

OFFICIAL MICROSOFT LEARNING PRODUCT

20745B

**Implementing a Software-Defined
DataCenter Using System Center Virtual
Machine Manager**

Companion Content

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Module 1

Introduction to server virtualization

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Lesson 1

Overview of Microsoft Virtualization

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Question and Answers

Question: You need to deploy a new application named Application A to the Marketing department. All Marketing users are using Windows 10 computers. During testing, you discover that Application A is not compatible with one of the applications that the Marketing department uses.

You need to enable the users in the Marketing department to use Application A. You also need to minimize processor utilization due to Application A on Marketing computers.

Which virtualization option should you use for Application A?

- Containers
- Application Virtualization (App-V)
- RemoteApp program
- Hyper-V
- User state virtualization

Answer:

- Containers
- Application Virtualization (App-V)
- RemoteApp program
- Hyper-V
- User state virtualization

Feedback: Containers are available only on Windows Server 2016 and not on Windows 10, which the Marketing computers use. You could potentially use App-V to resolve the issue by virtualizing both applications, but Application A would run locally on each Marketing computer and you would not meet the goal of minimizing processor utilization. User state virtualization will not help you with application compatibility issues. You could use Hyper-V or RemoteApp, but the requirement to minimize the utilization of the local processor is achieved by using RemoteApp.

Question: Can you run containers on a 64-bit Windows 10 Enterprise computer?

Answer: Yes, you can run Hyper-V containers on Windows 10. You can run Windows Server or Hyper-V containers on Windows Server 2016. You can also run containers on Linux container hosts.

Discussion: Benefits of virtualization

Question: What types of virtualization are you familiar with, and what are the benefits of each?

Answer: Answers will vary and will include different types of virtualization, such as server virtualization, network virtualization, and user state virtualization. Each of those virtualizations has different requirements and benefits. For example, with server virtualization, you must install Hyper-V role and user state virtualization is part of Windows operating system.

Question: What type of isolation does each type of virtualization provide?

Answer: Answers will vary. For example, user state virtualization separates user configuration and settings from the underlying operating system, and while server virtualization uses virtual machines to isolate the operating system from the hardware on which it is running and from other virtual machines that are running on the same hardware.

Question: Are there any specific requirements for that type of virtualization?

Answer: Answers will vary and depends on the virtualization type. For example, there are no specific requirements for user state virtualization, while for server virtualization, you must meet certain hardware prerequisites, such as Second Level Address Translation (SLAT) 64-bit operating system and Directory Access Protocol (DAP) and you must install Hyper-V role. SLAT is a new prerequisite for the Windows Server 2016 Hyper-V role.

Question: In which situation is virtualization especially useful?

Answer: Answers will vary based on the type of virtualization. In general, you would use virtualization when you want to isolate something, for example operating system, user settings, and data or network traffic from the underlying infrastructure and from each other.

What is server virtualization?

Question: What is the Microsoft solution for server virtualization and in which products is it included?

Answer: The Microsoft solution for server virtualization is Hyper-V. Hyper-V is available as a role in Windows Server 2016 and as a feature in the 64-bit version of Windows 10 and in Hyper-V Server 2016. Hyper-V is also available in the previous versions of the Windows Server and Windows client operating systems.

Question: Can you establish communication between two virtual machines that are running on the same Hyper-V host?

Answer: Virtual machines are isolated and you cannot establish direct communication from one virtual machine to another, even when they are running on the same Hyper-V host. However, virtual machines can have network connectivity if they are connected to the same network.

What is network virtualization?

Question: Do you need to replace your network infrastructure if you want to use network virtualization?

Answer: No. You implement network virtualization at the software level. It uses encapsulation and can use any standard network infrastructure.

Question: Which product would you typically use to manage network virtualization?

Answer: Network virtualization is included in Hyper-V in Windows Server 2016 and you can manage it by using Windows PowerShell. However, it is not practical or feasible to use Windows PowerShell to manage network virtualization in dynamic environments. In such environments, you would typically configure and manage network virtualization by using Virtual Machine Manager.

What is desktop virtualization?

Question: Can you install the trial version of Windows Server 2016 on a virtual machine that is running in Client Hyper-V on the 64-bit version of Windows 10 Pro?

Answer: Yes, you can install the trial version of Windows Server 2016 on a virtual machine that is running in Client Hyper-V on the 64-bit version of Windows 10 Pro. Client Hyper-V has the same set of core features as Hyper-V on Windows Server.

Question: Which Windows Server 2016 role must you deploy if you want to implement a VDI solution for your company?

Answer: If you want to implement a VDI solution for your company, you must deploy the Remote Desktop Services role. This role is included in Windows Server 2016 and in previous versions of Windows Server.

What is user state virtualization?

Question: How does the Windows operating system separate user state from operating system files in the Windows operating system?

Answer: In the Windows operating system, user environment, settings, and data are stored in the user profile, which is separate from the operating system files.

Question: Can you control which settings will roam when you configure users with roaming user profiles?

Answer: No. When you configure users with roaming user profiles, all settings roam and you cannot exclude specific settings from roaming.

What is presentation virtualization?

Question: Can you use presentation virtualization to run Windows applications on Android devices?

Answer: Yes. You can use presentation virtualization to run Windows applications on Android devices. With presentation virtualization, you separate the application from the operating system that is running on the device. Though the application is running on the remote computer that is running Windows Server, the Android device will display the application window.

Question: Can you run RemoteApp programs if you do not have network connectivity?

Answer: No. Network connectivity is mandatory to be able to run RemoteApp programs. RemoteApp programs are running on the remote server and the program windows transfers to the local device. If the device does not have network connectivity, you cannot run RemoteApp programs on that device.

What is application virtualization?

Question: Can you use App-V on Android devices?

Answer: No. You can only use App-V on Windows devices.

Question: Do you need to install virtualized applications?

Answer: No. You do not need to install virtualized applications. Such applications are stored as data files on a Windows device and you can run them only if the App-V client is installed on the device.

What are containers?

Question: Do containers include operating system images?

Answer: No. Containers do not include operating system images. Containers use operating system virtualization and the host on which you want to use the container must have an operating system image that the container can reference. However, the operating system image is not included in the container; it must be available on the host on which you want to use the container. The host might already have the operating system or obtains it from the image repository before you can run the container.

Question: Which two container types can you run on Windows Server 2016? What is the difference between them?

Answer: On Windows Server 2016, you can run Windows Server containers and Hyper-V containers. Hyper-V containers provide more strict isolation between containers and the host operating system.

Resources

What is server virtualization?

 **Additional Reading:** For more information, refer to Microsoft Hyper-V Server 2016: <https://aka.ms/Xk5sqp>.

What is network virtualization?

