Virtualization & Management

VMware Certified Associate 6 - Data Center Virtualization Fundamentals

KNOWLEDGE CHEATSHEET

THE SOFTWARE-DEFINED DATA CENTER

- **ESXi** — Virtualize
- **vCenter** — Manage
- **Policy** — Standardize
- **Operations** — Optimize

01 Virtualization and management

Abstraction and business value

- **Virtualization** abstracts physical compute, storage and networking into logical resources. An **ESXi hypervisor** runs multiple isolated virtual machines on one physical host.
- A **virtual machine (VM)** has virtual CPU, memory, disks and optional network adapters, plus its own guest operating system. A VM can have **zero virtual NICs** when network access is unnecessary.
- **Consolidation** improves utilization and can reduce server purchases, rack space, cabling, power and operating costs. Shared infrastructure still needs sufficient capacity and failure protection.
- **Scale up** increases a VM's resources; **scale out** adds application instances. vSphere supports both patterns within platform and application limits.

Management and repeatable provisioning

- **vCenter Server** centrally manages ESXi hosts and VMs. A **cluster** groups hosts for services such as HA and DRS; ESXi performs the actual virtualization.
- **Templates** provide reusable VM configurations for deployment. **Cloning** creates copies; **Content Library** organizes reusable templates and other deployment content.
- **Host Profiles** capture and apply host configuration for consistency. They address configuration standardization; availability services protect running workloads.
- The **Software-Defined Data Center (SDDC)** abstracts compute, storage and networking and manages them through software and policy. Automation reduces repetitive provisioning and administration.

Operations and capacity insight

- **vRealize Operations Manager** analyzes health, performance and capacity. Alerts and trends help identify developing problems, resource contention and inefficient sizing.
- **vSphere with Operations Management** combines virtualization with operations analytics, including proactive issue detection and opportunities to reclaim overprovisioned capacity.
- Use **metrics, events and alarms** to investigate changes and bottlenecks. Monitoring supports operational oversight; regulated environments also need appropriate permissions, audit records and compliance processes.

Compute & Migration

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RESOURCE DECISIONS

- **Pools** — Entitlements
- **DRS** — Placement
- **DPM** — Power
- **vMotion** — Mobility

02 Compute resources and live migration

Resource pools and DRS

- A **resource pool** groups CPU and memory allocations hierarchically. **Reservations** guarantee a minimum, **limits** cap consumption and **shares** express relative priority during contention.
- **Distributed Resource Scheduler (DRS)** uses resource demand and allocation rules to recommend or automate VM placement and balancing across cluster hosts, using vMotion for running VMs.
- **Affinity rules** keep selected workloads together; **anti-affinity rules** separate them. Balance performance goals with availability requirements and available host capacity.
- DRS manages **compute placement**; resource pools express resource entitlements. Neither creates additional physical CPU or memory.

Power management and growth

- **Distributed Power Management (DPM)** consolidates VMs onto fewer hosts when demand is low and places unused hosts in standby, reducing power consumption.
- DPM returns hosts to service when capacity is needed. **Scheduled tasks** can also prepare host capacity ahead of predictable demand; preserve headroom for availability requirements.
- **Hot Add** increases supported VM CPU or memory resources while the VM remains powered on. Enable the relevant setting and confirm guest OS, virtual hardware and application support.
- **Big Data Extensions** supports deployment and management of supported Hadoop environments on vSphere. It addresses distributed application provisioning rather than replacing CPU and memory controls.

vMotion and Storage vMotion

- **vMotion** moves a powered-on VM's execution to another host with minimal interruption. Use it for maintenance and compute balancing; preserve compatible CPU, network and storage access.
- **Storage vMotion** relocates a running VM's files between datastores. It can place different virtual disks on different destination datastores while the VM continues running.
- **Shared-nothing migration** can move host execution and storage together. Traditional compute-only vMotion uses storage accessible to both hosts; shared storage is not a universal requirement for every migration type.
- vSphere 6 introduced expanded **cross-vSwitch**, **cross-vCenter** and **long-distance vMotion** capabilities. Site-to-site live migration requires supported connectivity, latency, bandwidth and destination networking.
- **Live migration** moves a running workload. **Replication** maintains a recovery copy. A WAN connection alone does not make either operation a complete disaster recovery plan.

