -#.log | vmware-#.log (where # is a number starting with 1) | Old virtual machine log files |

* **Explain common practices for securing virtual machines**
* **Hot Extend a virtual disk**
* **Configure virtual machine options**
* **Configure virtual machine power settings**
* **Configure virtual machine boot options**
* **Administer virtual machine snapshots**
* **Assign a Storage Policy to a virtual machine**
* **Verify Storage Policy compliance for virtual machines**
* **Adjust virtual machine resources**
* **Differentiate between stop/shutdown/reboot/restart of a virtual machine**