 **Additional Reading:** For more information, refer to Hyper-V Network Virtualization Overview: <https://aka.ms/b83k7v>.

What is user state virtualization?

 **Additional Reading:** For more information, refer to User Experience Virtualization: <https://aka.ms/dpm07k>.

What is application virtualization?

 **Additional Reading:** For more information, refer to Overview of Application Virtualization: <https://aka.ms/Djo1se>.

What are containers?

 **Additional Reading:** For more information on containers, refer to “Windows Containers Documentation” at <https://aka.ms/xz4amx>. For more information on how to use Docker, refer to “Understanding Docker for Absolute Beginners” at <https://aka.ms/qtydvn>.

Lesson 2

Introducing the software-defined datacenter

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Question and Answers

Question: How can you configure storage in a software-defined datacenter? How can you help ensure that storage will have sufficient I/O throughput available and one virtual machine will not monopolize others?

Answer: In software-defined datacenters, you use policies to configure resources, including storage. You can create and assign a storage QoS policy, which will control the available I/O throughput.

Question: You plan to use converged networking in your datacenter. What should you include in each Hyper-V host?

Answer: You should include two RDMA adapters in each Hyper-V host and add them to the team. This would ensure redundant network connectivity and sufficient bandwidth. Then, you would create multiple virtual network adapters on top of the RDMA team for different purposes.

Question: Which System Center component can you use for managing compute, storage, and networking in a software-defined datacenter?

Answer: You can manage compute, storage, and networking in a software-defined datacenter by using Virtual Machine Manager.

Discussion: Challenges of traditional datacenters

Question: How can you increase the utilization of a physical server?

Answer: You can increase the utilization of a physical server by installing multiple roles on it or by using server virtualization and running multiple virtual machines on it.

Question: What is the benefit of converged networking?

Answer: In traditional datacenters, you use different networks for different purposes. For example, you have separate networks for accessing storage, managing servers, and client access. Converged networking enables you to use the same physical network for different purposes by using virtual networks and virtual network adapters. Rather than separating networks physically or by using VLAN tagging, you use policies and Quality of Service (QoS) to control who has access to virtual network and how much bandwidth is available to that network.

What are software-defined datacenters?

Question: Which resource is most critical for software-defined datacenters?

Answer: In software-defined datacenters, there is no strict separation between networking, storage, and compute. Converged networking is used to provide access to the required resources and policies control the resources. You could say that networking is most critical for software-defined datacenters.

Question: What are the three building blocks for a software-defined datacenter?

Answer: The three building blocks of a software-defined datacenter are software-defined networking, software-defined storage, and software-defined compute.

Software-defined networking

Question: Which Windows Server 2016 feature enables you to increase network throughput and provides resiliency against network adapter failure?

Answer: Windows Server 2016 includes support for network teaming. This feature enables you to increase network throughput and provides resiliency against network adapter failure by adding

multiple network adapters in the team. In Windows Server 2016, you can also team RDMA adapters, which was not possible in previous Windows Server versions.

Question: Do you need to have separate physical network adapters for accessing iSCSI storage, performing Live Migration, and accepting client connections?

Answer: We recommend that you have at least two physical network adapters, which you can add to the team to achieve high availability. You can create multiple virtual network adapters for different types of traffic and they can all share the same physical team. You can configure quality of service policies to ensure that each virtual network adapter has sufficient bandwidth.

Software-defined storage

Question: Which Windows Server 2016 feature enables you to create highly available and scalable storage by using local storage from multiple servers?

Answer: Windows Server 2016 includes the Storage Spaces Direct feature, which enables you to create highly available and scalable storage from local server storage. To be able to implement Storage Spaces Direct, servers with local storage must be nodes in a failover cluster.

Question: Which protocol is used for accessing storage on highly available scale-out file server shares?

Answer: Clients and servers access highly available scale-out file server shares by using the Server Message Block (SMB3) protocol.

Software-defined compute

Question: Can you perform live migration of virtual machines only between the nodes in the same failover cluster?

Answer: No. You can perform live migration of running virtual machines between Hyper-V hosts regardless of whether they are nodes of the same failover cluster or not. You can perform live migration between any two Hyper-V hosts as long as there is network connectivity between them.

Question: Why it is important that Hyper-V hosts have CPUs from the same manufacturer?

Answer: If you want to perform virtual machine live migration, the source and destination Hyper-V hosts must have the same CPU model from the same manufacturer, because the CPUs must support the same low-level instruction set. Different CPU models and CPUs from different manufacturers do not support the same low-level instruction set.

Managing software-defined datacenters

Question: Do you need to implement all System Center components if you want to manage a datacenter?

Answer: System Center includes several components, such as Virtual Machine Manager, Configuration Manager, Operations Manager, Service Manager, Orchestrator, and Data Protection Manager. Each component provides different features and you can implement each of them independent from the others. Based on your needs, you can decide which System Center components you should implement to manage the datacenter.

Question: Which System Center component do you use for monitoring a datacenter infrastructure and triggering remediation actions if the server is not operating as expected?

Answer: You can use System Center Operations Manager for monitoring the health and performance of a datacenter infrastructure.

Resources

What are software-defined datacenters?

 **Additional Reading:** For more information, refer to 4 datacenter challenges and how Windows Server 2016 software defined networking can help: <https://aka.ms/in97ur>.

 **Additional Reading:** For more information, refer to Software-Defined Datacenter with Windows Server 2016 Preview: <https://aka.ms/uq3wpu>.

Software-defined networking

 **Additional Reading:** For more information, refer to Software Defined Networking (SDN): <https://aka.ms/a8csz4>.

Software-defined storage

 **Additional Reading:** For more information, refer to Ten reasons you'll love Windows Server 2016: Software-Defined Storage: <https://aka.ms/rljj9n>.

Software-defined compute

 **Additional Reading:** For more information, refer to Ten reasons you'll love Windows Server 2016: Software-Defined Storage: <https://aka.ms/rljj9n>.

Managing software-defined datacenters

 **Additional Reading:** For more information, refer to 5 THINGS YOU'LL LOVE ABOUT SYSTEM CENTER 2016: <https://aka.ms/sfdydo>.

Lesson 3

Extending virtualization to the cloud

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Question and Answers

Question: You create four virtual machines in your Azure subscription and your colleague creates a single virtual machine in his Azure subscription. Can you be sure that he will pay a lower Azure fee than you will?

Answer: No. Azure has a pay as you go pricing model and you have to pay only for what you use. You will pay lower fees than your colleague if:

- Your four virtual machines use less resources and are of a smaller size than your colleague's virtual machine.
- Your virtual machines are turned off most of the time while your colleague's virtual machine is running all the time.

Question: Do you need to install any client software to be able to manage Azure from your Windows 10 computer?