Storage Architecture

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STORAGE DECISIONS

- **Datastore** — VM files
- **SPBM** — Requirements
- **Storage DRS** — Placement
- **SIOC** — Contention

03 Storage architecture and policy

Datastores and storage access

- A **datastore** is the logical storage container presented to vSphere for VM files. A **VMDK** is a virtual disk file; a **LUN** is a block-storage logical unit presented by a storage device.
- **Local storage** is directly attached to a host through an appropriate controller or adapter. It needs no external storage network and is not automatically accessible to other hosts.
- **VMFS** is a clustered filesystem for block-storage datastores. A VMFS datastore can span multiple supported storage extents; **NFS** datastores access file shares over an IP network.
- **Fibre Channel (FC)** provides block access over a storage fabric. **iSCSI** carries SCSI over TCP/IP; an **initiator** on the host establishes sessions with a storage **target**.
- A **software iSCSI initiator** uses host software and network adapters. A **hardware initiator** offloads supported iSCSI functions to an adapter; its independence from host networking depends on adapter type.
- **Fibre Channel over Ethernet (FCoE)** carries FC frames over a suitably configured Ethernet fabric. Converging storage and other traffic can reduce ports and cables, with compatible adapters and fabric support.

Policy-based storage and Virtual Volumes

- **Storage Policy-Based Management (SPBM)** expresses VM storage requirements as policies and matches them to storage capabilities. It provides consistent management across storage classes and tiers.
- **Virtual Volumes (VVols)** exposes VM storage objects to a compatible array, enabling array services at virtual-disk granularity instead of treating an entire LUN as one management unit.
- A VVol **storage container**, presented to vSphere as a **virtual datastore**, defines a logical capacity pool and available storage services. It does not require VMFS formatting.
- **VASA** communicates array capabilities and policy information; **protocol endpoints** provide access to VVol data. **Virtual SAN** instead pools participating hosts' local storage into a shared datastore.

Storage DRS and I/O control

- **Storage DRS** groups datastores into a datastore cluster and considers free space and I/O latency for initial placement and balancing recommendations. It uses Storage vMotion to relocate VM files.
- **Manual mode** presents recommendations for approval; **automated mode** applies eligible recommendations. Disable I/O-based balancing when only space balancing is wanted, or use overrides to constrain automation.

Storage Architecture / Virtual Networking

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NETWORK SERVICES

- **Switch** Connect
- **VLAN** Segment
- **NIOC** Allocate
- **NSX** Virtualize

- **Storage I/O Control (SIOC)** regulates competing VM disk I/O when a supported shared datastore becomes congested. Shares prioritize access during contention; SIOC does not relocate disks or add array throughput.
- High **latency** indicates slow I/O completion; low **free space** indicates capacity pressure. Storage DRS addresses placement, while SIOC addresses access to a congested datastore.

Shared storage dependencies

- **vSphere HA** must restart a VM on a host that can access its files. Conventional local-only VM storage is unavailable after that host fails; shared storage or a supported distributed datastore provides access.
- **vSphere 6 Fault Tolerance** requires supported shared storage accessible to the participating hosts. Primary and secondary VM files can use separate shared datastores for storage redundancy.
- Do not confuse **shared storage**, **SPBM**, **VVols** and **distributed switching**: they describe access, policy, storage objects and networking respectively. A feature's prerequisites depend on its actual configuration.

04 Virtual networking and traffic control

Virtual switches and segmentation

- A **virtual switch** connects VM network adapters, VMkernel adapters and physical uplinks. VMs on the same host can exchange local traffic without sending it through a physical switch.
- A **vSphere Standard Switch (vSS)** is configured per host. A **vSphere Distributed Switch (vDS)** provides centrally managed network configuration across participating hosts.
- **Port groups** apply common networking settings. **VLANs** segment Layer 2 networks; communication between different IP subnets normally requires a router or Layer 3 service.
- Shared physical **uplinks** reduce the need for a dedicated cable per VM. A switch without uplinks can form an isolated test network; NIC teaming can provide redundancy and distribute uplink traffic.

