VCAP5-DCD Study Outline

All documentation listed in the Blueprint can be downloaded on Jason Langer's site:
http://www.virtuallanger.com/2012/09/30/vcap-dcd-5-document-package/

Hope these notes assist you in passing the DCD….Best of luck on the exam!

SECTION 1 – BUSINESS REQUIREMENTS

Objective 1.1 – Gather and analyze business requirements (e.g. current availability, manageability)

Skills/Abilities
- Associate Stakeholder with information needing collected
    - ➢ **Application Owners, Network Admin, Server Admin, Storage Admin, Security Officer, Business Units, C-Level Team, Users**
    - ➢ **Stakeholder = person with interest in project; SME = infrastructure subject matter expert**

- Utilize customer inventory & assessment data from current environment to define a baseline state
    - ➢ **Gathering information from the following:**
        1. **Current-state analysis (best information)**
        2. **Documentation (though almost always lacking)**
        3. **Interviews (with Stakeholders & SMEs)**

- Analyze customer interview data to explicitly define customer objectives for a conceptual design
    - ➢ **What are the goals?**
    - ➢ **What is the scope? (i.e. boundaries)**
    - ➢ **What are the Business Requirements**
        - • **Compliance**
        - • **Consolidation**
        - • **Cost savings (cooling, power, administrative)**
        - • **BC/DR strategy**
        - • **VDI**

- Identify need for & apply requirements tracking
    - ➢ **Some form of listing Project Design goals & requirements; best to # each & give a description, timeframe, & associated SME/Stakeholder with the requirement**

- Given results of a requirements gathering survey, identify requirements for conceptual design
    - ➢ **From current-state analysis & "interviews", incorporate information into a high-level design**

- Categorize requirements by infrastructure qualities to prepare for logical design requirements
    - ➢ **Application**
    - ➢ **Infrastructure**
        - • **Compute**
        - • **Network**
        - • **Storage**
    - ➢ **Business Unit**
    - ➢ **BC/DR**

5 Steps Determine When to Virtualize:
1. **Understand Virtualization Benefits**
2. **Evaluate a Solution**
3. **Determine if Works Well With Apps**
4. **Analyze Cost of Virtualizing**
   a. **Consolidation**
   b. **Lower OPEX (power, cooling, DC space)**
   c. **Less Administration**
   d. **Rapid Elasticity (fast response to biz needs)**
5. **Analyze Time/Skill Needed to Virtualize → training, reading, implementation**

Functional Requirement – a function that a system/component *must* be able to perform
➢ **Specifies specific behavior:**
1. **Business rules**
2. **Transaction corrections**
3. **Admin functions**
4. **Authentication**
5. **Authorization**
6. **Audit**
7. **External interfaces**
8. **Certification requirements**
9. **Reporting requirments**
10. **Historical data**
11. **Legal/Reg requirements (Compliance)**
➢ **Functional testing – how well system executes functions, including user commands, data manipulation, searches, business process, user screens, & integrations**

Non-Functional Requirement (i.e. Constraints) – specifies how a system should behave; constraint upon system behavior
➢ **Specifies criteria that judge system operation; i.e. "quality characteristics"**
1. **Performance**
2. **Scalability**
3. **Capacity**
4. **Availability**
5. **Reliability**
6. **Recoverability**
7. **Maintainability**
8. **Serviceability**
9. **Security**
10. **Regulatory**
11. **Manageability**
12. **Environmental**
13. **Data integrity**
14. **Usability**
15. **Interoperability**
➢ **Non-Functional testing – evaluates system readiness according to criteria not covered in functional tests; enables measurement & comparison of non-functional attributes of software systems:**
1. **Performance testing**

2. **Security testing**
3. **Usability testing**
4. **Dependability testing**
5. **Reliability, Maintainability, Availability, Recoverability**
6. **Miscellaneous**
7. **Interoperability, Compatibility, Portability, Configuration, Instability**
- ➢ **V Model – testing & analyzing business requirements early in project**

Conceptual, Logical, Physical – It's Simple
- **Conceptual = owner requirements; what is trying to be produced; Requirements ("Owner's View"); 1pg**
  - ➢ **Row 2 → models of the businesses ("Things")**
- **Logical = how what is trying to be produced is designed; Architecture ("Designer's View"); a few pgs**
  - ➢ **Entities = logical representations of business requirements & goals**
  - ➢ **Row 3 → models of the systems of the business (Logical Model)**
  1. **Logical models are important:**
     a. **To think through the details of implementation; cheaper than 'trial & error'**
     b. **To be able to manage a business as it grows to be able to visibly see its product**
- **Physical = how to build what is designed; Design ("Builder's View"); many pgs**
  - ➢ **Row 4 → technology constrained physical implementation of business sytems**

Tools
VMware Virtualization Case Studies
Five Steps to Determine When to Virtualize Your Servers
Functional vs Non-Functional Requirements
Coneptual, Logical, Physical: It's Simple
Product Documentation

Objective 1.2 – Gather and analyze application requirements

Skills and Abilities
- Given a scenario, gather & analyze application requirements
- ➢ **Gather info using Capacity Planner and other tools (Perfmon, VMware Cost Calculator, vCOPs)**
- ➢ **Metrics to pay attention to:**
  - **CPU – %RDY, %USED**
  - **MEMORY – %ACTV (current RAM used by VM)**
  - **DISK – DAVG (device/SAN latency), KAVG (VMkernel latency)**
  - **NETWORK – MbRX/s (recv'd packets), MbTX/s (transmitted packets); %DRPRX, %DRPTX**

- Given a set of applications within a physical environment, determine the requirements for virtualization
- ➢ **Generally, almost all apps are good candidates for virtualization, but in previous years it was best to leave Tier 1 apps on physical hosts**
- ➢ **Business-designed and/or proprietary apps are generally left alone. These can typically be placed in a test/dev environment though**
- ➢ **For all others, use ISV specifications when virtualing apps (CPU, RAM, Storage/RAID, other)**

- Gather information needed in order to identify application dependencies

- From current-state analysis
  - Gather peak & off-peak data
  - Try to gather at least 1 month of data

- Given one or more application requirements, determine the impact of the requirements on the design
- This item has many facets, one such are app dependecies. If there are any, virtualization design needs to take that into acct (vApps may need to be used, for example); other examples:
  - If using MSCS, RDM disks (physical mode) need used
  - If using SAN replication or other SAN-based technology, physical RDMs may need used as well
  - If using VLANs, trunking needs configured on the physical switch
  - If using SRM, 2 vCenters are needed and are to be in Linked-Mode

VMware Cost Per Application Calculator
1. Input Appx # of Apps, Host CPU Type, Storage Protocol, Vendor to Compare, vSphere Ed., Mgmt Deployment (virt or phys), Power Cost Est, Real Estate Cost Est
   a. See sample report here:
http://www.vmware.com/technology/whyvmware/calculator/?num_app=25&workload_distribution=Typical&small_workloads=15&medium_workloads=8&large_workloads=2&host_type=C&software_version=EnterprisePlus&deploy=Virtual&power=Average&space=Low&storage_type=SAN&compare_vendor=Microsoft

Basically, for all Tier 1 Apps (Exchg, Oracle, SQL, etc.), resource best practice configs apply:
- Minimum vCPUs
- Vendor-specified (ISV) RAM allocation
- VMFS (unless need RDM) config'd on org-specified perfomance SLA RAID type; pvscsi controller for high I/O data disks (not OS disk); disk alignment
- Typical Network config – NIC Teaming; VMXNET3 driver
- HA, DRS capabilities
  - Backup/DR solutions
  - Replication technology if required

Exchange Design/Best Practice/Sizing Kit Takeaways
- CPU/RAM Requirement Minimums = 2 vCPUs / 4GB (10GB for multi-role VM)
- CPU Megacycle Requirement = Megacycles (based on # of msgs sent/recv'd) * Number of Mailboxes
  1. Example Megacycles per mailbox send/receive:
     a. 50 msgs = 1MC
     b. 100 msgs = 2MC
     c. 150 msgs = 3MC (etc. ; basically 1 megacycle [MC] per 50 msgs sent/recv'd)
- DB Cache Requirement = [DB cache per mailbox in MB (based on # of msgs sent/recv'd) * Number of Mailboxes] /1000 (to get # into GB size); ex. (9MB * 4000)/1000 = 36GB needed for Cache
  1. Average about 3MBs per 50 msgs sent/recv'd (i.e. 50 msgs = 3MB, 100 msgs = 6MB, etc.)
- Add 10% to CPU requirement for passive DB for a DAG configuration

Table 11. Building block CPU and RAM requirements for mailboxes with 150 messages sent/received per day

Building Block	500	1000	2000	4000
Profile	150 sent/received	150 sent/received	150 sent/received	150 sent/received
Megacycle Requirement	1,500	3,000	6,000	12,000
vCPU (based on 3.33GHz processor-based server)	2 (Minimum) (.6 Actual)	2 (Minimum) (1.3 Actual)	4 (2.6 Actual)	6 (5.1 Actual)
Cache Requirement	4.5GB	9GB	18GB	36GB
Total Memory Size	16GB	16GB	24GB	48GB

> ➤ **Design MBX Role → Determine User Block, CPU Req, RAM Req, Storage**
> ➤ **Design "Peripheral" Roles → CAS, HUB**
> ➤ **Determine # of VMs per Role**
> ➤ **Determine VM Distribution**
>   • **DAG approach – need to account for both Passive & Active mailboxes; addt'l 10% CPU**

Tools
VMware Cost-Per-Application Calculator
VMware Virtualizing Oracle Kit
Vmware Virtualizing Exchange Kit
VMware Virtualizing SQL Kit
VMware Virtualizing SAP Kit
VMware Virtualizing JAVA Kit
Business & Financial Benefits of Virtualization: Customer Benchmarking Study

Objective 1.3 – Determine Risks, Constraints, and Assumptions

<u>Skills and Abilities</u>
- Differentiate between general concepts of risk, requirement, constraint, & assumption
    1. **Assumption – considered valid but not proven**
    2. **Constraint – anything that limits design choices**
    3. **Requirement – items that *must* be met**
    4. **Risk – items that bring potential to hinder successful design**

- Given a statement, determine if it is a risk, requirement, constraint, or assumption
> ➤ **See various examples in this Section, as well as U.S. & APAC #vBrownBag sessions**

- Analyze impact of VMware best practices to identified risks, constraints, & assumptions
> ➤ **This is exactly what is written – when making design decisions, don't just implement a so-called best practice "just because"; instead, determine if it meets the business need/goal/requirement**

VMware Design Criteria → Usability, Manageability, Security, Cost

5-Step Design Process:
   1. **Initial Desgin Meeting**

2. Current-State Analysis
3. Stakeholder/SME Training
4. Design Sessions
5. Design Deliverables (Documentation)

Virtualization Benefits (PDF Reference)
1. Rapid recovery
2. Contain server growth
3. Rapid provisioning
4. Consolidation
5. Create dev/test environments
6. Hardware upgrade
7. Clustering
8. Maximize server resources

Virtualization Success Must Involve a Strategy That:
1. Clearly articulates business objectives, critical success factors (CSFs), & expected ROI
   a. Business objectives – containment of server costs & existing servers, reduce costs, rapid recovery, enable HA, provide instant provisioning; continual testing helps stay on track
   b. Identify CSFs – ROI achieved in 1yr, TCO reduced by n%, Reduced server deployment time by n%, Reduced server recovery by n%
2. Provides comprehensive understanding of costs, contraints, & risks
   a. Identifying risks & constraints helps to:
      i) Eliminate constraints & mitigate risks
      ii) Find ways to work with/around them so they're not roadblocks
   b. Constraints = minimal capital budget; limited staff; staff uncertainty
   c. Risks = lack of SME; impact on prod server; too many services on hardware; lack understanding
   d. Assumptions = all prod servers are virt candidates; virt is preferred over standalone; consensus of team will be achieved prior to mgmt recomm; prod guests & non-prod guests will reside on same hosts
3. Achieves consensus of key stakeholders
   a. Project sponsor (CIO, IT Director), App owners, Server archit lead, LAN/WAN archit lead, DC mgr
   b. Facilitated sessions with stakeholders help streamline/compress time to form consensus

