

VMware vSphere:
Design
Lab Manual
ESXi 7 and vCenter Server 7



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VMware vSphere: Design [v7]

Lab Manual

ESXi 7 and vCenter Server 7

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Typographical Conventions

The following typographical conventions are used in this course.

Conventions	Usage and Examples
Monospace	Identifies command names, command options, parameters, code fragments, error messages, filenames, folder names, directory names, and path names: <ul style="list-style-type: none">• Run the <code>esxtop</code> command.• ... found in the <code>var/log/messages</code> file.
Monospace Bold	Identifies user inputs: <ul style="list-style-type: none">• Enter <code>ipconfig/release</code>.
Boldface	Identifies user interface controls: <ul style="list-style-type: none">• Click the Configuration tab.
<i>Italic</i>	Identifies book titles: <ul style="list-style-type: none">• <i>vSphere Virtual Machine Administration</i>
< >	Indicates placeholder variables: <ul style="list-style-type: none">• <ESXi_host_name>• ... the <code>Settings/<Your_Name>.txt</code> file

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Lab 1 Determining Business Objectives

Objective and Tasks

Identify and document the business objectives:

1. Read the Case Study
2. Determine the Business Objectives

Task 1: Read the Case Study

You read the business overview of the client depicted in the case study. You also read a summary of the information gathered from initial interviews with stakeholders at the client company.

1. Read the business overview for the client company.

The client is an online marketplace for contemporary art, based out of Berlin, Germany. With nearly 500,000 listings from artists and dealers throughout the world, the company's web and mobile properties attract more than 1 million buyers every month. Adding further value, the company offers reviews and shopping advice.

The client currently has one data center on the outskirts of Berlin. The client began virtualizing workloads in 2010, starting with its test and development workloads. Virtualization was initially adopted to increase operational efficiency, lower power and cooling costs, and take advantage of the higher availability and increased flexibility that result from running virtualized workloads. Today, 80 percent of the production and development workloads in the Berlin data center are virtualized.

Business is thriving and the client is actively expanding into new markets. The Berlin data center is nearing maximum capacity. To accommodate the growth of the business, the client decides to open a second data center in Frankfurt. The new Frankfurt data center will host the same production and development workloads as the Berlin data center.

In addition, the client recently acquired a company that is an online marketplace specializing in fine arts and antiques. The newly purchased company has a small IT team that manages and maintains applications and supporting services. All applications and services run in virtual machines on Hyper-V Server. The client wants to host the acquired company's applications in the Frankfurt data center.

The client views the Frankfurt site as an opportunity to create a leading-edge, highly virtualized facility that can easily scale to meet future needs. The client's goal is 100 percent virtualization of all workloads (production and development) in the Frankfurt data center. The client is open to implementing the latest vSphere technologies for the Frankfurt data center, as long as these technologies are cost-effective and adhere to the company's business policies. The client needs to understand the benefits and drawbacks of the various options and is relying on you to design the vSphere infrastructure for the Frankfurt data center, according to VMware best practices.

2. Read the findings from initial interviews with the key stakeholders and an analysis of their service-level agreements.

Interview notes: Chief technology officer (CTO)

- Use the latest version of vSphere.
- Move from reactive to proactive monitoring.
- In the transition plan for the applications of the newly acquired company, include the migration of Hyper-V Server VMs to vSphere VMs in the Frankfurt data center.
- Automate as many processes as possible to eliminate human error and provide consistent results.
- According to requirements of system administrators, create a vSphere cluster architecture for the Frankfurt data center that is highly available, resilient, secure, and performs well. The Berlin data center currently has two clusters: A vSphere 6.0 cluster and a vSphere 6.5 cluster.
- Use Active Directory and vCenter Server in combination for domain and user account security and policy management.
- Support the client's existing security policies in the new design and mitigate the following security risks:
 - If a security breach on a ESXi host occurs, a virtual machine on that host might have unauthorized access to other virtual machines residing on the same host.
 - A security compromise of the vCenter Server system can result in unauthorized access to virtual machines managed by vCenter Server.
- Protect data always, especially when data is removed from the premises, for example, when placing data on removable media such as USB sticks.

- Achieve projected VM growth of a total of 60 percent over the next three years. The environment must be able to easily scale.

Interview notes: Chief financial officer (CFO)

- Server hardware for the ESXi hosts is already purchased. Server hardware specifications are provided to you later.
- Storage arrays are not yet purchased. The client wants you to recommend a cost-effective solution that satisfies the business requirements.
- Spending is limited this year because of the recent acquisition.

Interview notes: Chief operations officer (COO)

- The virtual infrastructure supports business activity 24 hours a day, 7 days a week and must be highly available to sustain operations during system failures.
- Availability is defined in the SLAs for the following application groups:
 - Mission-critical applications: 99.99 percent available (Downtime per year is 52.56 minutes.)
 - Non-mission critical applications: 99 percent available (Downtime per year is 3.65 days.)
- The IT team must be able to manage both data centers from a centralized management console.
- Movement of VMs between data centers should be evaluated as a possible way to avoid downtime and potential disasters.

Interview notes: IT manager

- The IT team consists of the IT manager, system administrators, network administrators, storage administrators, and database administrators.
- The online marketplace is a time-sensitive environment.
- The vSphere administrators have attended the following VMware courses:
 - vSphere 7: Install, Configure, Manage
 - vSphere 7: Optimize and Scale
- The IT team is responsible for both the Berlin and the Frankfurt data centers.