Answer: You can manage Azure by using the Azure portal. Because the portal runs in a web browser such as Microsoft Edge or Internet Explorer, you do not need to install anything in Windows 10 or in Windows Server 2016. However, if you want to manage Azure by using Windows PowerShell, then you need to install the Azure PowerShell module.

What is Microsoft Azure?

Question: What is Azure?

Answer: Azure is a cloud platform infrastructure created by Microsoft. You can use this infrastructure to build and operate cloud-based applications, virtual machines, and IT infrastructure. Azure offers many services for compute, data and storage, networking, hybrid integration, identity and access management. A global network of Microsoft datacenters host Azure services.

Question: How does Azure help ensure high availability of the services it is offering?

Answer: In Azure, all the data is stored at least three times inside the same datacenter. With geo-replication, Azure can also store data in a second datacenter in the same geographical region.

Service model offerings

Question: What is the difference between an Infrastructure as a Service (IaaS) and a Software as a Service (SaaS) offering?

Answer: In an IaaS service model, you have full control at the virtual machine level and you need to install the operating system in the virtual machines, configure and update them, and also install and manage applications. In the SaaS service model, you only need to configure and manage the application. All other tasks, such as updating the operating system and ensuring that the application is highly available are the responsibility of the service provider, which, in the case of Azure, is Microsoft.

Question: Which service model is most appropriate for developers who need to develop highly available and scalable web services, but do not want to maintain web servers or update the operating systems on which web servers are running?

Answer: For developers who want to focus on web service development, but do not want to be responsible for infrastructure maintenance, the Platform as a Service (PaaS) service model is most appropriate.

Managing Azure

Question: What must you install on Windows Server 2016 if you want to manage Azure by using Windows PowerShell?

Answer: If you want to manage Azure by using Windows PowerShell on Windows Server 2016, you need to first download and install the Azure PowerShell module. You can download it from the PowerShell Gallery or by using the Web Platform Installer.

Question: In how many different ways can you create a virtual machine in Azure?

Answer: You can create a virtual machine in Azure in several different ways. If you prefer a GUI, you can create a virtual machine by using the Azure portal. If you need to create multiple virtual machines in Azure or you want to automate the process of creating virtual machines, then you should use Windows PowerShell with the Azure PowerShell module or Azure CLI.

Extending your datacenter

Question: How you can connect your on-premises network with Azure and create a hybrid cloud infrastructure?

Answer: If you want to create a hybrid cloud, you should create a virtual network in Azure and then deploy site-to-site VPN.

Question: What must you create in Azure to be able to extend an on-premises datacenter to Azure?

Answer: To be able to extend an on-premises datacenter to Azure, you must create an Azure virtual network. You will also need to configure the VPN gateway and establish a site-to-site VPN connection.

Resources

What is Microsoft Azure?



Additional Reading: For more information, refer to Microsoft Azure: <http://aka.ms/Qe9skc>.

Extending your datacenter



Additional Reading: For more information, refer to Integrate your on-premises infrastructure with Azure: <https://aka.ms/a33wgr>.



Additional Reading: For more information, refer to Extending your datacenter to Microsoft Azure: <https://aka.ms/oe43hl>.

Demonstration: Using the Azure portal

Demonstration Steps

1. On **LON-HOST1**, on the taskbar, click the **Internet Explorer** icon.
2. In the Internet Explorer address box, type **http://portal.azure.com**, and then press Enter.
3. On the **Sign in to Microsoft Azure** dialog box, sign in with the Microsoft account that has the associated Azure subscription that you created earlier. If you follow the instructions, the account will be in the format **<YourInitials>MMDDYY@outlook.com**.



Note: For example, if your name is Don Funk and you are creating the account on August 15, 2018, the account name will be **DF081518@outlook.com**.

4. In the Azure portal, on the **Hub** blade on the left, click **All services**, point out the available services, and briefly describe some of them.
5. On the **Hub** blade, click **Virtual machines**.
6. On the **Virtual machines** blade, click **+Add**. The **Compute** blade opens.
7. On the **Compute** blade, in the **Recommended** section, click **Windows Server**, and then click **Windows Server 2016 Datacenter**.
8. On the **Windows Server 2016 Datacenter** blade, in the **Select a deployment model** drop-down list, select **Classic**, and then click **Create**. This will open the **Create virtual machine** blade and the **Basics** blade to its right.
9. On the **Basics** blade, specify the following settings, and then click **Next**:
 - o Name: **VM1-Classic**
 - o User name: **Student**
 - o Password: **20745Pa55w.rd**
 - o Confirm password: **20745Pa55w.rd**
 - o Subscription: **Azure Pass**
 - o Resource group: **Create new**
 - o New resource group: **VMRG**
 - o Location: *Azure region that is closest to your location. If the Azure subscription does not support virtual machine creation in that region, select **East US**.*
10. On the **Choose your virtual machine size** blade, click **D1_V2 Standard**, and then click **Select**.



Note: If **D1_V2 Standard** virtual machine size is not listed, click **View all**.

11. On the **Settings** blade, review the default values, and then click **OK**.
12. On the **Summary** blade, review the settings for the new virtual machine, and then click **OK**.



Note: The "Initializing deployment" message in the notification area at the top of the page appears and virtual machine deployment starts.

13. On the **Hub** blade on the left, in the **FAVORITES** section, click **Virtual machines**.
14. On the **Virtual machines** blade, click **+Add**. The **Compute** blade opens.
15. On the **Compute** blade, in the **Recommended** section, click **Windows Server**, and then click **Windows Server 2016 Datacenter**.

16. On the **Windows Server 2016 Datacenter** blade, in the **Select a deployment model** drop-down list, verify that **Resource Manager** is selected, and then click **Create**. This will open the **Create virtual machine** blade and the **Basics** blade to its right.
17. On the **Basics** blade, specify the following settings, and then click **OK**:
 - Name: **VM2-RM**
 - VM disk type: **SSD**
 - User name: **Student**
 - Password: **20745Pa55w.rd**
 - Confirm password: **20745Pa55w.rd**
 - Subscription: **Azure Pass**
 - Resource group: **Use existing**
 - Resource group: **VMRG**
 - Location: *Azure region that is closest to your location. If the Azure subscription does not support virtual machine creation in that region, select **East US**.*
18. On the **Choose a size** blade, click **D1_v2**, and then click **Select**.
19. On the **Settings** blade, review the default values. In the **Monitoring** section, for **Boot diagnostics**, click **Disabled**, and then click **OK**.
20. On the **Create** blade, review the information, and then click **Create**.
21. On the dashboard, point out the tiles for created virtual machines.

Module Review and Takeaways

Review Questions

Question: What do you need to install or enable in Windows 10 to use user state virtualization?