Traffic visibility and bandwidth

- **NetFlow** exports flow metadata, such as endpoints and traffic volumes, for analysis. **Port mirroring** copies packets to an analyzer for detailed inspection, including selected same-host VM traffic on a vDS.
- **Traffic shaping** applies average bandwidth, peak bandwidth and burst-size controls. A vSS supports outbound shaping; a vDS supports both inbound and outbound shaping.

Virtual Networking / Availability & Recovery

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PROTECTION BY PURPOSE

- **HA** — Restart
- **FT** — Take over
- **Backup** — Restore history
- **Replication** — Recover offsite

- **Network I/O Control (NIOC)** allocates bandwidth among traffic classes on a vDS using supported shares, reservations and limits. It helps prevent one traffic class from starving another under contention.
- **Load-based teaming** selects uplinks based on load; **VLANs** provide logical segmentation. These serve different purposes from NIOC bandwidth allocation and port-mirroring diagnostics.

NSX and the software-defined network

- **VMware NSX** provides network virtualization for the SDDC, including logical switching, routing and security services implemented in software.
- Logical networks can extend across hosts and physical network boundaries over a suitable **IP underlay**. NSX abstracts network services from particular physical switch hardware.
- The physical network still supplies **connectivity, capacity and resiliency**. Hardware independence does not remove underlay reachability, bandwidth or configuration requirements.

05 Availability, backup and disaster recovery

HA, Fault Tolerance and guest health

- **vSphere High Availability (HA)** detects host failure and restarts affected VMs on surviving cluster hosts. Restarting causes an interruption; reserve enough capacity to recover protected workloads.
- HA pools recovery capacity across a cluster, reducing dependence on a dedicated idle standby server for each workload. It still requires working network, storage and sufficient surviving resources.
- **Fault Tolerance (FT)** maintains a synchronized secondary VM on another host. If the primary host fails, the secondary takes over without the normal guest reboot required by HA.
- **FT logging** carries synchronization traffic between hosts. Inadequate bandwidth or excessive latency can impair performance; provision the required logging network and host resources.
- **VM Monitoring** uses VMware Tools heartbeats and other activity checks to detect guest OS failure and can reset the VM. **Application Monitoring** requires application integration to report application health.
- An **OS or application failure** can affect a synchronized FT pair. FT protects against host failure; backups, guest monitoring and application recovery address other failure types.

Availability & Recovery

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Data Protection and backup verification

- **vSphere Data Protection (VDP)** provides backup and recovery for supported virtual workloads. **Deduplication** reduces redundant stored backup data; **Changed Block Tracking (CBT)** identifies changed disk blocks for incremental processing.
- **Automated backup verification** restores and starts a VM in an isolated environment. A **VMware Tools heartbeat** provides a basic check that the recovered guest has started; scripts can test application functions more deeply.
- Backup success alone does not prove **recoverability**. Test restores and validate the required application or data, while preventing test VMs from interfering with production.
- **Snapshots** record a VM disk state for short-term operational use and remain dependent on the underlying VM storage. Maintain recoverable backups with suitable retention and independent protection.

Offsite replication and recovery

- **vSphere Replication** performs host-based, asynchronous replication of selected VM disks to another location. It uses network connectivity and does not require array-based replication or a dedicated storage replication link.
- **Site Recovery Manager (SRM)** orchestrates recovery plans and testing with supported replication. A recovery design includes destination compute, storage, network mappings and application startup dependencies.
- **RPO** describes acceptable data loss; **RTO** describes acceptable recovery time. Asynchronous replication can lose changes since the last replicated recovery point.
- **HA** handles local restart, **FT** handles primary host failure continuously, **backup** preserves recoverable history and **offsite replication** supports site recovery. Use the combination appropriate to the failure and business requirement.