Develop Selection Criteria, then 'Weigh' Them
➢ Criteria ex's = Availability, Reliability, Manageability, Recoverability, Flexibility, Scalability, Cost, Performance, Security, Deploy Time, Usability

Review Current State → WAN design, LAN design, SAN config, Server archit, Sever config mgmt, Server provisioning, DR Plan, Licensing, Resource usage (Server profile matrix)
➢ Server Profile Matrix helps determine VM Development/Design Stategy & Guest Selection Model
   i) Strategy can include: ID of virt candidates; Development of design; Server design (Storage, Cluster, Network, Switching); Templates, Recoverability methods; Mgmt processes; Provision processes
   ii) Ideal candidates are typically legacy systems. Once determined, perform a CBA

Deployment Plan
➢ CSFs helps ensure:

        i) **Zero impact on production**
        ii) **Availability of skilled resources**
        iii) **Development of key processes/procedures prior to production**
        iv) **Rollback plan**
        v) **Org deployment methods, policies, & procedures**
- **Identify project tasks via Brainstorming sessions**
- **Identify dependencies**
- **Identify deployment roles**

Tools
Developing Your Virtualization Strategy and Deployment Plan
Product Documentation

SECTION 2 – CREATE A VSPHERE LOGICAL DESIGN FROM AN EXISTING CONCEPTUAL DESIGN

Objective 2.1 – Map Business Requirements to the Logical Design

Knowledge
Explain common components of logical design
1. **Infrastructure component relationships/dependencies**
2. **Conceptual design**
   a. **Org goals and requirements**
3. **Constraints**
4. **Risks**

List the detailed steps that go into the makeup of a common logical design
1. **Initial Design Meeting**
2. **Current-state analysis**
3. **Key stakeholder & SME interviews**
4. **Determine business goals and requirements**
5. **Determine dependencies (entities affected by project)**
   - **Create Conceptual Design that achieves each entity goals & requirements and stays within constraints**

Differentiate functional and non-functional requirements for the design **– see Section 1**

Design Methodology – high-level process used to create a design.
- **4 Phases:**
  1. **Architectural Vision – info gathered by Stakeholder/SME interviews:**
    a. **Scope – project boundary (only main site DC, not remote)**
    b. **Goals – org wants to achieve; measureable (ex. 25% cost reduction by EOY)**
    c. **Requirements – business & technical (ex. 99.99% uptime for a service; compliance)**
    d. **Assumptions – assumed valid without proof (ex. DC uses shared networking across prod/non-prod infrastructures; org has enough bandwidth for replication btwn sites)**
    e. **Constraints – limit design choices (ex. vendor relationship, hardware already chosen; budget)**
    f. **Risks – items preventing achieving project goals (ex. DC has only 1 router (SPOF); lack of exec sponsorship)**

2. **Architectural Analysis** – current-state analysis AND determine target state to achieve org goals while considering business requirements, assumptions, & constraints
3. **Technical Architecture** – conceptual, logical, physical designs created
4. **Migration Planning** – planning necessary steps to transform DC from current to target state
   a. GAP analysis
   b. Incremental phases
   c. Achievable/sustainable interim states
      ▪ Procurement, training, P2V prep, etc.
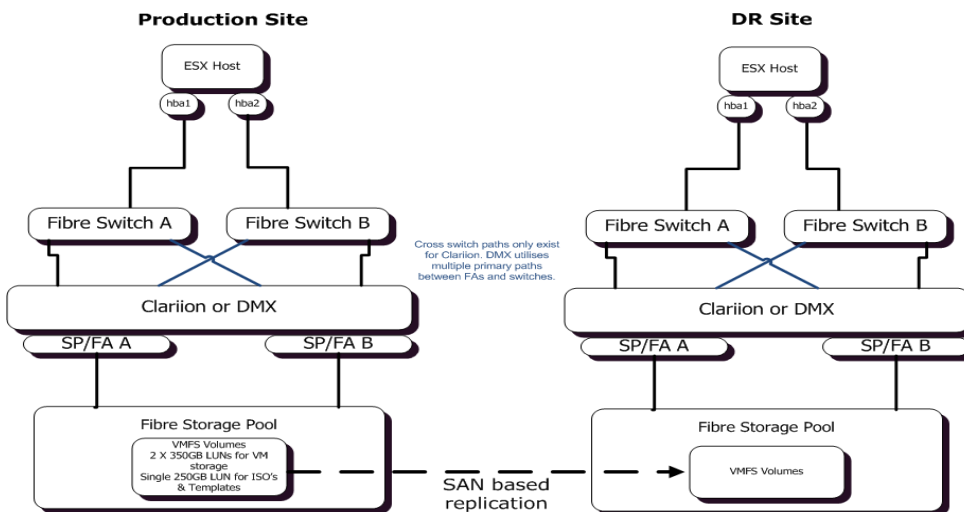
Conceptual Design example
- **Created from Current-State & SME Interviews**
- **Focuses on achieving org goals & requirements**
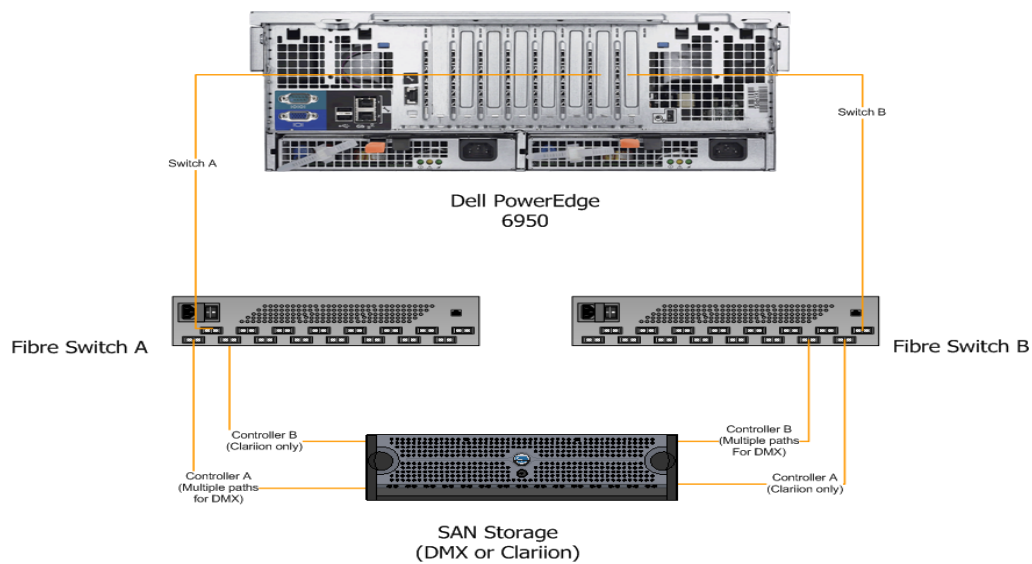 ➢ **Scope, goals, requirements, assumptions, constraints**
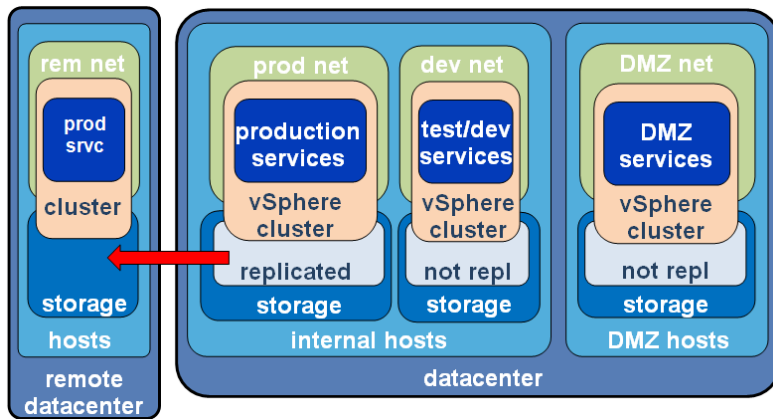
Logical Design example
- **A relationship between all major infrastructure components, to better understand & evaluate infrastructure design (meet goals, req's? yet, within constraints?)**
- **No physical details**

Physical Design example:

Dell PowerEdge
6950

Switch A

Switch B

Fibre Switch A

Fibre Switch B

Controller B
(Clariion only)

Controller B
(Multiple paths
For DMX)

Controller A
(Multiple paths
for DMX)

Controller A
(Clariion only)

SAN Storage
(DMX or Clariion)

Conceptual, Logical, Physical – It's Simple → See Section 1.1

Scope: So as not to form silos, look at the enterprise holistically (all businesses/depts), not individually

vSphere Basics
- **Virtualization benefits**
  - **Cloud computing foundation**
    a. **Pooled resources**
    b. **On-demand provisioning**
    c. **Elasticity**
  - **Scalable datacenters**
  - **Service delivery flexibility**
    a. **De-couples software from underlying hardware**
  - **Cost reduction (consolidation, power, cooling. OPEX)**
  - **Ease of manageability (centrally manage VMs; less physical resources to manage)**
  - **Better resource utilization**
- **vSphere Stack:**
  - **Virtual → Infrastructure Services (Compute, Storage, Network); Application Services (Availability, Security, Scalability)**
  - **Management → vCenter**
    a. **Plug-ins installed automatically – Storage Monitoring, Hardware Status (CIM), vCenter Server Status**
    b. **Plug-ins separate – VUM, vShield Zones, vCO, vDR**
  - **Interface → vSphere Client, SDK, Web Client, vMA, vCLI**
    a. **Web Client can only connect to vCenter; limited functionality**

What's New in vSphere 5

Skills and Abilities
- Build non-functional requirements into a specific logical design
  - **Keep in mind, these are considered operational-based requirements**

- Translate given business requirements and the current state of a customer environment into a logical design

- Create a service catalog
  - ➢ **Include the following information:**
    1. **Service name**
    2. **Service description**
    3. **Services included**
    4. **Services not included**
    5. **Service availability**

- • **ITILv3 Service Mgmt (Guide)**
  - ➢ **Purpose = assure IT services align to business needs**
  - ➢ **Defined = set of specialized org capabilities to provide value to customers via services**
    - o **Services = a means of delivering value to customers by facilitating outcomes customers want without ownership of cost or risk**
  - ➢ **Service Lifecycle:**
  1. **Service Strategy – Service Level Package; core of ITILv3 lifecycle; Perspective, Position, Plan, Pattern**
  2. **Service Design – Service Design Package; People, Products, Processes, Partners; SLAs; Availability, Capacity, Continuity, Security Mgmt**
  3. **Service Transition – Chg, Config, Knowledge, Release Mgmt; Service Validation/Testing**
  4. **Service Operation – Event, Incident, Problem Mgmt**
  5. **CSI → Continual Service Improvement; 7-step process:**
     a. **Define what SHOULD be measured**
     b. **Define what CAN be measured**
     c. **Gather the data**
     d. **Process the data**
     e. **Analyze the data**
     f. **Present & use information**
     g. **Implement corrective action**

Tools
Coneptual, Logical, Physical: It's Simple
VMware vSphere Basics Guide
What's New in VMware vSphere 5
Functional vs Non-Functional Requirements
ITIL v3 Introduction and Overview
Product Documentation

Objective 2.2 – Map Service Independencies

<u>Knowledge</u>
Identify basic service dependencies for infrastructure and application services
  - ➢ **Current-state and/or VMware vCenter Application Discovery Manager**