Answer: Windows 10 and other Windows operating systems use user state virtualization by default, because user settings and data are stored in the user profile, which is separate from the operating system and program files. However, if you want to be able to selectively control which user and computer settings are synchronized between domain-joined Windows 10 computers, you need to use Windows 10 Enterprise, which includes User Experience Virtualization (UE-V).

Question: Which tool can you use to configure network virtualization?

Answer: Although you can manually configure network virtualization by using Windows PowerShell, you will probably use tools such as Virtual Machine Manager for configuring network virtualization; it is considerably more complex to configure network virtualization statically by using Windows PowerShell. If you move a virtual machine to a different Hyper-V host, you must also manually update the network virtualization configuration. Virtual Machine Manager enables you to configure network virtualization by using a GUI, and it automatically updates the configuration if you move virtual machines between virtualization hosts.

Question: What is the difference between a standard network adapter and a Remote Direct Memory Access (RDMA) adapter?

Answer: Standard network adapters require CPU processing and operating system involvement on both sides when you transfer data over a network between two computers. RDMA adapters use direct memory access from the memory of one computer into the memory of another computer and do not involve the operating system of either computer.

Question: What you need to have to be able to create Azure virtual machines and use other Azure services?

Answer: Before you can use any Azure service or create Azure virtual machines, you must have an Azure subscription.

Lab Review Questions and Answers

Lab: Evaluating virtualization options

Question and Answers

Question: Which type of virtualization did you use in the second exercise?

Answer: In the second exercise, you first created two Azure virtual machines, which are an example of server virtualization. You then connected to an Azure virtual machine by using the RDP protocol, which is an example of presentation virtualization.

Question: Why did you need to create a Microsoft account before you were able to use your Azure Pass to create an Azure subscription?

Answer: The Azure portal requires you to sign in with a Microsoft Account or a work or school account. To be able to create a Work or school account, you need Azure AD, which is available as part of the Azure subscription. This means that you must have a Microsoft Account before you can create an Azure subscription.

Question: Will you be able to use the Azure subscription that you created in the second exercise after the end of this class?

Answer: In the second exercise, you created a trial Azure subscription, which has a spending limit. You can use this Azure subscription for up to one month or until you meet the spending limit, whatever happens first.

Module 2

Overview of Hyper-V virtualization

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Lesson 1

Installing and configuring the Hyper-V Role

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Question and Answers

Question: Can you use PowerShell Direct for managing a virtual machine that is running on a remote Hyper-V host?

Answer: You can use PowerShell Direct only for managing virtual machines that are running on a local Hyper-V host. To manage virtual machines that are running on a remote Hyper-V host, you can either first connect to remote Hyper-V and then use PowerShell Direct, or connect to virtual machines directly by using PowerShell remoting.

Question: Your company uses Hyper-V in Windows Server 2016 as a virtualization infrastructure. You are evaluating Virtual Desktop Infrastructure (VDI) for your company, which provides Windows 10 desktops to 20 employees in the finance department. Can you use Windows Server 2016 Datacenter virtualization rights for setting up virtual desktops for finance department users?

Answer: Windows Server 2016 Datacenter includes virtualization rights for unlimited virtual machines running on that platform, but virtual machines must be running a supported Windows Server operating system. Because Windows 10 is a client operating system and not a Windows Server operating system, it is not covered by Windows Server 2016 Datacenter virtualization rights.

Question: You install Windows Server 2016 in a virtual machine named VM1. Can you monitor disk input/output (I/O) for the physical server from VM1?

Answer: Because VM1 is running in a virtual environment, you can monitor only the resources that are available to VM1 from inside the virtual machine. You can monitor disk input/output (I/O) that is from VM1, but not disk I/O for the entire physical server. If you need to monitor disk I/O for the entire server, you will need to monitor Hyper-V in the parent partition.

Question: You plan to use Hyper-V virtualization on a Windows Server 2016 host. The driver for the physical server's display adapter is not included in Windows Server 2016. Do you need to install the driver for the display adapter into each virtual machine that runs on the host?

Answer: Virtual machines use a standard virtualized display adapter for which the driver is included in Windows Server 2016 and other operating systems. Therefore, you do not need to install a driver for the display adapter into each virtual machine that runs on the host. You must install a driver for the display adapter only once—into the parent partition of the physical host.

Question: Can you install the Hyper-V role on a server that does not have second-level address translation (SLAT)?

Answer: The server processor must support SLAT. If the processor does not have SLAT, you cannot install the Hyper-V role. The SLAT requirement used to apply to Client Hyper-V only, but in Windows Server 2016, it now is a prerequisite on the server-based Hyper-V as well.

Question: You installed the Hyper-V role in Windows Server 2016. Do you need to create Windows Firewall rules to enable remote management of Hyper-V?

Answer: No. When you installed the Hyper-V role, the appropriate Windows Firewall rules to allow remote Hyper-V management were created and enabled automatically. Therefore, you do not have to create these rules manually.

Question: You want all virtual machines that you create on a Hyper-V host to be stored in the same folder. Which Hyper-V setting should you configure, Virtual Hard Disks or Virtual Machines?

Answer: Both settings only specify a default folder for storing appropriate objects. When you create a new virtual machine, these settings define the default location, but you can configure any alternate location to which you have write permissions.

Question: When you connect to a Windows 10 virtual machine on a Windows Server 2016 Hyper-V host, is enhanced session mode used by default?

Answer: By default, Enhanced Session Mode is enabled on a Hyper-V host, but Enhanced Session Mode policy is not enabled. This prevents you from using Enhanced Session Mode when connecting to virtual machines; this mode is used only if both settings are enabled.

Question: Your virtualization environment has three Hyper-V hosts. In Hyper-V Manager, can you view the virtual machines on all three Hyper-V hosts simultaneously?

Answer: No. While you can use Hyper-V Manager to connect to and manage all three Hyper-V hosts, in Hyper-V Manager you can view only virtual machines from one Hyper-V host at a time. If you need to provide a list of virtual machines from all three servers, you can use Windows PowerShell or Failover Cluster Manager (in the case of highly available virtual machines), or you can install Virtual Machine Manager (VMM).

Question: You want to manage a Server Core virtual machine from a Hyper-V host by using Windows PowerShell. Do you need network connectivity to the virtual machine to manage it?

Answer: You do not require network connectivity, because you want to manage a Server Core virtual machine from the Hyper-V host on which the virtual machine is running. You can connect to the virtual machine by using PowerShell Direct, which utilizes VMBus.

Resources

Managing Hyper-V



Additional Reading: For additional information on managing Hyper-V by using Windows PowerShell, refer to: "Working with Hyper-V and Windows PowerShell" at: <https://aka.ms/eux0i5>.