Interview notes: Enterprise system administrators

- In the Berlin data center, nightly backups are performed according to backup policies:
 - All vSphere VM workloads are backed up by using vSphere Data Protection 6.1.4.
 - The Windows vCenter Server VM is backed up using vSphere Data Protection 6.1.8.
- The vSphere environment must be kept up to date with the latest patches (at minimum, the critical patches) and updates. Processes exist for patching the operating systems and applications running in the VMs. All patches and updates must be tested first before putting them into production.
- vSphere Update Manager is used in the Berlin data center to patch and update ESXi hosts, virtual machines, and virtual appliances. Proxy settings are used to connect to the Internet to download the latest VMware patches. Patches are downloaded during nonpeak hours.
- The McAfee Antivirus software agent is installed in all VMs. The client is open to evaluating other options for virus protection.
- Workloads of different trust levels are consolidated onto a single ESXi host and are not sufficiently separated from each other.
- The following users, and only these users, must have restricted access to vCenter Server:
 - Enterprise administrators require administrative rights to all vSphere objects.
 - System administrators provision virtual machines and troubleshoot issues for all vSphere objects.
 - Operators only monitor the vSphere environment.
- Application administrators will remotely access their VMs:
 - SSH for Linux VMs
 - Remote Desktop Protocol (RDP) for Windows VMs
 - HTML for browser-based administrative user interfaces

Interview notes: Network administrators

- The network infrastructure must be available 24 x 7, must be secure from attacks, must perform day-to-day operations efficiently, and must be easy to maintain:
- The network infrastructure must achieve the following goals:
 - Avoid single points of failure.
 - Ensure secure and resilient communications.
 - Efficiently use the available bandwidth.
- Mission-critical application data must be secure always, even when transmitted over the network.
- Infrastructure services must get enough bandwidth, but infrastructure traffic should not interfere with the performance of application traffic (mission-critical and nonmission-critical).
- Network communication between the Berlin and Frankfurt data centers is required.
- Network traffic must be monitored for troubleshooting and performance purposes.

Interview notes: Storage administrators

- The Berlin data center currently uses Fibre Channel storage arrays. Both production and development workloads run on these arrays. RAID 10 is used across all storage arrays.

Interview notes: Database administrators

- Microsoft SQL Server 2012 is used as the database server for mission-critical applications and for the Windows vCenter Server system in the Berlin data center.
- The database administration team has an existing database backup process. The team schedules incremental nightly backups and full weekend backups of all Microsoft SQL Server databases using MS SQL native tools.

Task 2: Determine the Business Objectives

You begin your vSphere design by determining the primary business and technical problems that the client is trying to solve.

You should perform this task in a small group.

1. Open `VSDW70_Design_Template_vSphereDesign.doc`.

`VSDW70_Design_Template_vSphereDesign.doc` is the template that you use to document the vSphere conceptual and logical designs for the client in the case study.

2. Identify a person on your team to record your work in the vSphere design document.
3. Agree on a company name for the client in the case study.
4. On the title page of the vSphere design document, replace the highlighted text with your company name and the names of the people in your group.
5. In section 1.2, summarize the main business activities of your company and the factors that are important to the overall project.
6. In section 1.4, list the business objectives for the virtualization project.
7. Save the vSphere design document as
`<Your_Company_Name>_vSphereDesign.doc`.

Lab 2 Creating a Conceptual Design

Objective and Tasks

Create a conceptual design using the business objectives defined in the case study:

1. Create the Conceptual Design

Task 1: Create the Conceptual Design

You create the conceptual design for the client in the case study.

The conceptual design categorizes the assessment findings into requirements, constraints, assumptions, and risks. You reference the conceptual design throughout the design process.

You should perform this task in a small group.

1. Analyze the stakeholder interview findings to determine the requirements, constraints, assumptions, and risks for your design.
2. Open <Your_Company_Name>_vSphereDesign.doc if it is not already open.
3. In section 1.5 of this design document, enter the business requirements.
4. In section 1.6, enter the constraints, assumptions, and risks.

Lab 3 Designing the vCenter Server Architecture

Objective and Tasks

Design the vCenter Server architecture and core management services:

1. Review the Conceptual Design
2. Evaluate vCenter Server Architecture Design Options
3. Diagram the vCenter Server Architecture
4. Create a vCenter Server Physical Design

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of a core management strategy for the vSphere environment.

You should perform this task in a small group.

1. Open <Your_Company_Name>_vSphereDesign.doc.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the core management logical design.

Task 2: Evaluate vCenter Server Architecture Design Options

You must make several decisions before you can create the logical design for the vCenter Server architecture.

You should perform this task in a small group.

1. Open <Your_Company_Name>_vSphereDesign.doc.
2. In section 2.1.1 of the vSphere design document, consider each decision in the vCenter Server System Design Decisions table.
 - a. Discuss options for each decision in terms of the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material for details about design options.
3. In the table, enter the decision, the justification for the design decision, and the implication of the decision on the design.

The screenshot shows an example.

Decision	Design Justification	Design Implication
Number of vCenter Server instances to deploy		
Two vCenter Server instances will be used.	The client has a policy to separate the dev/test environment from the production environment. So, each environment will have its own vCenter Server instance.	The client must buy a license for each site. However, manageability will be improved.

4. Complete all rows in the table.
5. Decide on naming conventions for the design components and enter the conventions in section 2.1.2 of your vSphere design document.
 - vCenter Server systems
 - vCenter Server High Availability
 - vCenter Single Sign-On sources
6. Save your vSphere design document, but do not close it.

Task 3: Diagram the vCenter Server Architecture

You create an entity relationship diagram that illustrates the vCenter Server topology and the relationships between the components in the topology.

You should perform this task in a small group.