Datacenter Operational Excellence/Application Discovery & Mapping
- • **Forces that have transformed IT:**
  1. **IT complexity**
  2. **Change mgmt – spawned by yrs of growth**
  3. **Resource allocation – "do more with less"**

        4. **Increasing expectations**
- **Data integrity issues:**
  1. **Data might not exist**
  2. **Approach carries risk – outdated information**
  3. **Manual process prone to error**
  4. **Data changes quickly**
- **Approaches to Automating Application Discovery & Dependency Mapping:**
  1. **Active discovery – gathers configuration items (CI) data from servers**
  2. **Passive discovery – relationship data connecting to core span & mirror ports**
  3. **Discovery analytics – deep-packet analysis of traffic**
- **Use Cases of Automating App Discovery…**
  1. **Up-to-date data for CMDBs**
  2. **Change & Config mgmt**
  3. **Better info for → DC consolidation (virtualization), Capacity planning, BC, App migration, Problem mgmt/analysis, Compliance mgmt**

Skills and Abilities
- Document service relationships and dependencies (Entity Relationship Diagrams)
  - ➤ **Using Application Discovery (or other method), review all App dependencies & document**
  - ➤ **Discover opportunities to clean house so to speak**
    1. **Application consolidation**
    2. **Clean up the CMDB**
    3. **Simplify capacity planning**
    4. **Streamline application migration**
    5. **Ease of BC/DR planning**

- Identify interfaces to existing business processes and define new business processes
  - ➤ **From first bullet above, take the information & implement better ways to do 'old' processes**

- Given a scenario, identify logical components that have dependencies on certain services
  - ➤ **Best to show an example:**

- Include service dependencies in a vSphere 5 logical design
  - ➤ **Keep in mind here what a logical design's function is – incorporate conceptual design, constraints, risks, requirements withOUT much detail; but do include dependencies that have been discovered**

- Analyze services to identify upstream/downstream service dependencies
  - ➤ **Using the above dependency map – the website is "upstream" and Cluster is "downstream"; if webserver crashes, the website is down, but that doesn't affect the Linux OS or Cluster. Reversely, if the Cluster goes down or is inaccessible, every dependency "upstream" is affected (site down due to inaccessible server/VM)**

- Having navigated logical components and their interdependencies, make decisions based upon all service relationships

> ➤ **I think the best example of a decision based on dependency is the use of vApps; if a service requires DNS, DB to be available before it can service requests, then those need to be started 1st upon completion of host maintenance, reboot, etc. A vApp 'feature' enables VM restart priority**

Tools
Datacenter Operational Excellence Through Automated Application Discovery & Dependency Mapping
Product Documentation

Objective 2.3 – Build Availability into the Logical Design

<u>Knowledge</u>
Understand what logical availability services are provided by VMware solutions
> ➤ **HA**
>   1. **VM monitoring**
>   2. **App monitoring**
> ➤ **FT**
> ➤ **vCenter Heartbeat**
> ➤ **3rd Party → MSCS**

Identify and differentiate infrastructure qualities – Availability, Manageability, Performance, Recoverability, Security
> ➤ **Availability = ability to access a resource(s) when needed; redundancy is key to achieving this**
> ➤ **Manageability = easy to deploy, administer, update, upgrade; mitigate unnecessary complexity**
> ➤ **Performance = measurement based on SLA; i.e. throughput, latency, amt of transactions, etc.**
> ➤ **Recoverability = how easy to recover infrastructure/services from a failure; RPO, RTO**
> ➤ **Security = minimizing risks; ease of security; implemented in layers (depth)**

Describe the concept of redundancy and the risks associated with SPOF
> ➤ **Without redundancy of a component(s) at a particular layer/level in the infrastructure, if a failure of the component occurs, the entire system could go down; thus, SPOF**
> ➤ **Components to make redundant:**
>   1. **Disks**
>   a. **RAID**
>   b. **Multiple datastores (shared storage – not having all "eggs" [VMs] in 1 basket)**
>   c. **Multipathing**
>   i. **HBA**
>   ii. **Fabric**
>   2. **Network → multiple pNICs (i.e. vmnics) in an Active/Passive configuration**
>   a. **Segregate traffic via pNICs and/or vSwitches**
>   b. **Multiple pSwitches**
>   3. **Compute**
>   a. **Hosts**
>   b. **Multiple power supplies**
>   c. **Multiple UPS's**
> ➤ **The main concept in providing a highly available infrastructure is to implement redundancy to eliminate SPOFs**

Differentiate Business Continuity and Disaster Recovery concepts
- **BC – keeping business operational**
- **DR – concept of restoring IT services in the event of a disaster; RTO, RPO**

Improving BC with VMware Solutions (PDF)
- **Challenges to delivering effective protection for BC (Traditional means):**
    1. **Difficulty meeting RTO and Availability goals**
    2. **High costs**
    3. **High complexity**
    4. **Unreliable solutions**
- **Ensure Availability**
    1. **Planned –   VMotion, sVMotion, HA, DRS**
    2. **Redundancy capabilities for storage & network (NIC Teaming, Multipathing)**
    3. **Servers – HA**
    4. **Resource Overload – DRS**
- **DR**
    1. **Rapid, Reliable, Affordable Recovery – SRM**
- **Key Benefits – SRM**
    1. **Reduce planned/unplanned downtime**
    2. **Lower BC Costs**
    3. **Simplify BC infrastructure & processes**
   4. **Expand protection**

HA Deployment Best Practices (Guide)
- **Redundancy helps reduce or eliminate downtime; eliminating SPOF**
    1. **NICs**
    2. **HBAs**
    3. **Pwr Supplies**
    4. **SANs**
    5. **Storage Networks (i.e. fabrics, NAS devices, etc.)**
    6. **Multiple Hosts**
    7. **Multiple Switches/Routers**
    8. **ESXi Host Mgmt Networks**
- **Servers**
    1. **Identical if possible**
        a. **Simplifies configs using Host Profiles**
        b. **Reduces potential resource defragmentation with HA**
- **vSphere Version – keep same when possible to avoid complexity and performance degradation**
- **Make vCenter Server highly available (HA, Heartbeat, Affinity with Auto-Deploy)**
- **Networking:**
    1. **Enable "PortFast" on physical switches**
    2. **Disable HA Host Monitoring when doing host maintenance to prevent isolation responses**
    3. **Use consistent port names on groups & VLANs**
    4. **Ensure port 8182 is open**
- **Storage**
    1. **Use Multipathing**
    2. **Storage Heartbeats (new) – minimum 2 DS used; pref to VMFS (over NFS); connected to most hosts**

vSphere HA – read Cluster Deepdive book or Availability Guide

- Determine availability component of service level agreements (SLAs) and service level management processes
  - ➢ **Basically, incorporate the appropriate availability configuration depending upon the SLA for a component/object**

- Explain availability solutions for a logical design based on customer requirements
  - ➢ **Sample high available DR logical design using SRM:**
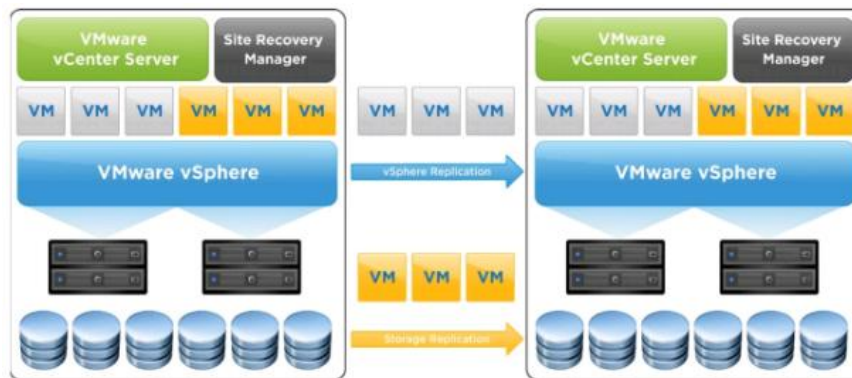
- Define an availability plan, inlcuding maintenance processes
  - ➢ **This includes planned & unplanned downtime**
    1. **Planned – maintenance mode for host maintenance, utilize vMotion**
    2. **Unplanned – unplanned host failure, implement HA; latency & capacity issues on a datastore, implement SDRS**
  - ➢ **Plan for failure instead of failing to plan**

- Prioritize each servcie in the service catalog according to availability requirements
  - ➢ **DRS automation levels**
  - ➢ **HA VM restart priority**

- Balance availability requirements with other infrastructure qualities
  - ➢ **Keep in mind the need to balance Availability with other "qualities" such as:**
    1. **Manageability**
    2. **Performance**
    3. **Recoverability**
    4. **Security**

Tools

Improving Business Continuity with VMware Virtualization Solution Brief
VMware High Availability Deployment Best Practices
vSphere Availability Guide
Product Documentation

Objective 2.4 – Build Manageability Requirements into the Logical Design

Knowledge

Understand what management services are provided by VMware solutions
  ➢ **vCenter**
  ➢ **vCLI**
  ➢ **PowerCLI**
  ➢ **vMA**
  ➢ **Host Profiles**
  ➢ **Alarms**
  ➢ **Scheduled Tasks**
  ➢ **Web Client**

Identify & differentiate infrastructure qualities – Availability, Manageability, Performance, Recoverability, Security – **See Section 2.3**

Optimizing (PDF)
- **Operational Deficiencies:**
  a. **Poor visibility into VM performance**
  b. **Lack of capacity planning**
  c. **Risk of over/under purchasing required capacity**
  d. **ROI/TCO models not tracking actual usage**
  e. **Lack of VM cost models – chargeback**
  f. **VM sprawl – control via change management and RBAC**
  g. **Lack of Host updating & maintenance**
  h. **Perf/Resource mgmt**
  i. **Lack of complete monitoring/mgmt**
- **Benefits of Virtualization Optimization:**
  a. **Manging & Mitigating Risk**
  b. **Optimize ROI**
  c. **Improve & Manage Performance**
  d. **Optimize Manageability**

Four Keys Managing Virtual Environment (PDF)
- **Implement Effective VM Cost Model**
  a. **Shared vs Individual**
- **Provide Visibility**
  a. **Capacity & Performance Monitoring and Reporting**
    1. **Current resource bottleneck**
    2. **Current available capacity**
    3. **Expected number of VMs that can be hosted per host**
    4. **Number of VMs currently hosted per host**
    5. **Remaining capacity**
- **Integrate Virtual Infrastructure in Config & Change Mgmt Procedures**
- **Develop Scheduled Maintenance Plans**
  a. **Daily, Weekly, Monthly**

Operational Readiness (Web Doc)
- **Defined – predetermined level of capability for service mgmt where services run on vSphere**

Skills and Abilities
- Build interfaces to existing operations practices into the logical design
  ➢ **AD-integrated**

- ➢ **Patch Mgmt**
- ➢ **Change Mgmt**
- ➢ **Config Mgmt**

- Address identified operational readiness deficiencies
  - ➢ **See Operational Deficiencies listed above; determine those applicable and mitigate**

- Define Event, Incident, & Problem Mgmt practices
  1. **Event – change of state which might have an influence for the mgmt of a service or system**
  2. **Incident – event which is not part of standard operations that may cause service disruption or reduce productivity**
  3. **Problem – cause of one or more incidents; usually identified because of multiple incidents**

- Define Release Mgmt practices
  - ➢ **To assemble & position all aspects of services into production & establish effective use of new or changed services**
    - o **Business value = change brought about by optimized speed & reduced risk & cost**
    - o **Consistency = auditable implementation of usable business systems**

- Determine Request Fulfillment processes
  - ➢ **Request from users for information or advice, for a standard change or access to IT services**
    - o **Purpose:**
      1. **Enable user requests**
      2. **Source & deliver services**
      3. **Provide information to users about services/procedures**
      4. **Assist with general information, complaints, comments**
      5. **Tools:**
         a. **Service catalog**
         b. **vCenter Orchestrator**

