* Upgrade ESXi
  + Single reboot
  + Quick reboot
* VMWare Cloud
  + vCenter Server Hybrid Linked Mode
* Port mirroring
  + Distributed Port Mirroring
  + Remote Mirroring Destination
* Storage
  + UNMAP
* Host power management policies
* CPU SKEW
* vCenter performance data collection levels
* VM Encryption keys
* Numa
  + PreferHT
* Mem reservation
* Traffic shaping
* Storage DRS
* Forged transmits
* vCenter Converter
* HA VM overrides

# Section 1 – VMware vSphere Architectures and Technologies

## Objective 1.1 – Identify the pre-requisites and components for vSphere implementation

* ESX Requirements
  + Hardware on the HCL
  + Two CPU Cores
  + 64-bit x86 processors released after sep 2006
  + NX/XD bit to be enabled
  + Min 4 GB RAM
  + Intel VT-x or AMD RVI must be enabled on x64 Bit CPUs for 64 bit VMs
  + GB or faster NIC
* vCenter Server
  + last release that can be installed on Windows
  + VCSA linux client is preferred install
  + Photon OS
  + Management VM for ESX Hosts
  + DNS resolution needs to be working
  + Hardware Requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Size | VMS and hosts | CPU | Mem | Storage |
| Tiny | 100 VMs – 10 Hosts |  | 2 | 10-250 GB |
| Small | 1000 VMs – 100 Hosts |  | 4 | 16 – 290 GB |
| Medium | 4000 VMs – 400 Hosts |  | 8 | 24-425 GB |
| Large | 10000 VMs – 1000 Hosts |  | 16 | 32-640 GB |
| x-Large | 35000 VMs – 2000 Hosts |  | 24 | 48-980 GB |

* + DB Requirements
    - Embedded postgres DB works fine for up to Small
    - Medium and larger needs external SQL or Oracle
  + VAMI
    - vCenter Server Appliance Management Interface
    - admin UI for VCSA
    - <Https://url:5480>
    - Used for
      * Changing Host name
      * Change network config
      * NTP
      * Applying patches and updates
      * Monitoring VCSA
* Datastore
  + Store VMs
  + Cluster will be shared storage

## Objective 1.2 – Identify vCenter high availability (HA) requirements

* Active, Passive, witness VMs
* Provides synch between nodes to allow seemless failover

## Objective 1.3 – Describe storage types for vSphere

## Objective 1.4 – Differentiate between NIOC and SIOC

## Objective 1.5 – Manage vCenter inventory efficiently

## Objective 1.6 – Describe and differentiate among vSphere, HA, DRS, and SDRS functionality

## Objective 1.7 – Describe and identify resource pools and use cases

## Objective 1.8 – Differentiate between VDS and VSS

## Objective 1.9 – Describe the purpose of cluster and the features it provides

## Objective 1.10 – Describe virtual machine (VM) file structure

## Objective 1.11 – Describe vMotion and Storage vMotion technology

* vMotion
  + Live migration without interruption
  + Can vMotion over routed networks
    - <= 100 ms RTT
  + vMotion process
    - memory content moved
    - control of VM moved to new host
  + Memory Bitmap
    - As memory copied , vcenter keeps track of changed memory, which then can be copied to destination
  + Requirements
    - Processors on each host must be similar
      * From same vendor
      * From same CPU Family
      * CPUs support same features
      * Intel VT or AMD-V for x64 VM
    - VM Requirments
      * No connection to physical host device
      * Not connected to internal only vSwitch
      * CPU affinity not set to specific CPU
      * Both host must be able to access the datastore the VM files are stored on
  + Encrypted vMotion
    - Used by default when migrating encrypted VM
    - Options when VM not encrypted
      * Disabled
        + Do not use encrypted vMotion
      * Opportunistic
        + Use if available on both target and source
        + Default
      * Required
    - Encrypted vMotion of unencrypted VM works cross-vCenter but not for encrypted VM
  + vMotion Boundry
    - when CPU in same cluster are different
  + Per-VM CPU Masking
    - Generally not supported except
    - Show or mask NX/XD bit
      * Allows for greatest vMotion capability
  + Enhanced vMotion Compatibility
    - Sets CPU-ID to a baseline so different CPUs appear the same
    - Can set per cluster
    - Per-VM EVC
      * Determines which cpu features VM needs from host to be migrated and powered on
      * Can only be changed when powered off
      * HTML5 client only
      * When VM moved outside of cluster a power reset will reset VM EVC to cluster’s setting
      * Overrides cluster but can’t be set higher than cluster
  + Cross-vCenter vMotion
    - Everything transfers with VM except performance data (which is stored in vCenter)
    - Additional requirements
      * Destination and source vCenter must be >= 6.0
      * Destination and source vCenter must be in same SSO
      * ESX Hosts >= 6.0
      * RTT <= 150 ms