Additional Reading: For more information about managing virtual machines with PowerShell Direct, refer to: "Manage Windows virtual machines with PowerShell Direct" at: <https://aka.ms/ac4jk0>.

Demonstration: Managing Hyper-V

Demonstration Steps

1. On **LON-HOST1**, click **Start**, and then click **Server Manager**.
2. In Server Manager, click **Tools**, and then click **Hyper-V Manager**.
3. In Hyper-V Manager, in the navigation pane, right-click **Hyper-V Manager** and select **Connect to Server**.
4. In the **Select Computer** dialog box, verify that **Another computer** radio button is selected, in the text box type **LON-SVR1**, and then click **OK**.
5. In Hyper-V Manager, in the navigation pane, click **LON-SVR1**. In the **Actions** pane, click **Hyper-V Settings**.
6. On the **Hyper-V Settings for LON-SVR1** page, in the navigation pane, click **Virtual Machines**, and in the details pane, point out that **C:\ProgramData\Microsoft\Windows\Hyper-V** displays.
7. In the navigation pane, click **Storage Migrations**, and point out that **2** simultaneous storage migrations are allowed.
8. Close the **Hyper-V Settings for LON-SVR1** page and minimize Hyper-V Manager.

9. On **LON-HOST1**, in File Explorer, navigate to **C:\LabFiles\Mod02**, right-click **Mod02-Demo1.ps1**, and then click **Edit**. The file opens in Windows PowerShell Integrated Scripting Environment (ISE).
10. In Windows PowerShell ISE, place the cursor in row 3, which has the following cmdlet, and press **F8**:

```
Set-VMHost LON-SVR1 -VirtualMachinePath C:\VMs
```

Explain that this cmdlet sets the virtual machine path.

11. In Windows PowerShell ISE, place the cursor in row 5, which has the following cmdlet, and press **F8**:

```
Set-VMHost LON-SVR1 -MaximumStorageMigrations 3
```

Explain that this cmdlet sets the allowed number of simultaneous storage migrations.

12. On **LON-HOST1**, on the taskbar, click **Hyper-V Manager**.
13. In Hyper-V Manager, in the **Actions** pane, click **Hyper-V Settings**.
14. On the **Hyper-V Settings for LON-SVR1** page, click **Virtual Machines**, and point out that **C:\VMs** is specified as the virtual machine location.
15. In the navigation pane, click **Storage Migrations**, and point out that the number of simultaneous storage migrations allowed is set to **3**.
16. To close **Hyper-V Settings for LON-SVR1** click **OK**, and minimize Hyper-V Manager.
17. In Windows PowerShell ISE, place the cursor in row 7, which starts with the following, and press **F8**:

```
$Session
```

Explain that this creates a PowerShell Direct session to the **20745B-LON-SVR1** virtual machine. When prompted for credentials, enter the username **Adatum\Administrator**, password **Pa55w.rd** and then click **OK**.

18. In Windows PowerShell ISE, place the cursor in row 9, which starts with the following, and press **F8**:

```
Copy-Item
```

Explain that this cmdlet copies the file through PowerShell Direct and that no network connectivity to the virtual machine is necessary.

19. In Windows PowerShell ISE, place the cursor in row 11, which has the following cmdlet, and press **F8**:

```
Enter-PSSession $Session
```

Explain that this enters the established session. Point out that the prompt now displays the **[20745B-LON-SVR1]** prefix.

20. In Windows PowerShell ISE, place the cursor in row 13, which has the following cmdlet, and press **F8**:

```
Get-Service | Measure-Object
```

Explain that this counts the number of services on **LON-SVR1**.

21. In Windows PowerShell ISE, place the cursor in row 15, which contains the following command, and press **F8**:

```
Dir C:\
```

Point out that the script **Services.ps1** that you copied earlier is available on drive **C** of **LON-SVR1**.

22. In Windows PowerShell ISE, place the cursor in row 17, which contains the following command, and press **F8**:

```
PSEdit C:\Services.ps1
```

23. Run the remote script by pressing the green arrow on the toolbar or by pressing **F5**.
24. In Windows PowerShell ISE, in the command pane, type **Exit**, and press Enter.
25. Close Windows PowerShell ISE.

Lesson 2

Creating and managing virtual hard disks and virtual machines

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Question and Answers

Question: You have a virtual machine named VM1 that is running on a Windows Server 2016 Hyper-V host. VM1 is configured with static memory and has Windows Server 2012 R2 installed. Can you modify VM1 memory while the virtual machine is running?

Answer: You can resize a virtual machine static memory only if the virtual machine is running Windows Server 2016 or Windows 10. Windows Server 2012 R2 does not support resize or static memory, and therefore you cannot resize VM1 memory while the virtual machine is running.

Question: You have a Windows Server 2016 virtual machine named VM1 that is running on a Windows Server 2016 Hyper-V host. Can you install a Hyper-V role in VM1?

Answer: By default, nested virtualization is not enabled, and you cannot install Hyper-V in VM1. But if you enable nested virtualization for VM1, you can install Hyper-V in VM1.

What is Microsoft Azure?

Question: Can Hyper-V allocate more storage space to a differencing virtual hard disk than to the parent disk to which it links?

Answer: A differencing virtual hard disk always links to a parent disk, which can be fixed-size, dynamically expanding, or another differencing virtual hard disk. When a differencing virtual hard disk links to a dynamically expanding or differencing virtual hard disk, Hyper-V can allocate to it more storage space than it allocates to the parent disk to which it is linked.

Question: Can you create a differencing virtual hard disk in .vhdx format that has virtual hard disk in .vhd format as its parent?

Answer: No. All virtual hard disks in the differencing hierarchy must be in the same format, either .vhd or .vhdx. If you want to create a differencing virtual hard disk in .vhdx format, then its parent must also be in .vhdx format.

Managing Azure

Question: Can you start a Generation 2 virtual machine from an IDE controller or from a legacy network adapter?

Answer: No. IDE controllers and legacy network adapters are available only for Generation 1 virtual machines; they are not available for Generation 2 virtual machines.

Question: Can you convert a Generation 1 Windows Server 2016 virtual machine to a Generation 2 virtual machine?

Answer: No. You can select the generation of the virtual machine only when you create the virtual machine, and you cannot change it later. If you already have a Generation 1 virtual machine, you cannot convert it to a Generation 2 virtual machine, regardless of the operating system on that virtual machine.

Question: Can you upgrade the configuration version of a running virtual machine?

Answer: No, you cannot upgrade the configuration version of a running virtual machine. You must turn off the virtual machine before you can upgrade its configuration version.

Question: Can you create a virtual machine that has configuration version 5.0 on Windows Server 2016?