- Design Service Asset & Configuration Mgmt (SACM) systems
  - ➢ **SACM – provides accurate information & control across all assets & relationships that make up an org's infrastructure**
    - o **Controls & accounts for service assets and configuration items (CI), protects and ensures integrity across the service lifecycle**
    - o **Tool = VMware Configuration Manager**

- Define Change Mgmt processes
  - ➢ **Ensuring changes are recorded in CMDB, evaluated, authorized, prioritized, planned, tested, implemented, documented, & reviewed in controlled manner**

- Based on customer requirements, identify required reporting assets & processes
  - ➢ **Start from a high-level then go from there to determine what's best for a customer to track**

Tools
Optimizing Your VMware Environment
Four Keys to Managing Your VMware Environment
Operational Readiness Assessment
Operational Readiness Assessment Tool

Objective 2.5 – Build Performance Requirements into the Logical Design

<u>Knowledge</u>
Understand what logical performance services are provided by VMware solutions
> **Monitor via:**
> 1. **ESXTOP**
> 2. **vCenter → Performance tab**
> **Disk = SIOC; enabled in each Datastore Properties, configured Shares in each VM (Resources)**
> **Network = NIOC (in vDS)**
> **Memory = TPS, Ballooning, Compression, Host Swap, Disk Swap**
> **Also, from pg. 10 of the Security Guide, VMware also provides inherent resource controls to prevent DoS (i.e. 1 VM taking up too many of host's resources):**
> **"**ESXi imposes a form of resource reservation by applying a distribution algorithm that divides the available host resources equally among the virtual machines while keeping a certain percentage of resources for use by other system components. This default behavior provides a degree of natural protection from DoS and distributed denial-of-service (DDoS) attacks**"**

Identify & differentiate infrastructure qualities – Availability, Manageability, Performance, Recoverability, Security **– See Section 2.3**

List the key performance indicators for resource utilization
> **KPI is used to assess if a "service" is running as expected; metrics used to help determine:**
- **Disk – DAVG, KAVG, QAVG, QUEUE**
- **Network – MbTX/s, MbRX/s**
- **CPU – %Rdy, %USED**
- **Memory – ACTIVE**

<u>Skills and Abilities</u>
- Analyze current performance, identify & address gaps when building the logical design
- Using a conceptual design, create a logical design that meets performance requirements
  > **Storage I/O requirements – RAID level, disk type (SSD, SAS, SATA), # of spindles**
  > **CPU – don't overallocate**
  > **Memory – allocate what's needed then monitor metrics (Active vs Consumed)**
  > **Network – utilize VMXNET(3) adapter if possible**
  > **May need to implement Resource Pools and/or segregate networked storage**
  > 1. **Implement Jumbo Frames (this is an end-to-end configuration)**

- Idenitfy performance-related functional requirements based on given non-functional requiremnts & service dependencies
  > **Example: with a non-functional requirement (constraint) to implement storage (i.e. a budget of only $50K), we can then identify what kind of storage we can procure and the performance characteristics based off our purchase choice; that purchase must meet (non)functional requirement of performance**

- Define capacity management practices & create a capacity plan
  > **Ability to utilize resources efficiently without compromising performance**
  > **Uitlizing tools to forecast resource capacity (being proactive instead of reactive)**

- Incorporate scalabiltiy requirements into the logical design
  - ➢ **Overprovision enough for future growth**

- Determine performance component of SLAs & service level management processes

Implementing ITILv3 Capacity Mgmt (Communities DOC)
- **Business Capacity Mgmt – ensure future business requirements are understood & have sufficient capacity to meet the requirements**
- **Service Capacity Mgmt – resource consumption, activity patterns/peaks/troughs of live operational services**
- **Component Capacity Mgmt – performance & capacity of underlying IT service components (CPU, RAM, Disks, etc.)**

Tools
Proven Practice: Implementing ITILv3 Capacity Mgmt in a VMware environemnt
vSphere Monitoring & Performance Guide
Product Documentation

Objective 2.6 – Build Recoverability Requirements into the Logical Design

Knowledge
Understand what recoverability services are provided by VMware solutions
  - ➢ **FT**
  - ➢ **HA**
  - ➢ **SRM**
  - ➢ **vDR**
  - ➢ **APIs are needed for 3ʳᵈ party solutions**

Identify & differentiate infrastructure qualities – Availability, Manageability, Performance, Recoverability, Security – **See Section 2.3**

Differentiate BC & DR concepts
  - ➢ BC **– overview of processes to ensure an organization can resume business after a disaster**
  - ➢ DR **– steps to resume IT services after a disaster**
    - a. **Processes based off customer requirements, RTO, RPO**

Describe & differentiate between RTO & RPO
  - ➢ **RTO – recovery time objective; appropriate time allowed to recover a critical system**
  - ➢ **RPO – recovery point objective; appropriate recovery point of a system, determing what is 'acceptable' data loss**

Mastering DR: BC & Virtualization Best Pract (PDF)
- **Traditional DR Challenges:**
  1. **Complexity**
  2. **Extensive training required**
  3. **High Costs**
- **Mastering BC Requirements – 3 Steps:**
  1. **Build on Reliable DR platform (highly available)**

2. **Solution should be hardware independent (flexibility)**
3. **Have broader Application support (instead of making trade-offs)**
- **Mitigate or Reduce Risks**
  1. **Make DR/BC plan mirror to dynamics/changes of IT org**
  2. **Reduce human error – more automation**
  3. **Frequent DR testing**

SRM Eval Guide (PDF)
- **SRM Installed**
- **SRM Plug-in Installed**
- **Dual vCenters (Linked)**
- **Dual DB Servers**
- **vSphere Replication (VRMS at each site – Protected and Recovery)**
  1. **VRS configured at Recovery Site (at Protected Site if using bi-directional)**
- **Configure VRMS connection**
- **Create Recovery Plan(s)**
- **Create VM Priorities & Dependencies**

<u>Skills and Abilities</u>
- Given specific RTO & RPO requirements, build these requirements into the logical design
  - ➢ **i.e. is Replication used? If so, is it array-based or vSphere-based (vRS with SRM) or 3rd party (Veeam)?**
    1. **With above bullet, is dual-SANs needed or does budget prevent?**
    2. **If Replication used, does network provide enough bandwidth to accommodate DR design?**

- Given recoverability requirements, identify the services that will be impacted & provide a recovery plan for impacted services
  - ➢ **This is what it is; not much more to be said here. Add VMs/Apps to DR plans as determined by business requirements**

- Given specific regulatory compliance requirements, build these requirements into the logical design
  - ➢ **Backups & retention periods may be driven not necessarily by RTO/RPO, but by regulation**

- Based on customer requirements, idenitfy applicable site failure/site recovery use cases
  - ➢ **I think what this is saying is based off customer requirements, determine the type of "site" to recover to in the event of "production site" failure (DR site – Hot, Cold, Cloud-based, Co-Lo)**
    1. **Will the DR site be used only for when it's needed?**
    2. **Will the DR site be used for prod services as well as recovery?**
    3. **Is there a business requirement to have bi-directional recoverability?**

- Determine recoverability components of SLAs & service level management processes
  - ➢ **What apps/services need to be backed up & thus recovered**
  - ➢ **What are the RTOs/RPOs of these components**
  - ➢ **Once the above is decided, implement the appropriate solution with the appropriate configuration**

- Based on customer requirements, create a data retention policy
  - ➢ **See above bullet**

Tools
VMware SRM Evaluation Guide
A Practical Guide to BC & DR with VMware Infrastructure
Mastering DR: BC & DR Whitepaper
Designing Backup Solutions for VMware vSphere
Product Documentation

Objective 2.7 – Build Security Requirements into the Logical Design

Knowledge
Understand what security services are provided by VMware solutions
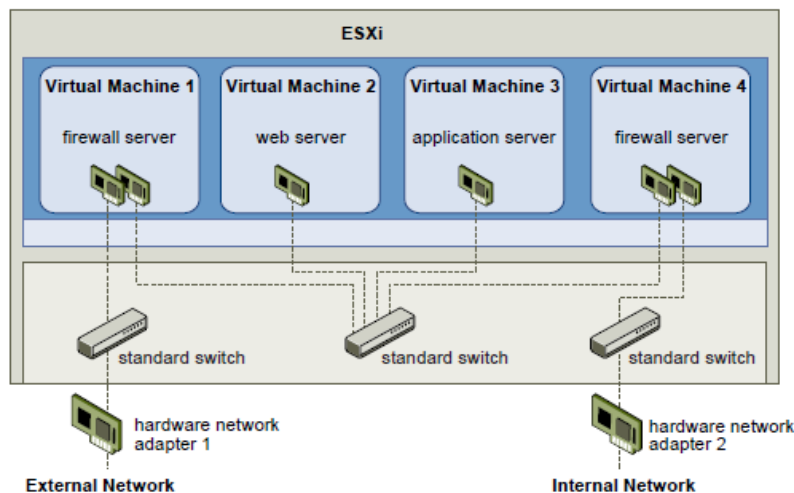- ➢ **vShield**
- ➢ **Compliance Checker**
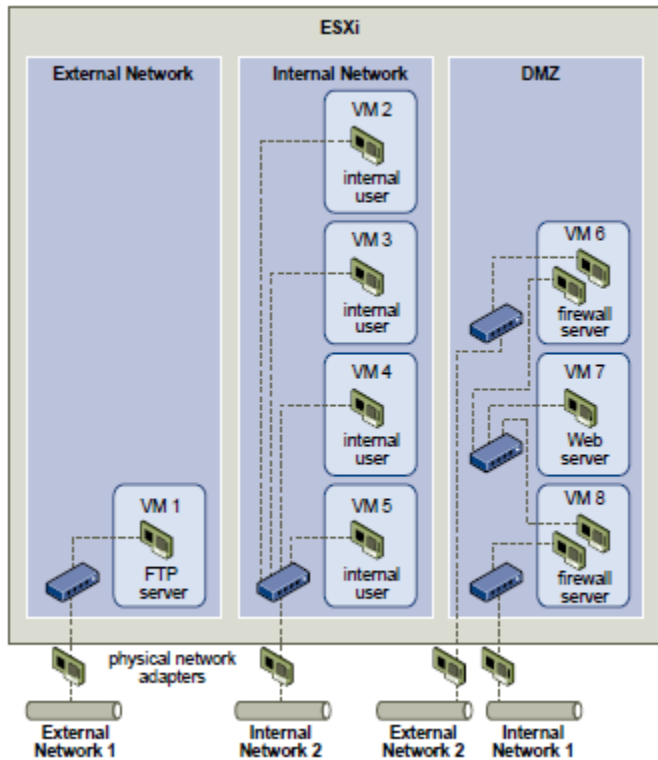- ➢ **Hardening Guide**

Identify & differentiate infrastructure qualities – Availability, Manageability, Performance, Recoverability, Security **– See Section 2.3**

Describe layered security considerations, including but not limited to Trust Zones
- ➢ **Trust Zone types: DMZ, PCI Environment, Dept or Functional, App-Defined**
- ➢ **3 Trust Zone configurations: Partially Separated Physical; Partially Separated Virtual; Fully-Collapsed**
- ➢ **From Guest OS (VM) to pSwitches (A/V, Firewalls, VLANs, Endpoint Security, RBAC, IDS)**
- ➢ **See below diagrams for sample single-host DMZ configuration (Security Guide)**

Figure 1-4. DMZ Configured on a Single ESXi Host

ESXi

| External Network | Internal Network | DMZ |

VM 2 — internal user

VM 3 — internal user

VM 4 — internal user

VM 5 — internal user

VM 1 — FTP server

VM 6 — firewall server

VM 7 — Web server

VM 8 — firewall server

physical network adapters

External Network 1   Internal Network 2   External Network 2   Internal Network 1