1. Diagram a solution for the vCenter Server deployment architecture.

For example, you can draw your solution on paper and photograph the diagram.

Consider adding the following components in the design, if applicable:

- vCenter Server instances
 - vCenter Server High Availability replicas (if necessary)
 - Identity sources
2. Add the diagram to section 2.2 of your vSphere design document.
For example, insert a photograph of the diagram into your design document.
 3. Save your changes.

Task 4: Create a vCenter Server Physical Design

You document the physical design for the vCenter Server architecture.

The physical design includes all the information that is necessary to install the solution. You should perform this task in a small group.

1. Open `VSDW70_Design_Template_ConfigurationWorkbook.xlsx`.

`VSDW70_Design_Template_ConfigurationWorkbook.xlsx` is the template that you use to document the physical design of the vSphere infrastructure.

2. Save the vSphere configuration workbook template as `<Your_Company_Name>_ConfigurationWorkbook.xlsx`.

3. Specify the configuration information for the vCenter Server instances in your design.
 - a. Click the **vCenter Infrastructure** tab.
 - b. In the appropriate column, replace the example information with the information for the first vCenter Server instance in your design.

If you are unsure of a value, you can enter a placeholder value, such as TBD.

NOTE

You do not need to document all the vCenter Server instances. However, you must document enough of your plan so that you can explain your solution during the class discussion.

4. (Optional) Delete unused columns.
5. Save your vSphere configuration workbook and close it.

Lab 4 Calculating Resource Requirements

Objective and Tasks

Calculate the minimum required number of ESXi hosts:

1. Read the Capacity Planning Assessment Summary
2. Calculate Total CPU and RAM Capacity Requirements
3. Read the ESXi Host Server Specifications
4. Calculate the Minimum Required Number of ESXi Hosts

Task 1: Read the Capacity Planning Assessment Summary

You review the CPU and memory resource usage for the virtual servers that were analyzed during the capacity planning assessment.

Sizing capacity gives you an idea of consolidation ratios. You can use this information to ensure that performance or stability does not change significantly when compared to current physical workloads. You should perform this task individually.

1. Read the summary of the capacity planning assessment for CPU and memory usage.

During the capacity planning assessment, the performance and use of 250 virtual servers were analyzed.

Virtual Servers Represented in the Capacity Planning Assessment Report

Server Type	Amount
Linux VMs (Virtual hardware version 11)	100
Windows VMs (Virtual hardware version 11)	100
Hyper-V Server VMs	50

Over the sampling period, CPU and RAM metrics were recorded.

Summary of CPU Resource Usage for Virtual Servers

Metric	Amount
Average number of CPUs per system	5 (cores)
Average CPU GHz	2.3 GHz
Average normalized CPU per system	11.5 GHz
Average CPU utilization per system*	9% (1.04 GHz)
Average peak CPU utilization per system*	13% (1.5 GHz)

Summary of Memory Resource Usage for Virtual Servers

Metric	Amount
Average amount of RAM per system	18 GB
Average RAM utilization per system*	30% (5.4 GB)
Average peak RAM utilization per system*	50% (9 GB)

* Per the client's request, both production and development servers are included in these calculations.

The metrics for the existing servers can be viewed in `VSDW70_DesignCaseStudy_WorkloadAssessmentWorkbook.xlsx`.

`VSDW70_Design_CaseStudy_WorkbookAssessmentWorkbook.xlsx` is a spreadsheet that contains the results of a workload assessment done on the client's production and development workloads. This document is called the workload assessment workbook or the Capacity Planning Assessment report.

Task 2: Calculate Total CPU and RAM Capacity Requirements

You analyze the capacity analysis data and assumptions, and you calculate the total CPU and RAM requirements for the environment.

You can do the calculations individually or in a small group.

1. Read the guidelines for calculating CPU and memory requirements.
 - The client requests that you size hosts for peak utilization levels. This method supports all systems running at their observed peak resource levels simultaneously.
 - Keep transparent page sharing turned off. In vSphere 6.0 and later, memory sharing is turned off by default.
 - Increase the number of virtual machines by the VM growth projection.
 - Do not include additional capacity for high availability. You make high availability design decisions later on in this lab.
2. Analyze the capacity analysis data and assumptions.
 - Q1. Using information from your conceptual design, what is the VM growth projection?

- Q2. Using information from task 1, what is the total number of servers represented in the capacity planning assessment report?
3. Determine the number of virtual machines that the infrastructure must support.
- Q3. Based on your answers to questions 1 and 2, what is the adjusted total number of virtual machines that the infrastructure must support?
4. Open <Your_Company_Name>_vSphereDesign.doc.
5. In your vSphere design document, enter the information about the adjusted total number of VMs to section 3.1.1.
6. Calculate the total CPU resources required.
- $$\text{Adjusted_total_number_of_VMs} \times \text{Average_peak_CPU_utilization_per_system} = \text{Total_CPU_resources_required}$$
- Q4. What is the value in GHz for total CPU resources required?
7. Enter the value for total CPU resources required in section 3.1.2 of your vSphere design document.
8. Calculate the total RAM resources required.
- $$\text{Adjusted_total_number_of_VMs} \times \text{Average_peak_RAM_utilization_per_system} = \text{Total_RAM_resources_required}$$
- Q5. What is the value in GB for the total RAM resources required?
9. Enter the value for the total RAM resources required in section 3.1.3 of your vSphere design document.
10. Save your vSphere design document and keep the document open.

Task 3: Read the ESXi Host Server Specifications

You review the server specifications provided to you by the client.

You should perform this task individually.