# Section 2 – VMware Products and Solutions

## Objective 2.1 – Describe vSphere integration with other VMware products

## Objective 2.2 – Describe HA solutions for vSphere

## Objective 2.3 – Describe the options for securing a vSphere environment

* Lockdown Mode
  + Strict Mode
    - DCUI disabled and no one can use it
  + Normal
    - Some users can use DCUI
  + Exception Users
    - Members who are admins can use DCUI, shell and SSH in normal lockdown
    - Main use for service accounts to log onto ESX
    - Members who are admins can use SSH and Shell when in Strict mode
  + DCUI.Access
    - Can access DCUI in normal lockdown
    - Advanced setting
    - Root member by default

# Section 3 – There are no testable objectives for this section

# Section 4 – Installing, Configuring, and Setting Up a VMware vSphere Solution

## Objective 4.1 – Understand basic log output from vSphere products

## Objective 4.2 – Create and configure vSphere objects

## Objective. 4.3 – Set up a content library

## Objective 4.4 – Set up ESXi hosts.

* DCUI
  + Access limited to Local admins only
  + DCUI user acts as agent for direct console – not interactive
    - Primary purpose is to config lockdown
  + Smart card authentication
    - Join host to AD
    - Use web client to enable smartcard and copy certs to host
  + If host looses management network connectivity, you can
    - Restore Network Settings
      * Set ESX host back to factory settings
    - Restore Standard switch
      * Creates new VMK on new vSwitch
      * Uplick is migrated to vswitch
      * Connectivity restored
    - Restor vDS
      * Creates a new Epheral port on vDS
  + Restart Management agent

## Objective 4.5 – Configure virtual networking

## Objective 4.6 – Deploy and configure VMware vCenter Server Appliance (VCSA)

## Objective 4.7 – Set up identity sources

## Objective 4.8 – Configure an SSO domain

* Single sign on
  + STS
    - Secure Token Service
  + IDM
    - Identy Management Service

# Section 5 – Performance-tuning and Optimizing a VMware vSphere Solution

## Objective 5.1 – Determine effective snapshot use cases

* Snapshots freeze VMDK and start writing to delta disk
* Options
  + Snaptshot VM memory
    - Include RAM
    - Current contents of RAM written to .VMSN file
  + Quiesce guest file system
* Can cause performance issues when left overtime
* Snapshot Consolidate
  + Sometimes backup apps fail to compress after deleting the snapshot
  + Commits delta back to base disk
* Limitations
  + Does not support
    - Raw Disks
    - Physical RDM
    - Guest with ISCSI initiator
    - Direct I/O
  + VM w/ independent disk must be powered off
  + No VM bus sharing
  + Not meant to be long term backup / restore
  + Can cause performance issues
  + Larger than 2 TB takes long time to snapshot

## Objective 5.2 – Monitor resources of VCSA in a vSphere environment

## Objective 5.3 – Identify impacts of VM configurations

* vTMP 2.0
  + Trusted Platform Module
  + Specialized microcontroller cryptoprocessor to securely create and store assets
    - Stores identifying artifacts
      * Encryption keys
      * Platform measurments
  + 6.7 can only use 2.0
  + Attestation
    - Known good boot securely stored to compare w/ each new boot
    - Attestation key
  + HTML5 only
  + vTPM works with VM only
  + window 10 and 2016
  + stores attestation in NVRAM with vm files
  + encrypt VM for security of vTPM NVRAM

# Section 6 – There are no testable objectives for this section

# Section 7 – Administrative and Operational Tasks in a VMware vSphere Solution

## Objective 7.1 – Manage virtual networking

## Objective 7.2 – Manage datastores

## Objective 7.3 – Configure a storage policy

## Objective 7.4 – Configure host security

## Objective 7.5 – Configure role-based user management

## Objective 7.6 – Configure and use vSphere Compute and Storage cluster options

## Objective 7.7 – Perform different types of migrations

## Objective 7.8 – Manage resources of a vSphere environment

## Objective 7.9 – Create and manage VMs using different methods

## Objective 7.10 – Create and manage templates

## Objective 7.11 – Manage different VMware vCenter Server objects

## Objective 7.12 – Setup permissions on datastores, clusters, vCenter, and hosts

* Users or Groups are assigned to roles that have privileges
* Users
  + Authentication
* Group
  + Collection of users
* Privileges
  + Action that you can perform
* Role
  + Collection of privileges
* Permission
  + Pairs user/group with role at inventory object to allow permission to do something
* Allowing AD user to login
  + After joining to domain , user / group should be paired with role at vcenter object to allow user to login with AD credentials
  + Because account exists outside ESX, the actions by user creast task that then calls VPXUser on ESX to Run it
    - Used to communicate between VCSA and ESX
    - Stored in ESX DB
    - No shell access
* Effective Permissions
  + Object lower in hierarchy permissions overwrite inherited permissions
  + Groups at same level are joined / unioned / cumulative
  + User per at same level as group takes precedence
  + No access overrides all
* Global root
  + Assign permissions across all solutions

## Objective 7.13 – Identify and interpret affinity/anti affinity rules

## Objective 7.14 – Understand use cases for alarms

## Objective 7.15 – Utilize VMware vSphere Update Manager (VUM

## Objective 7.16 - Configure and manage host profiles