<u>Skills and Abilities</u>
- Identify required roles, create a role-based access model & map roles to services
  - ➢ **Use a Directory Service**
  - ➢ **Use local Windows user/group for Admin rights**
  - ➢ **Do not create an ALL user**
  - ➢ **Default users:**
    1. **ESXi** & **vCenter:**
       a. **No Access – tabs appear without content**
       b. **Read Only – can view all tabs EXCEPT the console tab**
       c. **Administrator**
    2. **vCenter:**
       a. **VM Power User – Take a VM snapshot, Install Guest OS (virtual machine.state.create Snapshots); can make VM hardware changes**
       b. **VM User – can interact with a VM console, insert media & perform power operations**
       c. **Resource Pool Administrator –vMotion, Cold migration, svMotion (resource.migrate; resource.assign); can create & modify CHILD Resource Pools; can add VMs to parent & child Resource Pool; can NOT create new VMs**
       d. **Network Consumer – Create a VM, Deploy VM from Template (network.assign Network privilege)**
       e. **Datastore Consumer – Create a VM, Deploy VM from Template, Take a VM snapshot (datastore.allocate Space privilege)**
          - Virtual Machine Administrator – CAN DO ALL TASKS
          -Datacenter Administrator –vMotion, Cold migration, svMotion
          ** The Security Guide lists the above 2 "sample" roles but doesn't list them as 'Defaults'…not sure why
  - ➢ **Local User Password Requirements**
    1. **4 character classes – lowercase, uppercase, numbers, special character**
    2. **If using 2 classes, pwd must be 8 characters long**

3. **If using 3 classes, pwd must be 7 characters long**
4. **If using 4 classes, pwd must be 6 characters long**
5. **Beginning with uppercase doesn't count towards number of classes**
6. **Ending with number doesn't count towards number of classes**
- ➢ **vCenter Users:**
  1. **Can only remove permissions via AD/Windows**
  2. **Removal causes not being able to log in**
     a. **If already logged in, users keep credentials until next validation period ~24hrs**
  3. **Name change causes original name to become invalid**
  4. **Group Name change causes to be invalid after vCenter reboot**
  5. **Use Security Groups that are NOT also Distribution Groups**
  6. **Default Administrators:**
     a. **Users in the local Administrators group of vCenter**
     b. **For Host = root, vpxuser (created by vCenter when host is attached), dcui user (local host admin user)**
  7. **Permissions:**
     a. **User permissions override group permissions on an object if a user is explicitly assigned permissions as well as in a group on a specific object**
     b. **Permissions at child object override permissions propagated from a parent**

- Create a security policy based on existing security requirements & IT governance practices
  - ➢ **For example:**
    1. **vShield Security Policies based on Compliance**
    2. **Change Mgmt Policies**
    3. **Config Mgmt Policies → Host Profiles, vCO, Templates**
    4. **Patch Mgmt Policies → VUM, Shavlik**
    5. **Access Mgmt → RBAC**

- Incorporate customer risk tolerance into the security policy
  - ➢ **In other words, what is an org willing to risk by not configuring for better security?**

- Given security requirements, assess the services that will be impacted & create an access mgmt plan
  - ➢ **Using RBAC**
  - ➢ **Firewalls?**

- Given a regulatory requirement example, determine the proper security solution that would comply with it
  - ➢ **For example, HIPPA requires info to be encrypted. Think of where this can be implemented in the infrastructure to meet compliance (IPSec, HTTPS)**
  - ➢ **Try to keep all PCI data at PCI organization and not on-site**

- Based upon a specified security requirement, analyze the current state for areas of compliance/non-compliance
  - ➢ **Basically, this is an Audit; Configuration Manager can do this (which now incorporates Compliance Checker)**

- Explain how compliance requirements will impact the logical security design
  - o **HIPPA – medical information; requires encyption**
  - o **PCI – card data; access control**

- o **SOX – finance; access control**
- o **So, based off the above, and implementing certain security tools/features, are more CPU required? vDS for PVLAN?...which requires elevated vSphere licensing; etc.**

vSphere Security (PDF)
- **Firewalls**
- **Common Ports:**
  1. **80**
  2. **443 – Client to vCenter; Client to Host; vCenter to Host**
  3. **902 – Host to Host; Client to VM Console/MKS**
  4. **903 – Client to VM Console/MKS**
  5. **1234/5 – vSphere Replication**
  6. **2049 – NFS**
  7. **3260 – iSCSI**
  8. **5988/9 – CIM**
  9. **8000 – VMotion**
  10. **8100/8200 – FT**
  11. **8182 – HA**
- **Segment Networks:**
  1. **Use separate pNICs**
  2. **VLANs**

Develop Virtualization Stategy/Deployment Plan (PDF)
- **Identify Key Stakeholders**
- **Establish Business Objectives**
- **Identify CSFs – what "must" be achieved**
- **Identify Constraints & Risks**
- **Capture Assumptions**
- **Develop & Weight Selection Criteria**
  a. **Score & weight each 'alternative' against the selection criteria (i.e. Flexibility, Availability, etc.)**
- **Review Current State**
- **Develop Server Profile Matrix**
- **VM Strategy Development & Design**
- **Guest Selection/VM Model**

Achieving Compliance in Virtual Environment (PDF)
- **Proactively Determine How Virtualization Impacts Compliance**
  1. **Document compliance objectives for the standard & identify risk**
- **What's Needed to Achieve/Demonstrate Compliance**
  1. **Preventative controls**
  2. **Detection controls**
  3. **Corrective controls**
     - **3 Control Objectives**
     a. **Access control – segregate duties & data, monitor user acct chgs**
     b. **Change & Configuration control – apply org standards, develop chg policy, monitor**
     c. **Operational control – logging, IDS, external vulnerability scans**
- **Recommendations for Compliance**
  1. **Security first, not necessarily compliance**
  2. **Design for compliance**

3. **Understand scope of compliance**
4. **Ensure controls are comprehensive**
5. **Assign right Project Mgr**
6. **Collaborate with Auditor**

Infra Security: Compliance in Cloud (RSA PDF) – For the most part, this covers security items already discussed above & in other sections of the Blueprint (i.e. RBAC, Firewalls, Guest A/V, VLANs, etc.)

Tools
vSphere Security Guide
Developing Your Virtualization Strategy & Deployment Plan
Achieving Compliance in a Virtualized Enviroment
Infrastructure Security: Getting to the Bottom of Compliance in the Cloud
Securing the Cloud
Product Documentation

SECTION 3 – CREATE A VSPHERE PHYSICAL DESIGN FROM AN EXISTING LOGICAL DESIGN

Objective 3.1 – Transition from a Logical Design to a Physical Design

<u>Skills and Abilities</u>
- Determine & explain design decisions & options selected from the logical design
  - ➢ **These will be based off biz requirements, constraints, current-state analysis, SME interviews, as well as obviously deriving from the Logical Design itself**
  - ➢ **Nice physical Cloud Design example:**
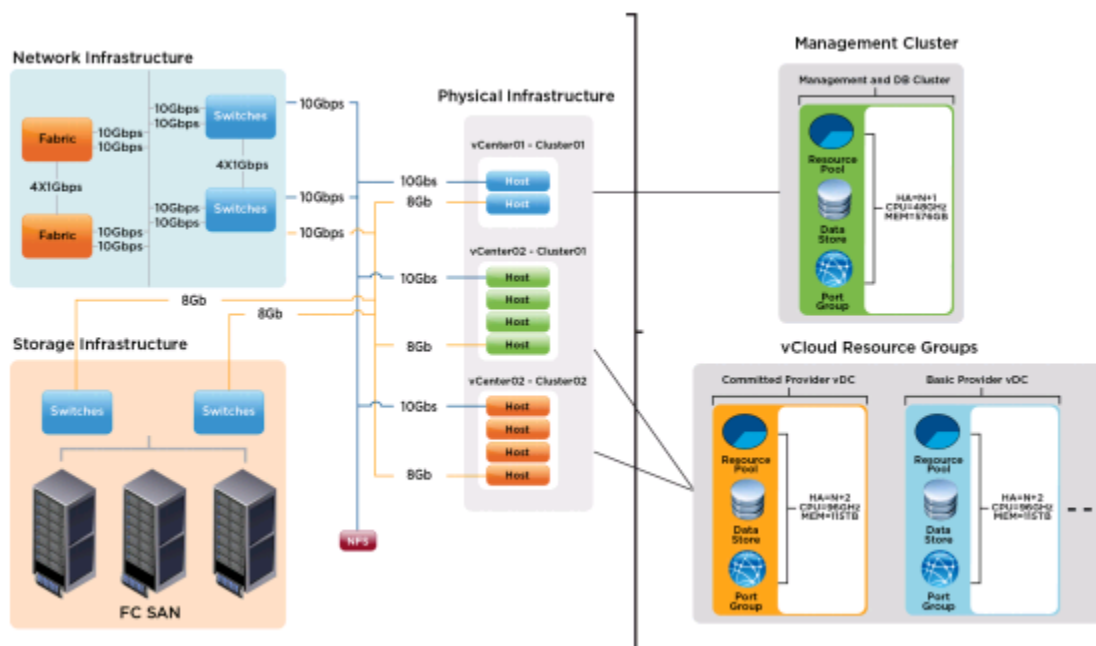
- Build functional requirements into the physical design
  - ➢ **Add: biz requirements, admin functions, authentication, authorization, auditing, logging, & compliance into the physical design**

- Given a logical design, create a physical design taking into account requirements, assumptions, & constraints
  - ➢ **Not much more to comment on…it is what it is; since the same was done with the Logical Design, do the same here, but just provide more design detail**

- Given the operational structure of an organization, identify the appropriate management tools & roles for each staff member
  - ➢ **Mgmt Tools = vCenter Server, vSphere Client, vCLI, vMA, PowerCLI, Web Client**
  - ➢ **Roles → use least permissions; give access only where needed (from Sect. 2.7, below bullets)**
    - a. **Virtual Machine Admin ? – create VM, deploy VM from Template, Take Snapshot, Move VM into RP, Install OS, VMotion, Cold Migrate, sVMotion, Move Host into Cluster**
    - b. **Datastore Consumer**
    - c. **Network Consumer**
    - d. **VM Power User – Take Snapshot, Install OS**
    - e. **VM User**
    - f. **Datacenter Admin ? – VMotion, Cold Migrate, sVMotion, Move Host into Cluster**
    - g. **Resource Pool (RP) Admin – VMotion, Cold Migrate, sVMotion**

Tools
Conceptual, Logical, Physical: It's Simple
vSphere Server & Host Management Guide
vSphere Virtual Machine Management Guide
Product Documentation

Objective 3.2 – Create a vSphere 5 Physical Network Design from an Existing Logical Design

Knowledge
Describe VLAN options, including PVLANs, with respect to virtual & physical switches
  - ➢ **VLANs – feature of both vSS & vDS; 3 types = EST, VST (default), VGT**
  - ➢ **PVLANs – vDS capability (virtual); Primary = Promiscuous, Secondary = Community, Isolated**
  - ➢ **pSwitches = need Trunk port(s) configured; if possible, enable Link-State and disable Native VLAN mode**

Describe switch-specific settings for ESXi-facing ports, including:
  - ➢ STP → **disable on physical switch**
  - ➢ Jumbo Frames → **enable end-to-end on storage/network path; must be cmd line on vSS**
  - ➢ Load-Balancing → **NIC Teaming; Route based on Originating Virtual Port ID**
  - ➢ Trunking → **VLAN Tagging; enable on physical switch when using VLANs**