Answer: If you create a virtual machine by using Hyper-V Manager, the virtual machine will use the highest available configuration version, which is 8.0 on Windows Server 2016. However, if you create a new virtual machine by using the **New-VM** cmdlet, you can specify the version number. In this way, you can create a virtual machine with configuration version 5.0 on Windows Server 2016.

Question: When you create a Generation 1 virtual machine, can you configure a legacy network adapter?

Answer: No. When you are creating a virtual machine, it is configured with single network adapter. You can modify virtual machine default configuration after the machine is created, for example, replacing a network adapter with a legacy network adapter.

Question: Can you add a network adapter to a running VM?

Answer: The answer will vary according to the generation number of the VM. You can add a network adapter to a Generation 1 VM only if that VM is turned off. However, with a running Generation 2 VM, you can add or remove a network adapter.

Question: Do you need to install Integration Services in a virtual machine if the operating system in the virtual machine already includes them and is aware that it is running in a virtualized environment?

Answer: If the operating system in the virtual machine already includes Integration Services, you do need to verify if the latest version of Integration Services is installed. If the virtual machine was migrated from a previous version of the Hyper-V host or if the operating system already includes Integration Services, for example, Windows Server 2012, then you probably need to update them.

Question: If you want to copy a file to a virtual machine by using the **Copy-VMFile** cmdlet, do you need to install Integration Services onto a Windows Server 2016 virtual machine?

Answer: Windows Server 2016 includes Integration Services, and you do not need to install it if Windows Server 2016 is running in the virtual machine. But you must enable Guest integration service for the virtual machine because this service is not enabled by default and is required to copy a file to the virtual machine by using the **Copy-VMFile** cmdlet.

Question: How does dynamic memory enable you to run more virtual machines on the Hyper-V host?

Answer: If you configure a virtual machine with static memory, the Hyper-V host allocates it the same amount of memory, regardless of how much memory the operating system in the virtual machine needs. With dynamic memory, you can configure startup, minimum, and maximum RAM for the virtual machine. Based on the operating system requirement, the Hyper-V host dynamically assigns memory to a virtual machine between the minimum and maximum allowable RAM. If virtual memory does not require all the memory, then the memory is released, the Hyper-V host has more available memory, and it can run additional virtual machines.

Question: Does the dynamic memory feature only work with virtual machines that are running Windows Server 2012 or newer Windows Server operating systems?

Answer: No. The dynamic memory feature also works with other supported operating systems, such as Windows 10 and Linux.

Question: Can you configure nested virtualization for a virtual machine that is configured with dynamic memory?

Answer: Yes. You can configure nested virtualization for virtual machines that are configured with statically assigned memory or with dynamic memory.

Question: Can you enable nested virtualization in Hyper-V Manager?

Answer: No. You cannot enable nested virtualization in Hyper-V Manager. You can enable nested virtualization only from Windows PowerShell by running the **Set-VMProcessor** cmdlet with the **ExposeVirtualizationExtensions** parameter set to **\$true**.

Question: Can you turn a Generation 1 virtual machine into a shielded virtual machine?

Answer: No, you cannot. A shielded virtual machine must be a Generation 2 virtual machine, and you cannot change a Generation 1 virtual machine into a Generation 2 virtual machine. The only

option would be to create a new Generation 2 virtual machine, which you could then configure to be a shielded virtual machine.

Question: Can you run a shielded virtual machine on a Windows Server 2016 Standard edition Hyper-V host?

Answer: No. The Windows Server 2016 Standard edition does not support shielded virtual machines. You can run shielded virtual machines only on the Windows Server 2016 Datacenter edition.

Question: If you want to implement TPM-trusted attestation, why must you replace the existing Hyper-V hosts?

Answer: For TPM-trusted attestation, the Hyper-V hosts must have TPM 2.0 and UEFI 2.3.1. Servers that are in use today usually do not include those components. Therefore, you cannot use them with TPM-trusted attestation; you can use them only with admin-trusted attestation.

Question: Which server role must be present on the network if you want to run shielded virtual machines?

Answer: You can run shielded virtual machines on the guarded fabric. The guarded fabric includes Hyper-V hosts and the Host Guardian Service (HGS) server. HGS assures that Hyper-V hosts are healthy, and without it you cannot run shielded virtual machines.

Question: If you want to create a shielded virtual machine on-premises, do you need to have connectivity to HGS on a Hyper-V host that is not part of a guarded fabric?

Answer: You need a guardian key to create a shielded virtual machine. But if you want to create a shielded virtual machine on a Hyper-V host that is not part of a guarded fabric, you can obtain a guardian key on a computer that has connectivity to HGS, store it in a file, and then import it to the Hyper-V host.

Question: Can you convert an existing Generation 2 virtual machine to a shielded virtual machine?

Answer: Yes, you can convert an existing Generation 2 virtual machine to a shielded virtual machine. For example, you can use Microsoft Azure Portal or Virtual Machine Manager to perform the conversion.

Resources

Overview of the Hyper-V virtual hard disk formats and types



Additional Reading: For more about the Hyper-V virtual hard disk formats, refer to "Hyper-V storage I/O performance" at: <https://aka.ms/vlcyvp>.

Generation 1 and Generation 2 virtual machines



Additional Reading: To read more about Generation 2 virtual machines, refer to "Generation 2 Virtual Machine Overview" at: <https://aka.ms/cn4szt>.

Virtual machine configuration versions



Additional Reading: For more information, refer to "Upgrade virtual machine version in Hyper-V on Windows 10 or Windows Server 2016" at <https://aka.ms/Lvn7ga>.

Overview of Integration Services

 **Additional Reading:** To read more about Hyper-V Integration Services, refer to: "Managing Hyper-V Integration Services" at: <https://aka.ms/h2a2tl>.

What is dynamic memory?

 **Additional Reading:** To read more about dynamic memory in Hyper-V, refer to: "Hyper-V Dynamic Memory Overview" at: <https://aka.ms/zmaq249>.

 **Additional Reading:** To read more about dynamic memory in Linux virtual machines, refer to: "Microsoft Loves Linux Deep Dive #3: Linux Dynamic Memory and Live Backup" at: <https://aka.ms/Wsilwv>.

What is nested virtualization?

 **Additional Reading:** To read more about nested virtualization, refer to: "Run Hyper-V in a Virtual Machine with Nested Virtualization" at: <https://aka.ms/dx4dmq>.

What is a shielded virtual machine?

 **Additional Reading:** To read more on shielded virtual machines and watch a demonstration on how data are protected in shielded virtual machines, refer to: "A closer look at shielded VMs in Windows Server 2016" at: <https://aka.ms/aqu8u2>.

Host Guardian Service and attestation mode

 **Additional Reading:** To read step-by-step instructions for configuring HGS, refer to: "Step by Step – Configuring the Host Guardian Service in Windows Server 2016" at: <https://aka.ms/jnz36y>.