1. Read the specifications for the ESXi host server hardware that are provided by the IT manager.

ESXi Host Server Specifications

Attribute	Specification
Processor type and speed	Intel 2.40 GHz
Number of CPU sockets	2
Number of cores per CPU	6
Total number of cores	12
Memory	128 GB
Onboard NIC description	Dual port
Onboard NIC ports x speed	2 x 10G
Number of attached NICs	1 (excluding onboard)
External NIC description	Quad port
Number of ports/NIC x speed	2 x 1 Gb/s
Total number of NIC ports	4
Storage HBA type	Fibre Channel
Number of HBAs	2
Number of HBA ports x speed (per HBA)	2 x 16 GB
Total number of HBA ports	4
Number and type of local drives	4 x 500 GB SSD
RAID level	RAID 10 (Mirror plus stripe)
Total storage	1 TB

Task 4: Calculate the Minimum Required Number of ESXi Hosts

Using the server specifications provided by the client, you calculate the number of ESXi hosts required to support the design. You must not include high availability requirements in this calculation.

You can do the calculations individually or in a small group.

1. Determine the available resources per host.

- a. Calculate the total CPU per host.

$$\text{Total_number_of_cores} \times \text{Processor_speed} = \text{Total_CPU_per_host}$$

- Q1. What is the total CPU per host in GHz?

- b. Calculate the total RAM per host.

- Q2. What is the total RAM per host in GB?

2. Determine the maximum host CPU and RAM utilization for each host.

The client requests that CPU and memory utilization for each host are limited to 80 percent of the resources, so that 20 percent is allowed for overhead and unanticipated usage.

- a. Calculate the available CPU per host.

$$\text{Total_CPU_per_host} \times \text{Percentage_of_maximum_host_CPU_utilization} = \text{Available_CPU_per_host}$$

- Q3. What is the available CPU per host in GHz?

- b. Calculate the available RAM per host.

$$\text{Total_RAM_per_host} \times \text{Percentage_of_maximum_host_RAM_utilization} = \text{Available_RAM_per_host}$$

- Q4. What is the available RAM per host in GB?

3. Calculate the number of hosts required to satisfy CPU requirements.

$$\text{Total_CPU_resources_required} / \text{Available_CPU_per_host} = \text{Number_of_hosts_to_satisfy_CPU_requirements}$$

- Q5. How many hosts are required to satisfy the CPU requirement?

4. Enter the number of hosts required to meet CPU requirements in section 3.2.1 of your vSphere design document.

5. Calculate the number of hosts required to satisfy RAM requirements.

$$\frac{\text{Total_RAM_resources_required}}{\text{Available_RAM_per_host}} = \text{Number_of_hosts_to_satisfy_RAM_requirements}$$

Q6. How many hosts are required to satisfy the RAM requirement?

6. Enter the number of hosts required to satisfy RAM requirements in section 3.2.2 of your vSphere design document.
7. Record the higher value of the two host requirement calculations in section 3.2.3 of your vSphere design document.

Q7. What is the minimum number of hosts required for your design?

Lab 5 Designing the Virtual Data Center Infrastructure

Objective and Tasks

Calculate capacity requirements and create the vSphere cluster design:

1. Review the Conceptual Design and Capacity Planning Assessment Data
2. Evaluate vSphere Cluster Design Options
3. List vSphere Clusters
4. Create a vSphere Cluster Physical Design

Task 1: Review the Conceptual Design and Capacity Planning Assessment Data

You review your conceptual design to identify what is important in terms of a vSphere cluster strategy for the vSphere environment.

You should perform this task in a small group.

1. Open <Your_Company_Name>_vSphereDesign.doc.
2. Review your conceptual design.
 - a. Review the business requirements, assumptions, constraints, and risks.
 - b. Identify any item that might affect decisions that you make for the vSphere cluster logical design.
3. Keep your vSphere design document open.

Task 2: Evaluate vSphere Cluster Design Options

You must make several decisions before you can create the vSphere cluster logical design.

You should perform this task in a small group.

1. In section 4.1.1 of your vSphere design document, consider each decision in the vSphere Cluster Architecture Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material for details about design options.
2. In the table, enter the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. Save your vSphere design document.

Task 3: List vSphere Clusters

You review your conceptual design to define the clusters for the vSphere environment.

You should perform this task in a small group.

1. Open `VSDW70_Design_CaseStudy_WorkloadAssessmentWorkbook.xlsx`.
2. Review the report to get a general understanding of the characteristics of each server to be included in the virtual data center.
3. Using the information in your conceptual design and the data in the capacity planning assessment report, discuss how best to organize the servers based on your design decisions and the requirements of your design.
 - Cluster name
 - Purpose of cluster
 - Approximate number of ESXi hosts per cluster
4. In section 4.1.2 of your vSphere design document, enter the name of each vSphere cluster, a short description of the cluster, and approximately how many hosts to place in each cluster.
5. Save your vSphere design document.

Task 4: Create a vSphere Cluster Physical Design

You document the physical design for the vSphere Cluster architecture. The physical design includes all the information that is necessary to install the solution.

You should perform this task in a small group.

1. Open <Your_Company_Name>_ConfigurationWorkbook.xlsx.
2. Click the **Data Centers and Clusters** tab.
3. In each cell in column B, replace the example information with the information for the first type of cluster in your design.

If you are unsure of a value, you can enter a placeholder value, such as TBD.

NOTE

For this exercise, you do not need to document all your clusters. However, you must document enough of your plan so that you can explain your solution during the class discussion.