Describe network redundancy considerations at each individual component level
  - ➢ **Management network → utilize active/standby vmnics (pNICs)**
    - 1. **2 vSwitches & 2 Mgmt Netwks (1 on ea vSwitch) OR, 1 Mgmt Netwk with 2 pNICs**
  - ➢ **Dual physical switches**
  - ➢ **Multiple pNICs within hosts**
  - ➢ **Multipathing for storage (HBAs)**

Cite virtual switch security policies & settings
  - ➢ **Settings:**

1. **Failback = yes; mitigates false positive of a phys switch being active when it's still down**
2. **Notify Switches = yes**
3. **VM Network traffic → configure pNICs for Port Group in Active/Active**

➢ **Security Policies:**
1. **IP Storage: segregate from VM traffic using VLANs; NFS export (/etc/export); iSCSI CHAP**
2. **MAC Address Change → REJECT; if using iSCSI set to ACCEPT**
3. **Forged Transmits → REJECT; prevents MAC impersonation**
4. **Promiscuous Mode → REJECT**
5. **IPSec → authentication & encryption on packets**
6. **Disable native VLAN use on pSwitches to prevent VLAN hopping**

Deployment Method Consideration for vDS

DEPLOYMENT SITUATION	SUGGESTED METHOD	DETAILS
New servers, same vmnic config, no active VMs	vDS + HP	Migrate first host with vDS wizard. Take host profile and apply to remaining hosts
<5 Existing Servers, no active VMs	vDS	Small number of servers. Can use host profiles, but possibly easier to continue with vDS wizard
>5 Existing servers, same vmnic configs, no active VMs	vDS + HP	Larger number of servers with similar vmnic configuration. No active VMs so can enter maintenance mode and use Host Profiles
Existing Servers, active/operational VMs	vDS	Cannot use Maintenance Mode as VMs active. Phased vmnic migration suggested to ensure continuity of VM communications
Existing Servers, dissimilar vmnic configurations	vDS	Enables per host tailoring of vmnic to dvUplink PortGroup mapping
Ongoing Compliance Checking	HP	Non-disruptively check network settings are compliant with approved "golden" configuration

vDS Migration/Config (PDF)
- **Maximums to be aware of:**
  1. **32 vDS per vCenter**
  2. **350 hosts per vDS**
  3. **1016 total active vDS (vSS) switch ports per host**
  4. **4096 switch ports per host (vDS/vSS)**
- **Setting Differences Between vDS & vSS:**
  1. **Ingress (to VM) traffic shaping**
  2. **Port blocking**
  3. **Network vMotion → persistent VM network state during vMotion when using vDS**
  4. **PVLANs**
  5. **NetIOC → Isolation; Shares (prevent overcommitment); Load-Based Teaming**
- **Migration vSS to vDS High-Level Procedure:**
  1. **Create vDS**
  2. **Create vDS Port Groups**
  3. **Add Host**
     a. **Migrate vmnics to dvUplinks**

b. **Migrate Virtual Adapters (i.e. map vSS Port Groups to vDS Port Groups)**
4. **Migrate VM Networking → select source (vSS) PG, destination PG (vDS)**
5. **Repeat for remaining hosts**
6. **Option = delete vSS of each host after migration to vDS**
7. **Adjust vDS PG Policies (NIC Teaming, Load Balancing, Failover)**

Network I/O Architecture, Performance, Best Practice (PDF)
- **Configured: Home > Inventory > Networking on Resource Allocation tab**
    1. **Click 'Properties' to Enable NetIOC**
- **"Resource Pools" for NetIOC: vMotion, iSCSI, FT, Mgmt, NFS, VM Traffic**
- **Configuration → Shares, Limits, LBT (on dvPortGroup – 'Route Based on Physical NIC Load')**

Skills and Abilities
- Based on service catalog & given functional requirements, for each service:
    o Determine most appropriate networking technologies for the design
    1. **vSS vs vDS → small or relatively large infrastructure?**
    2. **VLANs or not → meet compliance (HIPPA) or SLAs by segregating traffic**
    3. **IP Storage? → Jumbo frames configured**
    4. **1GbE or 10GbE**

    o Implement the service based on required infrastructure qualities (AMPRS)

- Determine and explain selected network teaming & failover solution
    ➢ **Default Team = Route based on originating virtual port ID; also, originating MAC; IP Hash**
    ➢ **Default Failover = Use Explicit Failover**

- Implement logical Trust Zones using network security/firewall technologies
    ➢ **Review pg. 10-13, Security Guide for "Trust Zones" (DMZ) example configurations**
    ➢ **Also, see "Network Segmentation" whitepaper**

- Based on service level requirements determine appropriate network performance characteristics
    ➢ **Taken from current-state analysis, determine pNIC speed required; budget plays role in deciding if 10GbE option is viable**
        1. **Mgmt network**
        2. **vMotion → multiple pNICs can be used; metro vMotion increase 5ms to 10ms; SDPS**
        3. **VM traffic**
        4. **FT**
        5. **IP Storage (NFS/iSCSI)**
    ➢ **Example:**

TRAFFIC TYPE	BANDWIDTH USAGE	OTHER TRAFFIC REQUIREMENTS
MANAGEMENT	Low	Highly reliable and secure channel
vMOTION	High	Isolated channel
FT	Medium to high	Highly reliable, low-latency channel
ISCSI	High	Reliable, high-speed channel
VIRTUAL MACHINE	Depends on application	Depends on application

TRAFFIC TYPE	PORT GROUP	TEAMING OPTION	ACTIVE UPLINK	STANDBY UPLINK	NIOC SHARES	NIOC LIMITS
MANAGEMENT	PG-A	LBT	1, 2, 3, 4, 5, 6, 7, 8	None	5	-
vMOTION	PG-B	LBT	1, 2, 3, 4, 5, 6, 7, 8	None	10	-
FT	PG-C	LBT	1, 2, 3, 4, 5, 6, 7, 8	None	10	-
ISCSI	PG-D	LBT	1, 2, 3, 4, 5, 6, 7, 8	None	10	-
VIRTUAL MACHINE	PG-E	LBT	1, 2, 3, 4, 5, 6, 7, 8	None	20	-

- Given a network configuration as well as technical requirements & constraints, determine appropriate virtual switch solution:
  - o vSS **– used for smaller environments**
  - o vDS **– easier mgmt/administration; centralized; larger environments; req's Ent+**
  - o 3rd Party (Nexus 1000v) **– considerations needed on what is supported (i.e. vShield, iSCSI, Host Profiles, AppSpeed, vDR, Multipathing – no support, DPM – no support, SRM)**
  - o Hybrid **– used so connectivity can be continued if vCener goes down (needed for vDS); when mixing ESX (w/Serv Cons) & ESXi (Mgmt Netwks)**
  - o **Cisco has a great PDF listing feature comparison of vSS, vDS, &Nexus http://www.cisco.com/en/US/prod/collateral/switches/ps9441/ps9902/solution_overview_c22-526262.pdf ; based off business requirements, you can compare the switches and determine which is best (budget may be a constraint for purchase of 3rd party switch as well as vSphere Edition needed)**

- Based on existing logical design, determine appropriate host networking resources
  - ➢ **Many items will be factored into here – business requirements vs budget, config max limitations, BC/DR, Compliance, Security, etc.**

- Properly apply converged networking considering VMware best practices
  - o **Using 10GbE cards and consolidating traffic on 1 card, using 2nd for redundancy**
  - o **Recommended (if licensed for it) to use NIOC (on vDS) for QoS on traffic types**

Tools
vCenter Server & Host Management Guide
vSphere Installation & Setup Guide
vMotion Architecture, Performance & Best Practices in vSphere 5
VMware vSphere: Deployment Methods for vNetwork Distributed Switch
vNetwork Distributed Switch: Migration & Configuration
Guidelines for Implementing vSphere with Cisco Nexus 1000V Virtual Switch
VMware Network I/O Control: Architecture, Performance, & Best Practices
Product Documentation

Objective 3.3 – Create a vSphere 5 Physical Storage Design from an Existing Logical Design

Knowledge
Describe selection criteria for commonly used RAID types

- o I/O requirements
- o Constraints → SAN type, budget
- o SLAs → performance requirements
- o RAID0 = JBOD (Stripe)
- o RAID1 = mirror (data copied across both disks); can lose only 1 disk
- o RAID3 = Dedicated parity disk (min of 3 disks); can lose only 1 disk
- o RAID5 = Distributed Parity across all RAID disks; data loss potential during RAID rebuilds (min of 3 disks); decent Reads but Write is a division of 4 (n*IOPS/4)
- o RAID6 = Dual-Parity disk distribution; n+2 during RAID rebuilds; less Reads due to 2 disks lost to Parity; Writes is less as a division of 6 (n*IOPS/6)
- o RAID1+0 = 2 disks used for striping and mirroring (min. 4 disks); best performance & most expensive; Read = sum of all disks * IOPS; Writes = ½ Read IOPS (n*IOPS/2)


Skills and Abilities
- Based on service catalog & given functional requirements, for each service:
  - o Determine most appropriate storage technologies for the design
    1. FC
    2. FCoE
    3. iSCSI
    4. NFS
    ** Take into consideration budget, # of spindles needed to fulfill performance requirement, RAID level needed, disk type (SSD, FC, SAS, SATA)

  - o Implement the service based on required infrastructure qualities
- Create a physical storage design based on selected storage array capabilities including:
  - o Active/Active – all storage paths are active at all times unless a path fails; default = FIXED
  - o Active/Passive – 1 SP is "default owner" for a given LUN. 2nd SP can take over in case of "default owner" failure; default = MRU
  - o ALUA – either MRU or RR
  - o VAAI (now called vStorage APIs – Storage Awareness) – Managed in PSA (VMKernel layer)
    - Hardware Acceleration API
    - Array Thin Provisioning API
    - Turned on by default on host; needs enabled on storage array (if supported)
    - Support statuses -> Unknown, Supported, Not Supported
    - Provides efficiency for:
      - ▪ Storage VMotion

- **Deploy VM from Template**
- **Clone VM from Template**
- **VMFS locking and metadata operations**
- **Thick/Thin disk writes**
- **Creating FT VMs**
    - VASA – **see above**
    - PSA – **collection of APIs to allow 3rd party ISVs to design their own load balance/failover techniques**
        a. PSPs → **I/O path selection; MRU (default for A/P), Fixed (default for A/A), RR (either)**
   b. SATPs → **I/O path failover**
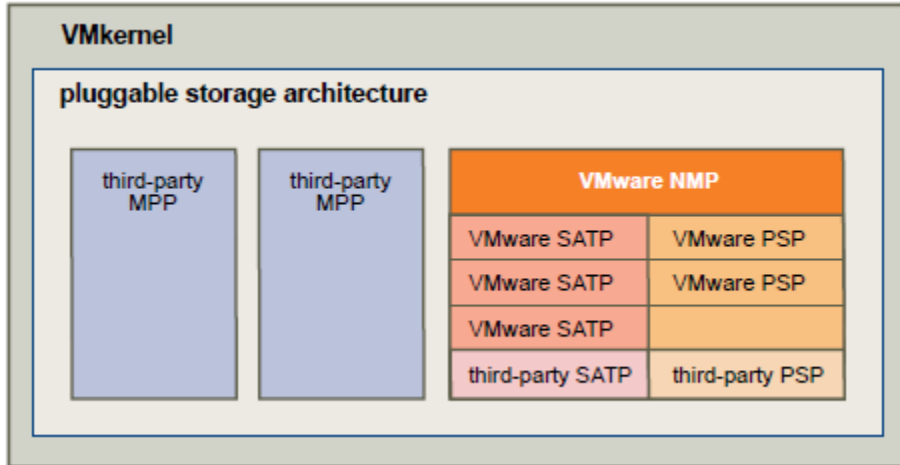
- Identify proper combination of media & port criteria for given end-to-end performance requirements
    - ➢ **"Tier" based datastores (i.e. SSD, SAS, FC, SATA backend)**
    - ➢ **Questions to ask:**
        a. **VM criticality**
        b. **VM performance/availability SLAs**
        c. **PiT restore requirement (RPO)**
        d. **VM backup requirements**
        e. **VM replication requirements**
    - ➢ **Tiering example:**