To read step-by-step instructions for creating shielded virtual machines in an environment without SCVMM, refer to: "Step by step – Creating Shielded VMs without VMM" at <https://aka.ms/mky6ov>.

 **Additional Reading:** To read more in-depth information on shielded virtual machines in a white paper on deploying guarded hosts and shielded virtual machines, refer to: "Guarded Fabric Deployment Guide for Windows Server 2016" at: <https://aka.ms/hucofa>.

To watch a Microsoft Ignite session on guarded virtual machines, refer to: "Harden the Fabric: Protecting Tenant Secrets in Hyper-V" at: <https://aka.ms/i6s12q>.

Creating shielded virtual machines

 **Additional Reading:** To read detailed instructions on creating shielded virtual machines on on-premises Hyper-V hosts and moving them to a guarded fabric, refer to: "Deploy Guarded Hosts and Shielded Virtual Machines" at: <https://aka.ms/anxa6s>.

Demonstration: Creating new virtual machines

Demonstration Steps

1. On **LON-HOST1**, in Hyper-V Manager, in the navigation pane, click **LON-HOST1**, in the **Actions** pane, click **New**, and then click **Virtual Machine**.
2. In the **New Virtual Machine Wizard**, on the **Before You Begin** page, click **Next**.
3. On the **Specify Name and Location** page, in the **Name** field, type **LON-VM2**, and then click **Next**.
4. On the **Specify Generation** page, click **Generation 2**, and then click **Next**.
5. On the **Assign Memory** page, in **Startup Memory**, type **1024**, select the **Use Dynamic Memory for this virtual machine** check box, and then click **Next** four times.
6. On the **Completing the New Virtual Machine Wizard** page, click **Finish**. A virtual machine named LON-VM2 is created.
7. In File Explorer, navigate to **C:\LabFiles\Mod02**, right-click **Mod02-Demo2.ps1**, and then click **Edit**. The script opens in Windows PowerShell ISE.
8. In Windows PowerShell ISE, place the cursor in row 3, which starts with the following, and press **F8**:

```
New-VM
```

Explain that this cmdlet creates a new virtual machine.

9. In Windows PowerShell ISE, place the cursor in row 5, which starts with the following cmdlet, and press **F8**:

```
New-VHD
```

Explain that this cmdlet creates a new virtual hard disk, and discuss some of its parameters.

10. In Windows PowerShell ISE, place the cursor in row 7, which starts with the following cmdlet, and press **F8**:

```
Add-VMHardDiskDrive
```

Explain that this cmdlet adds a virtual hard disk drive to the existing virtual machine, and point out its parameters.

11. On **LON-HOST1**, in Hyper-V Manager, right-click **LON-VM2**, and then click **Settings**.
12. In **Settings for LON-VM2 on LON-HOST1**, point out that four types of hardware display in the **Add Hardware** section in the details pane. Point out also that in the left pane, in the **Hardware** section, no BIOS, IDE Controllers, COM ports, or Diskette Drive are listed, but that Firmware is listed, and then click **OK**.
13. In Hyper-V Manager, right-click **LON-VM1**, and then click **Settings**.
14. In **Settings for LON-VM1 on LON-HOST1**, point out that there are five types of hardware listed in the **Add Hardware** section, in the details pane. Point out also that in the left pane, in the Hardware section, BIOS, IDE Controllers, COM ports, and Diskette Drive are listed, but Firmware is not listed, and then click **OK**.

Demonstration: Using nested virtualization and Integration Services

Demonstration Steps

1. On **LON-SVR2**, on the taskbar, click **Start**, and then click **Server Manager**.

2. In Server Manager, in the menu bar, click **Manage**, and then click **Add Roles and Features**.
3. In the **Add Roles and Features Wizard**, on the **Before you begin** page, click **Next**.
4. On the **Select installation type** page, ensure that the **Role-based or feature-based installation** option is selected, and then click **Next**.
5. On the **Select destination server** page, ensure that **Select a server from the server pool** is selected, and then click **Next**.
6. On the **Select server roles** page, in the **Roles** section, click **Hyper-V**.
7. In the **Add Roles and Features Wizard**, verify that **Include management tools (if applicable)** is selected, and then click **Add Features**. Explain that Validation results show an error because nested virtualization is not enabled.
8. In the **Add Roles and Features Wizard** dialog box, click **OK** and then click **Cancel**.
9. In the **20745B-LON-SVR2 on LON-HOST1** window, click the **Action** menu, click **Shut Down**, and then click **Shut Down**.
10. On **LON-HOST1**, click **Start**, and then click the **Windows PowerShell** tile.
11. In the **Windows PowerShell** window, run the following cmdlet:

```
Set-VMProcessor 20745B-LON-SVR2 -ExposeVirtualizationExtensions $true
```

12. In the **20745B-LON-SVR2** window, click the **File** menu, and then click **Settings**.
13. In the **Settings for 20745B-LON-SVR2 on LON-HOST1** window, in the navigation pane, expand the **Network Adapter** that is connected to the Internal Network, and click **Advanced Features**. In the details pane, select the **Enable MAC address spoofing** check box, and then click **OK**.
14. In the **20745B-LON-SVR2** window, click the **Action** menu, and then click **Start**.
15. Wait until **LON-SVR2** starts, and then sign in with the user name **Adatum\Administrator** and password **Pa55w.rd**.
16. In **LON-SVR2**, click **Start**, and then click **Server Manager**.
17. In Server Manager, in the menu bar, click **Manage**, and then click **Add Roles and Features**.
18. In the **Add Roles and Features Wizard**, on the **Before you begin** page, click **Next**.
19. On the **Select installation type** page, ensure that the **Role-based or feature-based installation** option is selected, and then click **Next**.
20. On the **Select destination server** page, ensure that **Select a server from the server pool** is selected, and then click **Next**.
21. On the **Select server roles** page, in the **Roles** section, click **Hyper-V**.
22. In the **Add Roles and Features Wizard**, verify that **Include management tools (if applicable)** is selected, and then click **Add Features**. Explain that this time there is no error because you enabled nested virtualization for **LON-SVR2**.
23. On the **Select server roles** page, click **Next**.
24. On the **Select features** page, click **Next**.
25. On the **Hyper-V** page, click **Next**.
26. On the **Create Virtual Switches** page, click **Next**.
27. On the **Virtual Machine Migration** page, click **Next**.