4. Save your changes.

Lab 6 Designing the Compute Infrastructure

Objective and Tasks

Create a compute infrastructure design:

1. Review the Conceptual Design
2. Evaluate Compute Infrastructure Design Options
3. Document the ESXi Host Physical Design

Task 1: Review the Conceptual Design

You review your conceptual design to identify important elements in terms of a compute infrastructure strategy for the vSphere environment.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_vSphereDesign.doc`.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the compute infrastructure logical design.

Task 2: Evaluate Compute Infrastructure Design Options

You must make several decisions before you can create the compute infrastructure logical design.

You should perform this task in a small group.

1. In section 5.1.1 of your vSphere design document, address each decision in the ESXi Host Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material for details about the design options.
2. In the table, enter the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. Save your changes.

Task 3: Document the ESXi Host Physical Design

You document the hardware specifications for each host. Documenting these specifications provides an inventory for future reference.

You should perform this task in a small group.

1. Review the ESXi host server specifications provided by the client.

ESXi Host Server Specifications

Attribute	Specification
Processor type	Intel 2.40 GHz
Number of CPU sockets	2
Number of cores per CPU	6
Total number of cores	12
Memory	128 GB

Onboard NIC description	Dual port
Onboard NIC ports x speed	2 x 10G
Number of attached NICs	1 (excluding onboard)
External NIC description	Quad port
Number of ports/NIC x speed	2 x 1 Gb/s
Total number of NIC ports	4
Storage HBA type	Fibre Channel
Number of HBAs	2
Number of HBA ports x speed (per HBA)	2 x 16 GB
Total number of HBA ports	4
Number and type of local drives	4 x 500 GB SSD
RAID level	RAID 10 (Mirror plus stripe)
Total storage	1 TB

2. Open <Your_Company_Name>_ConfigurationWorkbook.xlsx.
3. Click the **ESXi Hosts** tab.
4. Using information from your logical design and the client's server hardware specifications, replace the sample values with the specifications for the ESXi hosts in your design.

If you are unsure of a value, you can enter a placeholder value, such as TBD.

IMPORTANT

You do not need to document every ESXi host. Documenting one ESXi host is sufficient.

5. Save your changes.

Lab 7 Designing the Storage Platform Infrastructure

Objective and Tasks

Create the storage platform infrastructure design:

1. Review the Conceptual Design
2. Evaluate Storage Platform Design Options
3. Diagram the Storage Platform Architecture
4. Create the Storage Platform Physical Design

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of a storage platform strategy for the vSphere environment.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_vSphereDesign.doc`.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the storage platform logical design.

Task 2: Evaluate Storage Platform Design Options

You must make several decisions before you can create a storage platform logical design.

You should perform this task in a small group.

1. In section 6.1.1 of your vSphere design document, consider each decision in the Storage Platform Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material for details about the design options.
2. In the table, enter the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. Save your changes.

Task 3: Diagram the Storage Platform Architecture

You diagram the storage platform architecture. In this diagram, you include the relationships between components and any upstream and downstream dependencies.

You should perform this task in a small group.

1. Discuss how best to define the storage platform based on your design decisions and the requirements of your design.
2. Diagram the storage platform architecture for each ESXi host in your design.

You must include the following specifications for each ESXi host in the diagram:

- Storage platform to be used (Fibre Channel, iSCSI, NFS, vSAN, vSphere Virtual Volumes, RDMA over converged Ethernet)
- Relationships between the ESXi host, HBA, LUNs, and datastores
- Storage redundancy

NOTE

You do not need to diagram your complete solution. However, diagram enough of your plan so that you can explain your solution during the class discussion.

3. Insert the diagram into section 6.2.1 of your vSphere design document.

4. In section 6.3, determine the appropriate specification to satisfy the requirements of your design and document your decisions in the Storage Platform Physical Design Specifications table.

You can leave LUN size and Total LUNs blank.

If you are unsure of a value, you can enter a placeholder value, such as TBD.

5. Save your changes.

Task 4: Create the Storage Platform Physical Design

You create the storage platform physical design. The storage platform configuration specifications provide the information to configure each datastore in the virtual data center.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_ConfigurationWorkbook.xlsx`.
2. Click the **Storage** tab.
3. Calculate the datastore size based on the number of virtual machines and the total amount of storage space that a virtual machine uses.
 - a. In row 7, columns A to E, experiment with different values until you calculate the datastore sizes that are appropriate for the client.
 - Number of VMs
 - Average VM Memory Size
 - Average Disk Size
 - Snapshot Space

Cells 7A to 7E accept numeric values. You must not enter letters in the cells.

4. In the **Storage** tab, enter details about each datastore, such as datastore type, datastore name, size, and so on.

You can replace the sample values with the specifications for each of your datastores.

You can use the information from your design decisions and logical designs. If you are unsure of a value, you can enter a placeholder value, such as TBD. If a column does not apply to your datastore, you can enter **n/a**.

You can remove extra rows that contain sample values.

NOTE

For this exercise, you do not need to document the information for every datastore. You must provide a good representation of most of your datastores.

5. Save your changes.
6. Return to your vSphere design document.
7. In the Storage Platform Physical Design Specifications table in section 6.3.1 of your vSphere design document, enter values for LUN size and Total LUNs based on the size of the datastores and the total amount of storage space required.
8. Save your changes.

Lab 8 Calculating Storage Capacity

Objective and Tasks

Create the storage platform infrastructure design:

1. Review the Capacity Planning Assessment Findings for Storage Usage
2. Calculate Storage Capacity Requirements

Task 1: Review the Capacity Planning Assessment Findings for Storage Usage

You review the storage usage for the virtual servers that were analyzed during the capacity planning assessment.

Calculating the storage usage for all servers can help you determine the number of datastores required and the sizes of each datastore.

You should perform this task in a small group.