Tier	Disk_Type	Disk_RPM	Raid_Level	#_of_Disks	#_of_VMs_per_Datastore
1	FC	15K	10	8	10
2	SAS	10K	5	6	15
3	SATA	7.2K	6	6	15

- Specify the type of zoning that conforms to best practices & documentation
    - ➢ **Defines which HBAs (WWNs) can connect to Targets**
    - ➢ **Controls/isolates paths in FC fabric**
        a. **Used for test vs prod environment setup**
        b. **Prevents non-ESXi systems from accessing storage (compliance, security)**

- Based on service level requirements utilize VMware technologies including:
    - Storage I/O Control – **enabled on Datastores, configured on VMs**

- o   Storage Policies **– profile-driven storage**
- o   Storage vMotion → **used for no downtime for DS maintenance; transitioning to new Array; DS load balancing (SDRS)**
- o   Storage DRS → **latency & I/O Load Balancing solution**

- Determine use case for virtual storage appliances including vSphere Storage Appliance
  - ➢ **Basically used in SMBs where SANs are too expensive, altho this is as well**
  - ➢ **Changed min requirement of disk RAIDs so better use case available**
  - ➢ **Ability to use local storage yet have capability to utilize vSphere features (vMotion, HA, etc)**

- Given functional requirements size the storage for capacity, availability, and performance including:
  - o   Virtual Storage (Datastores, RDM, Virtual Disks)
  - o   Physical Storage (LUNs, Storage Tiering)
  - ➢ **Take I/O metrics of guests (VDI) and server workloads. Take into acct disk type & write penalty for RAID Type**
  - ➢ **Capacity → consider overhead for snapshots, vswp, and logging**
  - ➢ **Availability → multiple HBAs, multipathing, multiple switches**
  - ➢ **Performance → enable read/write cache on SAN; enable CRBC in VDI; *NOTE: disable write cache if not battery-backed***
  - ➢ **Datastores → segregate high I/O traffic on different DSs**
  - ➢ **RDMs → needed for SAN-based replication & tasks; required for MSCS**
  - ➢ **Virtual Disks → recommended; better provisioning capability over RDM; more portable; functional with all vSphere features**
  - ➢ **LUNs → ONE VMFS (DS) per LUN; can have multiple on a target or 1 per target**
  - ➢ **Storage Tiering → based on app SLAs (SSD vs SAS vs SATA); thin provisioning**

- Based on logical design, select & incorporate an appropriate storage network into the physical design:
  - o   FC → **encapsulates SCSI commands in FC frames**
    1. **Proper FC Design: connect each HBA to separate FC switch & each switch to each SP**
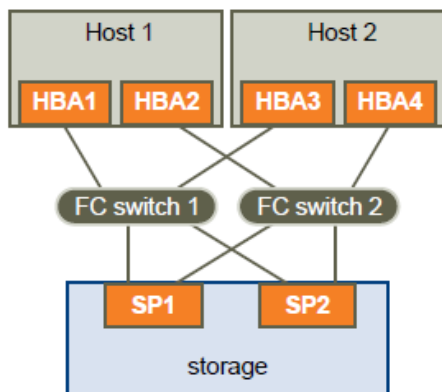
  - o   FCoE → **encapsulates FC frames in Ethernet frames; maximum of 4/host supported**
  - o   NFS
  - o   Local
    1. **Basically, the decision of protocol will mainly be decided by cost, constraints (vendor relationship, customer current solution), requirements, project goals (i.e. vSphere features required to make project successful → HA, DRS, FT, vMotion, etc.**

Table 1-4. Networked Storage that ESXi Supports

Technology	Protocols	Transfers	Interface
Fibre Channel	FC/SCSI	Block access of data/LUN	FC HBA
Fibre Channel over Ethernet	FCoE/SCSI	Block access of data/LUN	■ Converged Network Adapter (hardware FCoE) ■ NIC with FCoE support (software FCoE)
iSCSI	IP/SCSI	Block access of data/LUN	■ iSCSI HBA or iSCSI-enabled NIC (hardware iSCSI) ■ Network adapter (software iSCSI)
NAS	IP/NFS	File (no direct LUN access)	Network adapter

Table 1-5. vSphere Features Supported by Storage

Storage Type	Boot VM	vMotion	Datastore	RDM	VM Cluster	VMware HA and DRS	Storage APIs - Data Protection
Local Storage	Yes	No	VMFS	No	Yes	No	Yes
Fibre Channel	Yes	Yes	VMFS	Yes	Yes	Yes	Yes
iSCSI	Yes	Yes	VMFS	Yes	No	Yes	Yes
NAS over NFS	Yes	Yes	NFS	No	No	Yes	Yes

Tools

vSphere Storage Guide
vSphere Install & Setup Guide
Performance Implications of Storage I/O Control-Enabled NFS Datastores in vSphere 5
Managing Performance Variance of Applications Using Storage I/O Control
VMFS: Technical Overview & Best Practices
Product Documentation

Objective 3.4 – Determine Appropriate Compute Resources for a vSphere 5 Physical Design

Knowledge
Describe best practices with respect to CPU family choices
- **Consistency**
- **Choose Same vendor for ease of mgmt (vMotion, DRS, svMotion)**
- **If not the same class or is legacy version, enable EVC in Cluster**
- **Verify it is Hardware-Assisted compatible to be able to install 64bit VMs (Intel-VT, AMD-V)**

Skills and Abilities
- Based on service catalog & given functional requirements, for each service:
    - Determine most appropriate compute technologies for the design
        1. **AMD-Vi (IOMMU) or Intel VT-d CPUs for direct I/O compatibiltiy (direct-connect NICs, etc.)**
        2. **CPU Affinity – configure only if needed (could hinder VM performance upon VMotions, etc.)**
        3. **BIOS Settings**
            a. **Enable NUMA (disable Node Interleaving)**
            b. **Enable Turbo Boost**

          c. **Enable Intel-VT-x or AMD-V, AMD-RVI, Intel-EPT**

- o Implement the service based on required infrastructure qualities
- Explain the impact of a technical design on the choice of server density:
  - o Scale Up → **less mgmt overhead, less heating/cooling, less space; "more for less"; less failover capacity**
  - o Scale Out → **more servers, better for DRS/SDRS/HA; more failover capacity**
  - o Auto Deploy → **good use for enterprise to deploy many hosts; use with Host Profiles**
  - o **Blade vs Server**
    - a. **Blades = less space; less I/O slots; less RAM slots; non-scalable cost; more heating/cooling cost; vendor lockin; simpler cabling; shared chassis (SPOF?); expertise**
    - b. **Rack = more I/O & RAM slots; take up more space**

- Determine consolidation ratio based upon capacity analysis data
  - ➢ **Can typically run about 4-6 VMs per core on quad-core socket processor**
  - ➢ **During current-state analysis, determine total CPU and RAM required, then divide that out to the # of hosts required to meet the CPU/RAM requirement. This will also be based on budget, as well as what the compute 'density' requirement is (i.e. scale-up or scale-out approach)**
  - ➢ **Also keep in mind that the number of cores/host must at least match or exceed the # of the vCPUs of the largest VM (i.e the VM you configure with the most vCPUs)**

- Calculate number of nodes in a HA Cluster based on host failure count & resource guarantees
  - ➢ **If possible, size Clusters for amount needed for resources PLUS 2…. 1 for failover & 2nd to cover if a 2nd host fails while 1 is down or if a host fails while 1 is in maintenance mode**
  - ➢ **Refer to Availability Guide (pg.) and/or Cluster Deepdive book (Ch. 6 on Admission Ctrl); take into account slot size or % Reserve Resources required based off current used capacity and capacity available**

- Explain implications of using reservations, limits, & shares on physical design
  - ➢ **Reservations – guranteed to VM even when host under contention; override Shares**
    1. **CPU – resources can be used by other VMs when not in use**
    2. **RAM – can NOT be used by other VMs when not in use *IF* orig VM consumed that reserved memory…until that VM is powered off (then other VMs can claim that unused reserved memory)**
  - ➢ **Shares – per vCPU = 2K(high), 1K(normal), 500(low); RAM = 20/MB (high), 10/MB(normal), 5/MB(low)**
  - ➢ **Limits = upper bound; VM can never use more than limit which may hinder performance**

- Specify Resource Pool & vApp configuration based on resource requirements
  - ➢ **RP → partition resources based of biz unit SLAs**
    - a. **A multi-tenant solution of isolating & guaranteeing "purchased" amt of resources**
  - ➢ **vApp → a container; used to contain 'dependent' VMs & have restart order capability**
    - a. **Best used for Cloud environments**

- Size compute resources:
  - o Memory → **always take into acct not only VM RAM needed but overhead, which is based of # of vCPUs and config'd RAM of VM; size for 70% capacity**
  - o CPU – **start with 1, then add later if needed; size for 60% capacity**
  - o I/O Devices → **minimum of 4 pNICs, 2 HBAs for load balancing & failover; Jumbo Frame support**

     o Internal Storage → **min 5 GB; scratch partition created**

- Given a constraint to use existing hardware, determine suitability of the hardware for the design
  - ➢ **Does it meet biz requirements – i.e. performance, availability, manageability, usability, etc.**
  - ➢ **Does hardware support vSphere features required**
  - ➢ **Is H/W on HCL**

Tools
vCenter Server & Host Management Guide
vSphere Installation & Setup Guide
vSphere Resource Management Guide
Product Documentation

Objective 3.5 – Determine Virtual Machine Configuration for a vSphere 5 Physical Design

<u>Knowledge</u>
Describe applicability of using RDM or virtual disks for a VM
- • **RDM → for MSCS (phys); some SAN technologies (replic); when volume needed up to 64TB (phys); NPIV**
- • **Virtual Disks → provide similar performance to RDM; portable; needed for FT;**

<u>Skills and Abilities</u>
- Based on service catalog & given functional requirements, for each service:
  - o Determine most appropriate VM configuration for the design
    1. **Always start with only 1 vCPU**
    2. **Enable TPS**
    3. **Always install VMware Tools**
    4. **Only allocate RAM needed**
    5. **Align virtual disks**
    6. **Remove Floppy and any unneeded I/O devices or VM Hardware**
    7. **Paravirtual SCSI for Data disks (not OS); typically use for > 2000 IOPS**
    8. **VMXNET3 Ethernet Adapters**
    9. **If redirecting VM swap files, do so on Shared Storage for better vMotion performance**

  - o Implement the service based on required infrastructure qualities
- Based on logical design determine appropriate virtual disk type and placement
  - ➢ **Thick, Lazy Zeroed = "flat" disk; zeroes at a later time**
  - ➢ **Thick, Eager Zeroed = zeroes free space upon creation; required for FT**
  - ➢ **Thin Provisioned = when storage is at a premium; monitoring storage is key!**

- Explain the impact of licensing for the host choice options ('scale up' vs 'scale out')
  - ➢ **vRAM**
  - ➢ **CPU Sockets**
  - ➢ **So, first think about CPU sockets as that is the easiest; then, think about total RAM *per CPU socket*. If you need more RAM for VMs than what the CPU license can cover in memory, you'll need more licenses**
  - ➢ **In 5.1 this is no longer the case, but the current DCD probably covers vRAM so know it**

- Size VMs appropriately according to application requirements incorporating VMware best practices