1. Read the summary of the capacity planning assessment findings for storage usage.

The storage usage for the existing servers can be viewed in `VSDW70_DesignCaseStudy_WorkloadAssessmentWorkbook.xlsx`.

Storage Usage

Metric	Amount
Total storage space for existing servers	25,500 GB

Task 2: Calculate Storage Capacity Requirements

You calculate the storage capacity for each virtual server. By calculating the storage capacity for each virtual server, you can size your datastores appropriately.

You can do the calculations individually or in a small group.

1. Find the total storage space (GB) required for all existing servers.
 - Q1. What is the total storage space in GB for the existing VMs?
2. In section 6.4 of your vSphere design document, enter the value for the total storage space (GB).
3. Calculate the percentage of storage reserved for virtual machine growth.
 $(\text{Total_storage_space_for_existing_VMs} \times \text{Percentage_for_VM_growth}) \times \text{Number_of_years} = \text{Total_storage_space_for_VM_growth}$
 - Q2. What is the company's projected growth rate, and over how many years?
 - Q3. Based on the growth rate, what is the total storage space in GB for VM growth?
4. In section 6.4 of your vSphere design document, enter the value for total storage space for VM growth (in GB).
5. Calculate the total amount of swap space capacity required for all VMs.
 - a. In section 3.1.1 of your vSphere design document, find the adjusted total number of VMs.
 - b. Record the adjusted total number of VMs. _____
 - c. In section 3.1.3 of your vSphere design document, find the average amount of RAM per system.
 - d. Record the average amount of RAM per system. _____
 - e. Calculate the total swap space capacity for all VMs.
 $\text{Adjusted_total_number_of_VMs} \times \text{Average_amount_of_RAM_per_system} = \text{Total_swap_space_capacity_for_all_VMs}$
 - Q4. What is the total swap space capacity for all VMs (in GB)?
- f. In section 6.4 of your vSphere design document, enter the value for the total swap space capacity for all VMs.

6. Calculate the percentage of storage reserved for VM snapshots.
 - a. Decide on an appropriate percentage of storage to reserve for VM snapshots and record the value. _____
 - b. Calculate the amount of storage space to reserve for VM snapshots.

Q5. What is the total storage space to reserve for VM snapshots (in GB)?

$$(\text{Total_storage_space_for_existing_VMs} + \text{Total_storage_space_for_VM_growth}) \times \text{Percentage_for_VM_snapshots} = \text{Total_storage_space_for_VM_snapshots}$$
 - c. In section 6.4 of your vSphere design document, enter the value for the total storage space to reserve for VM snapshots (in GB).

7. Calculate the total amount of storage space required.

$$\text{Total_storage_space_for_existing_VMs} + \text{Total_storage_space_for_VM_growth} + \text{Total_swap_space_capacity_for_all_VMs} + \text{Total_storage_space_for_VM_snapshots} = \text{Total_storage_space_required}$$

Q6. What is the total storage space required (in GB)?

8. In section 6.4 of your vSphere design document, enter the value for the total amount of storage space required.

Lab 9 Designing the Storage Management Infrastructure

Objective and Tasks

Create the storage management infrastructure design:

1. Review the Conceptual Design
2. Evaluate Storage Management Design Options
3. (Optional) Document the Datastore Cluster Physical Design

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of a storage management strategy for the vSphere environment.

You should perform this task in a small group.

1. Open <Your_Company_Name>_vSphereDesign.doc.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the storage management logical design.

Task 2: Evaluate Storage Management Design Options

You must make several decisions before you can create the storage management logical design.

You should perform this task in a small group.

1. In section 7.1.1 of your vSphere design document, consider each decision in the Storage Management Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material to research the details of the design options.
2. In the table, document the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. If your design includes storage tiering, diagram or explain your storage tiering architecture in section 7.1.2.
5. If your design includes datastore clusters, vSphere Storage DRS, and vSphere Storage I/O Control, create a diagram of the datastore cluster architecture and add the diagram in section 7.1.3.

NOTE

For this exercise, you do not need to diagram your complete solution. However, diagram enough of your plan so that you can explain your solution during the class discussion.

6. Save your changes.

Task 3: (Optional) Document the Datastore Cluster Physical Design

If your design includes datastore clusters, you document the physical specifications to configure the datastore clusters.

You should perform this task in a small group.

1. Open <Your_Company_Name>_ConfigurationWorkbook.xlsx.
2. Click the **Datastore Clusters** tab.
3. Using the information in your logical design, replace the sample values with the specifications for each of the datastore clusters in your design.

If you are unsure of a value, you can enter a placeholder value, such as TBD.

NOTE

You do not need to document the information for every datastore cluster. You must provide a good representation of most of your datastore clusters so that you can explain your solution during the class discussion.

4. Remove any unused rows that contain sample values.
5. Save your changes.

Lab 10 Designing the Network Component Infrastructure

Objective and Tasks

Create the network component design:

1. Review the Conceptual Design
2. Evaluate Network Component Design Options
3. Create a Network Component Relationship Diagram
4. Document the Network Component Physical Design
5. Document the ESXi Host Networking Physical Design

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of the network component infrastructure for the vSphere environment.

You should perform this task in a small group.

1. Open <Your_Company_Name>_vSphereDesign.doc.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the network component logical design.

Task 2: Evaluate Network Component Design Options

You must make several decisions before you can create the network component logical design.

You should perform this task in a small group.

1. In section 8.1.1 of your vSphere design document, address each decision in the Network Component Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material to research the details of the design options.
2. In the table, document the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. Save your changes.

Task 3: Create a Network Component Relationship Diagram

You diagram the virtual network architecture and identify the relationships between the network components. You also identify the upstream and downstream dependencies.

You should perform this task in a small group.

1. Discuss how best to connect the networking components based on your design decisions.
You do not have to discuss NIC teaming details now.
2. Diagram the virtual network architecture and include the necessary specifications in the diagram.
 - Virtual switches
 - Port groups
 - Virtual NICs
 - Physical switches
 - VLANs
 - Relationships between components
 - Dependencies that these components have with vCenter Server, ESXi, virtual machines, and so on

NOTE

For the exercise, you do not need to diagram your complete solution. However, diagram enough of your plan so that you can explain your design during the class discussion.

3. In section 8.2 of the design document, add your solution for the virtual network architecture.
4. Save your changes.

Task 4: Document the Network Component Physical Design

You document the physical specifications for the virtual switches.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_ConfigurationWorkbook.xlsx`.
2. Click the **Networking (Switch & Portgroup)** tab.

This tab provides you with areas to define your virtual switches, the port groups for a virtual switch, and the port group's policies.

3. Using the information from your logical design, replace the sample values with the specifications for each of the virtual switches in your design.
4. Replace the sample values with the specifications for each of the port groups in your design.
5. In the Port Group Policy Details section, change any of the sample values if necessary. If you are unsure of a value, you can enter a placeholder value, such as TBD.

NOTE

For this exercise, you do not need to list every virtual switch and port group.

6. Save your changes.

Task 5: Document the ESXi Host Networking Physical Design

You document the ESXi host networking configuration specifications. These specifications provide networking information for each host, such as the virtual switch name, vmnics, traffic type, and TCP/IP stack.

You should perform this task in a small group.

1. In your vSphere configuration workbook, click the **Networking (ESXi Host VMkernel)** tab.
2. For each ESXi host in your design, replace the sample values with the networking specifications for each host in the cluster.

If you are unsure of a value, enter a placeholder value, such as TBD.

You can add and remove columns to adjust for the number of hosts within the cluster.

NOTE

For this exercise, you do not need to document the networking information for every ESXi host. Network configuration specifications for one or two hosts is sufficient.

3. Save your changes.

Lab 11 Designing the Network Management Infrastructure

Objective and Tasks

Create a network management design:

1. Review the Conceptual Design
2. Evaluate Network Management Design Options
3. Document the Network Management Physical Design

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of a network management strategy for the vSphere environment.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_vSphereDesign.doc`.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the network management logical design.

Task 2: Evaluate Network Management Design Options

You must make several decisions before you can create the network management logical design.

You should perform this task in a small group.

1. In section 9.1 of your vSphere design document, address each decision in the Network Management Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material to research the details of the design options.
2. In the Network Management Design Decisions table, document the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. Save your changes.

Task 3: Document the Network Management Physical Design

You document the NIC teaming and failover specifications for each port group. If Network I/O Control is part of your design, you document the Network I/O Control physical specifications for the distributed switches.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_ConfigurationWorkbook.xlsx`.
2. If you are using Network I/O Control in your design, determine and save the appropriate settings.
 - a. Click the **NIOC Bandwidth** tab.

This tab provides a Network I/O Control bandwidth calculator.
 - b. To determine the shares, limits, and reservations for your design, enter different uplink speeds and different share values for different traffic types in the calculator fields.
 - GB Uplink Speed
 - Traffic Type in Use?
 - NIOC Share

- c. After determining the shares, limits, and reservations to use, click the **NIOC Settings** tab to enter the specifications for a sampling of Network I/O Control settings in your design.

If you are unsure of a value, you can enter a placeholder value, such as TBD.

NOTE

For this exercise, you do not need to list Network I/O Control settings for every distributed switch.

- d. Save your changes.

Lab 12 Designing Virtual Machines

Objective and Tasks

Create a virtual machine design:

1. Review the Conceptual Design and Capacity Planning Assessment Data
2. Evaluate Virtual Machine Design Options

Task 1: Review the Conceptual Design and Capacity Planning Assessment Data

You review your conceptual design and capacity planning assessment data to identify what is important in terms of a virtual machine strategy for the vSphere environment.

You should perform this task in a small group.

1. Open `VSDW70_Design_CaseStudy_WorkloadAssessmentWorkbook.xlsx`.
2. In the Capacity Planning Assessment report, review the columns of information to get a general idea of the types of servers to be virtualized.
 - OS Name
 - Environment
 - Workload Type
 - Number of CPU Cores
 - Total RAM
 - Storage Required
3. Open `<Your_Company_Name>_vSphereDesign.doc`.

4. Review your conceptual design.
 - a. Review the business requirements, assumptions, constraints, and risks.
 - b. Identify any item that might affect decisions that you make for the virtual machine logical design.

Task 2: Evaluate Virtual Machine Design Options

You must make several decisions before you can create the virtual machine logical design.

You should perform this task in a small group.

1. In section 10.1.1 of your vSphere design document, address each decision in the Virtual Machine Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material to research the details of the design options.
2. In the Virtual Machine Design Decisions table, document the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. If your design uses standard VM sizes, complete the Virtual Machine Resource Sizes table in section 10.1.2.
 - a. Fill out only the columns that apply to your environment.
 - b. Change the headings in the table if necessary.
5. Save your changes.

Lab 13 Designing Infrastructure Security

Objective and Tasks

Create an infrastructure security design:

1. Review the Conceptual Design
2. Evaluate Security Design Options
3. Document vCenter Server Users, Groups, and Roles

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of an infrastructure security strategy for the vSphere environment.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_vSphereDesign.doc`.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the infrastructure security logical design.