- ➤ **This just is what it is. Not much else needs to be said. Always start with 1 vCPU and only allocate RAM required by ISVs for a given app**
- ➤ **For storage, you can get this by current-state analysis, then add enough for growth (patches/updates), vswp, logging, other 'overhead' → (avg size of VMs * # VMs on Datastore) + 20% = round up the final number**
- ➤ **IMPORTANT: Size VM resources in accordance with NUMA boundaries. So, if you have 4 cores, assign vCPUs by multiple of 4, 6 cores = multiple of 6, etc.**
- ➤ **If overallocate RAM, more RAM overhead is used per VM thus wasting RAM…for larger environments that is more applicable**

- Determine appropriate reservations, shares, limits
  - ➤ **Typically none are needed**
  - ➤ **Sparingly use limits if at all; only required if it's assume a VM takes up too many resources**
  - ➤ **Reservations – needed to guarantee SLAs basically; unallocated reservation amt can be allocated to other VMs that need it**
  - ➤ **Shares – probably best use for Resource Allocation; determines relative priority of resources for sibling VMs *when contending for resources*; shares are a 4:2:1 ratio no matter the numbers used**

- Based on existing logical design, determine virtual hardware options
  - ➤ **Some virtual hardware (CD/DVD Drive) affects vMotion negatively**
  - ➤ **HW vers 8 enables increased resources for VMs (RAM, vCPUs, SCSI Controller)**
  - ➤ **Disable/remove hardware not needed**

- Design a vApp catalog of appropriate VM offerings (templates, OVFs, vCO)
- Describe implications of & apply appropriate use cases for vApps
  - ➤ **Above *2* bullets:**
    1. **Use for Appl-Dependent VMs**
    2. **VM resart priority is required**
    3. **Security boundaries**
    4. **Use cases = Service Providers, vCD Catalog Offerings, Simplified Deployment & Mgmt**

- Describe suitability of using FT or 3rd party clustering products based on application requirements
  - ➤ **Consider limitations of FT (1 vCPU, Eager Zeroed Disk, NOT a 2nd "copy" vs need to have instantaneous VM recovery and/or uptime**
  - ➤ **FT covers for VM uptime, but not app failure**

- Determine & implement antivirus
  - ➤ **vShield Endpoint is VMware's A/V offloading solution. A small 'agent' is part of VMware Tools so no other provisioning is required for the VM. On the other hand, there is no agent, so not quite as secure as agent-based solutions**

Tools
vCenter Server & Host Managment Guide
Virtual Machine Administration Guide
Best Practices for Performance Tuning of Latency-Sensitive Workloads in vSphere
Virtualizing Windows AD Infrastructure
Guest OS System Installaton Guide
Product Documentation

Objective 3.6 – Determine Datacenter Management Options for a vSphere 5 Physical Design

Knowledge
Differentiate & describe client access options
- **vSphere Client**
- **vSphere Web Client**
- **vCLI**
- **PowerCLI**
- **DCUI**
- **vMA**

Skills and Abilities
- Based on service catalog & given functional requirements, for each service
  - Determine most appropriate datacenter management options for the design
    a. **This will more be about comfort level for a particular client access mgmt tool than anything, as well as tool required for a particular task. For example, you can only do some tasks via cmd line & not with vSphere or Web Clients**
    b. **NOTE: Web Client will be sole Client access tool in future (5.1 and above); vCLI, PowerCLI, vMA are still available, but no more vSphere Client feature enhancements**

  - Implement the service based on required infrastructure qualities
- Analyze cluster availability requirements for HA & FT
  - ➢ **There is almost no use case to NOT use HA**
  - ➢ **FT will be case-by-case – only 1 vCPU can be used (so far); need dedicated vmk port, no thin provision disk, & other limitations that may prevent its use; no snaps; no vMotion**

- Analyze cluster performance requirements for DRS & vMotion
  - ➢ **Be wary of vMotion/DRS requirements for VMs with certain Virtual HW and host version**
  - ➢ **vMotion/DRS performs better on vSphere 5 with multi-NIC support & increase from 4 → 8 simultaneous vMotions; VAAI (now Storage API – AI) assists with vMotion performance**
  - ➢ **DRS – take into acct CPU compatibility, enabling EVC or not, etc.**

- Analyze cluster storage performance requirements for SDRS & Storage vMotion
  - ➢ **VAAI (now VASA) helps with SDRS/SVM**

- Determine the appropriate vCenter Server design & sizing requirements:
  - vCenter Server Linked-Mode
    a. **For large environments to expand upon Config Max's**
    b. **For SRM**

  - vCenter Server VIrtual Appliance
    a. **SMBs → 5 hosts, 50 VMs for built-in DB2 DB; No Linked Mode, External Oracle, No VSA**

  - vCenter Sever Heartbeat
    a. **For protecting vCenter; dual vCenter systems communicating via heartbeats**

- Determine appropriate access control settings, create roles, & assign users to roles
  - ➢ **See Section 2.7**

- Based on the logical design, identify & implement asset & configuration management technologies
    - ➢ **VMware GO – patch mgmt & help desk**
    - ➢ **VMware Service Manager – change & config mgmt, service catalog, workflow automation**
    - ➢ **VMware Configuration Manager**

- Determine appropriate host & VM deployment options
    - ➢ **Host**
        1. **Full/manual install → good for small environments**
        2. **AutoDeploy → good for large environments**
            a. **EXCELLENT post by Gabrie van Zanten:**
            http://www.gabesvirtualworld.com/vsphere-5-how-to-run-esxi-stateless-with-vsphere-auto-deploy/
        3. **Boot from SAN (PXE)**
        4. **Image Builder – requires PowerCLI knowledge**
        5. **Scripted – with kickstart file**
    - ➢ **VM**
        1. **P2V**
        2. **V2V**
        3. **Fresh install**
        4. **Deploy from Template**

- Based on logical design, identify & implement release management technologies such as Upd Mgr
    - ➢ **Update hosts**
    - ➢ **Update VM tools and hardware**
    - ➢ **Update virtual appliances**
    - ➢ **If greater than 300 VMs/30 Hosts, separate VUM DB from vCenter; if greater than 1000 VMs/100 Hosts, separate install as well as DB; small environments = install on same host and can utilize same DB**

- Based on the logical design, identify & implement event, incident, & problem management technologies
    - ➢ **Traditionally, approaches to each have been reactive**
    - ➢ **Being proactive allows for: efficiency, agility, reliability**
        1. **Need → automation tools, intelligent analytics**
    - ➢ **Tools = VMware Service Manager; vCenter Orchestrator; others**

- Based on the logical design, identify & implement logging, monitoring, & reporting technologies
    - o **Most widely used 'system' is Alarms within vCenter**
        - ▪ **Events – record of user or system actions in vCenter**
        - ▪ **Alarms – notifcations activated in response to events**
    - o **Monitoring → can be done using SNMP traps**
        - ▪ **SNMP agent is embedded in 'hostd'**
    - o **Logging – best to setup a logging server; product called "Syslog Collector" can be used**
        - ▪ **Install with vCenter Server media; point to log server**

Tools
vSphere Monitoring & Performance Guide
vCenter Server & Host Management Guide
VMware vCenter Update Manager 5 Performance & Best Practices

SECTION 4 – IMPLEMENTATION PLANNING

Objective 4.1 – Create and Execute a Validation Plan

<u>Knowledge</u>
Recall standard functional test areas for design & operational verification
- **From the Functional vs Non-Functional document – determine needed 'function(s)', create Roles or Operations for that function, then test it out. If it works, you're good; if not, troubleshoot until the requirement is met**

Differentiate between operational testing & design verification
- **I see Operational Testing as testing pieces of the virtual infrastructure in general**
- **Design Verification to me means implementing a business goal or requirement and verifying its accuracy with the business, that the design item(s) perform as expected and, if so, accepted by the business (i.e. meeting a Compliance requirement); this may or may not be outside of standard implementation criteria**

<u>Skills and Abilities</u>
- From an existing template, choose the appropriate test areas
  - ➤ **Test vSphere features (i.e. vMotion, HA, DRS) under certain workloads to see how apps perform**

- Identify expected results
  - ➤ **Document what you expect results to be and the actual results seen (GAP analysis)**

- Demonstrate an ability to track results in an organized fashion
  - ➤ **Simply, create test cases for each metric required and track & document results**
  - ➤ **Tools → RV Tools, Health Check Script**

- Compare actual & expected results & explain differences
  - ➤ **This is just knowing what you're testing, what the results mean and doing GAP analysis**

- Apply validation plan metrics to demonstrate traceability to business objectives
  - ➤ **This, IMO is taking test results and comparing them to business objectives, requirements, & goals**

Tools
vCenter Server & Host Management Guide
Validation Test Plan
Product Documentation

Objective 4.2 – Create Implementation Plan

<u>Skills and Abilities</u>

- Based on key phases of enterprise vSphere5 implementations, map customer development needs to a standard implementation plan template
  - ➢ **The main point here is that when using a template (or framework) don't just accept best practices or what is 'standard' on the template. 1. Verify it still applies (std may have changed due to feature/infrastructure enhancements) 2. Verify it even applies to the business**

- Evaluate customer implementation requirements & provide a customized implementation plan
  - ➢ **Install the infrastructure based on requirements, constraints (SAN, H/W already decided upon), and best practices**

- Incorporate customer objectives into a phased implementation schedule
  - ➢ **Phased implementation focus areas:**
    1. **Early ROI workloads**
    2. **Low risk/high visibility**
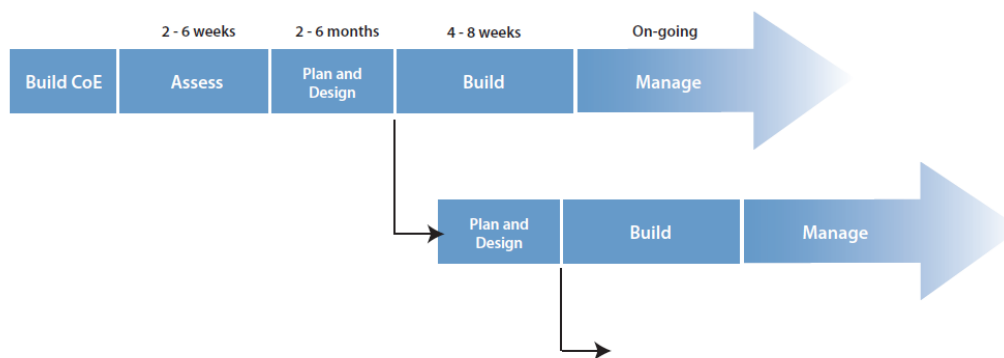
- Match customer skills & abilities to implementation resource requirements
  - ➢ **Sample Roles:**
    1. **Relationship Mgr – liason between biz & IT**
    2. **IT Analyst – identifies operational areas & recommend changes**
    3. **IT Infrastructure Architect – translates requirements into architecture designs**
    4. **IT Infrastructure Engineer – provides specific technical design for virtualization solutions**

- Indentify & correct implementation plan gaps
  - ➢ **Expand on implementation plan when/where needed (provide more details)**

Tools
vCenter Server & Host Management Guide
Operational Test Requirement Cases
Product Documentation

Objective 4.3 – Create an Installation Guide

Knowledge
Identify standard resources required to construct an installation guide
  - ➢ **vSphere Documentation is best (product Guides)**
  - ➢ **Check out product Whitepapers**
  - ➢ **Community blogs, forums, and communities**

Skills and Abilities

- Consider multiple product installation dependencies to create a validated configuration
  - ➢ **Be aware of vSphere interdependencies (i.e. vCenter with DB, etc.)**

- Recognize opportunities to utilize automated procedures to optimize installation
  - ➢ **Scripted installs using kickstart files**
  - ➢ **PXE boot**
  - ➢ **AutoDeploy**

- Create installation documentation specific to the design
  - ➢ **This is what it is. This is what I call a "procedural" document of 'step-by-step' how-to's**

Tools
vSphere Server and Host Management Guide
Deployment Guide
Product Documentation
vSphere Client

Also see here: http://virtuallyhyper.com/2012/08/vcap5-dcd/