Task 2: Evaluate Security Design Options

You must make several decisions before you can create the infrastructure security logical design.

You should perform this task in a small group.

1. In section 11.1 of your vSphere design document, address each decision in the Infrastructure Security Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material to research the details of the design options.
2. In the Infrastructure Security Design Decisions table, document the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. Save your changes.

Task 3: Document vCenter Server Users, Groups, and Roles

You identify and document vCenter Server users and groups, and assign roles to them. Documenting these specifications provides an inventory for future reference.

You should perform this task in a small group.

1. Open `<Your_Company_Name>_ConfigurationWorkbook.xlsx`.
2. Click the **Roles and Credentials** tab.
3. Replace the sample values with the specifications for user accounts, vCenter Server roles, and groups that you want to use in your design.

If you are unsure about a value, you can enter a placeholder value, such as TBD.

NOTE

For this exercise, you do not need to list every role, group, and user. Several representative roles, groups, and users are sufficient.

4. Save your changes.

Lab 14 Designing Infrastructure Manageability

Objective and Tasks

Create an infrastructure manageability design:

1. Review the Conceptual Design
2. Evaluate Manageability Design Options

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of an infrastructure manageability strategy for the vSphere environment.

You should perform this task in a small group.

1. Open <Your_Company_Name>_vSphereDesign.doc.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the infrastructure management logical design.

Task 2: Evaluate Manageability Design Options

You must make several decisions before you can create the infrastructure manageability logical design.

You should perform this task in a small group.

1. In section 12.1 of your vSphere design document, address each decision in the Infrastructure Manageability Design Decisions table.
 - a. Discuss the decision as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material to research the details of the design options.
2. In the table, document the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the decision table.
4. Save your changes.

Lab 15 Designing Infrastructure Recoverability

Objective and Tasks

Create an infrastructure recoverability design:

1. Review the Conceptual Design
2. Evaluate Recoverability Design Options

Task 1: Review the Conceptual Design

You review your conceptual design to identify what is important in terms of an infrastructure recoverability strategy for the vSphere environment.

You should perform this task in a small group.

1. Open <Your_Company_Name>_vSphereDesign.doc.
2. Review the business requirements, assumptions, constraints, and risks.
3. Identify any item that might affect decisions that you make for the infrastructure recoverability logical design.

Task 2: Evaluate Recoverability Design Options

You must make several decisions before you can create an infrastructure recoverability logical design.

You should perform this task in a small group.

1. In section 13.1 of your vSphere design document, address each decision in the Infrastructure Recoverability Design Decisions table.
 - a. Discuss the option as it relates to the functional and nonfunctional requirements of your design.
 - b. Check the corresponding lecture material to research the details of the design options.
2. In the table, document the decision, the justification for the design decision, and the implication of the decision on the design.
3. Complete all rows in the table.
4. Save your changes and close the document.

Answer Key

Lab 4 Calculating Resource Requirements

Task 2: Calculate Total CPU and RAM Capacity Requirements.....15

- Q1. Using information from your conceptual design, what is the VM growth projection?
- A1.** Projected VM growth is a total of 60 percent over the next three years.
- Q2. Using information from task 1, what is the total number of servers represented in the capacity planning assessment report?
- A2.** 250
- Q3. Based on your answers to questions 1 and 2, what is the adjusted total number of virtual machines that the infrastructure must support?
- A3.** 400 The calculation for this value is $(250 \times 0.60) + 250$.
- Q4. What is the value in GHz for total CPU resources required?
- A4.** 600 GHz $(400 \times 1.5 \text{ GHz})$.
- Q5. What is the value in GB for the total RAM resources required?
- A5.** 3,600 GB $(400 \times 9 \text{ GB})$

Task 4: Calculate the Minimum Required Number of ESXi Hosts..... 18

- Q1. What is the total CPU per host in GHz?
- A1.** 28.8 GHz $(12 \times 2.4 \text{ GHz})$
- Q2. What is the total RAM per host in GB?
- A2.** 128 GB
- Q3. What is the available CPU per host in GHz?
- A3.** Approximately 23 GHz (28.8×0.80)
- Q4. What is the available RAM per host in GB?
- A4.** Approximately 102 GB (128×0.80)
- Q5. How many hosts are required to satisfy the CPU requirement?
- A5.** 26 hosts $(600 \text{ GHz} / 23 \text{ GHz})$

- Q6. How many hosts are required to satisfy the RAM requirement?
- A6.** 35.29, rounded up to 36 (3,600 GB / 102 GB).
- Q7. What is the minimum number of hosts required for your design?
- A7.** 36.

Lab 8 Calculating Storage Capacity

Task 2: Calculate Storage Capacity Requirements 32

- Q1. What is the total storage space in GB for the existing VMs?
- A1.** 25,500 GB
- Q2. What is the company's projected growth rate, and over how many years?
- A2.** Total of 60 percent growth over the next three years.
- Q3. Based on the growth rate, what is the total storage space in GB for VM growth?
- A3.** 15,300 GB (25,500 GB x 0.60).
- Q4. What is the total swap space capacity for all VMs (in GB)?
- A4.** 7,200 GB (400 x 18 GB)
- Q5. What is the total storage space to reserve for VM snapshots (in GB)?
- (Total_storage_space_for_existing_VMs + Total_storage_space_for_VM_growth)
x Percentage_for_VM_snapshots = Total_storage_space_for_VM_snapshots
- A5.** The answer depends on the percentage you choose. For example, if the percentage of storage to reserve is 15 percent, the total storage space to reserve for VM snapshots is 6,120 GB. The calculation for this value is (25,500 + 15,300) x 0.15.