28. On the **Default Stores** page, click **Next**.
29. On the **Confirm installation selections** page, select the **Restart the destination server automatically if required** option, click **Yes**, and then click **Install**.
30. On **LON-SVR1**, click **Start**, and then click **Server Manager**.
31. In Sever Manager, click the **Tools** menu, and then click **Services**.
32. In the **Services** window, in the details pane, point out that the Hyper-V Time Synchronization Service is running.
33. On **LON-SVR1**, on the taskbar, click **Start**, type **command**, and then click **Command Prompt**.
34. In **Command Prompt** window, type **Time**, and press Enter.
35. Point out the current time, type **11:00** as the current time, and then press Enter.
36. In the **Command Prompt** window, type **Time**, and press Enter twice. Point out that the time was automatically set back to its previous value, and explain that Integration Services automatically synchronized the time on **LON-SVR1** with the time on **LON-HOST1**.



Note: You might need to wait a few seconds for the time to reset.

37. On **LON-HOST1**, in Hyper-V Manager, in the navigation pane, verify that **LON-HOST1** is selected. In the details pane, right-click **LON-SVR1**, and then click **Settings**.
38. In **Settings for LON-SVR1 on LON-HOST1**, in the navigation pane, click **Integration Services**. In the details pane, clear the **Time synchronization** check box, and then click **OK**.
39. On **LON-SVR1**, in **Services**, right-click **Services (Local)**, and then click **Refresh**. Point out that the Hyper-V Time Synchronization Service is not running, and then close **Services**.
40. In **LON-SVR1**, at the command prompt, type **Time** and press Enter. Point out the current time, type **11:00** as the current time, and then press Enter again.
41. At the command prompt, type **Time**, and then press Enter twice. Confirm that the returned time is a few seconds after **11:00**, because the time on the virtual machine is no longer synchronizing with the Hyper-V host.
42. In the **LON-SVR1** window, click the **File** menu, click **Settings**, and in the navigation pane, click **Integration Services**. In the details pane, select the **Time synchronization** check box, and then click **OK**.
43. On **LON-SVR1**, at the command prompt, type **Time**, and press Enter twice. Point out that the time on the virtual machine is synchronized with the time on **LON-HOST1**.

Lesson 3

Creating and using Hyper-V virtual switches

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Question and Answers

Question: Do you need to create a virtual switch on a Hyper-V host?

Answer: Yes, you likely want to create virtual switch on Hyper-V host, because if there is no virtual switch on a Hyper-V host, you cannot connect virtual machines to a network. Additionally, virtual machines cannot communicate with other computers on the network, or between themselves, even if they are running on the same Hyper-V host. The Hyper-V host still has network connectivity, but a virtual switch does not control its network traffic. In practice, you always create one or more virtual switches on a Hyper-V host.

Question: How can you manage Hyper-V virtual switches?

Answer: You can manage Hyper-V virtual switches by using the Virtual Switch Manager action in Hyper-V Manager, or by using Windows PowerShell cmdlets, such as **New-VMSwitch** or **Set-VMSwitch**.

Question: What happens in the parent partition when you create a new internal virtual switch? Is it the same as when you create a new private virtual switch?

Answer: When you create an internal virtual switch, a new virtual network adapter is created in the parent partition, and it is connected automatically to the created internal switch. When you create a private virtual switch, no additional network adapter is created in the parent partition.

Question: Can a virtual machine access the internet if it is connected to an internal virtual switch?

Answer: If a virtual machine is connected to an internal virtual switch, its connectivity is generally limited to the Hyper-V host itself, and to other virtual machines that are running on the same Hyper-V host and are connected to the same internal virtual switch. However, if the Hyper-V host has internet connectivity and is configured to perform NAT, then the virtual machine could also have internet connectivity. Another way to achieve internet connectivity would be to configure another virtual machine with two network adapters, one connected to the internal network and the other connected to the external network as a gateway.

Question: Why can you create only a maximum of 4,094 VLAN networks?

Answer: The Ethernet frame reserves only 12 bits for VLAN Identification (VLAN ID), and that limits the number of VLANs that you can create. However, many physical switches do not support that many virtual networks.

Question: Why can you not configure a VLAN ID for a private virtual switch?

Answer: A VLAN ID on a virtual switch specifies the virtual LAN that the management operating system uses for all network communications through the network interface that is connected to virtual switch. As a management operating system is not connected to a private virtual switch, you cannot configure a VLAN ID for a private virtual switch.

Question: Do you need to enable DHCP guard protection on each virtual machine that you want to protect from obtaining TCP/IP configuration from a rogue DHCP server?

Answer: No. You should enable DHCP guard protection only on virtual machines in which the (potentially) rogue DHCP server is installed. When you enable DHCP guard protection on a virtual machine, DHCP in this virtual machine cannot provide TCP/IP settings to other systems on the network. DHCP guard protection settings have no effect on whether the virtual machine can obtain TCP/IP settings.

Question: Do you configure router guard per virtual machine, per virtual network adapter, or per virtual switch?

Answer: Router guard functionality is provided by Hyper-V virtual switch, but it is configured per virtual network adapter.

Resources

Types of virtual switches

 **Additional Reading:** In Windows Server 2016, you can create a virtual switch that provides NAT functionality for a virtual network. To read step-by-step instructions on how to create a virtual switch, refer to “Set up a NAT network” at <https://aka.ms/Vjoyjh>.

Demonstration: Using Virtual Switch Manager

Demonstration Steps

1. On **LON-HOST1**, in Hyper-V Manager, in the navigation pane, verify that **LON-HOST1** is selected. In the **Actions** pane, click **Virtual Switch Manager**.
2. In the Virtual Switch Manager for the **LON-HOST1** window, point out that in the Virtual Switches section, there are three virtual switches listed named **Private Network**, **Internal Network**, and **External Network**.
3. In the right pane, in the **Create virtual switch** section, click **Private**, and then click **Create Virtual Switch**.
4. In the Virtual Switch Manager for the **LON-HOST1** window, in the **Name** text box, type **Demo Network**, and then click **OK**.
5. On **LON-SVR3**, on the taskbar, right-click **Start**, and then click **Windows PowerShell**.
6. In Windows PowerShell, run the following command, and point out that four replies are returned:

```
ping LON-DC1
```

7. On **LON-HOST1**, in Hyper-V Manager, right-click **20745B-LON-SVR3**, and then click **Settings**.
8. In the **Settings for 20745B-LON-SVR3 on LON-HOST1** window, in the left pane, click **Network Adapter**, in the **Virtual Switch** drop-down box, click **Demo Network**, and then click **OK**.
9. In **LON-SVR3**, in Windows PowerShell, run the command **ping 172.16.0.10**, explain that this is the IP address of **LON-DC1**. Point out that this time **LON-DC1** is not reachable because now **LON-SVR3** is on different network as **LON-DC1**.
10. On **LON-HOST1**, in Hyper-V Manager, right-click **20745B-LON-SVR3**, and then click **Settings**.
11. In the **Settings for 20745B-LON-SVR3 on LON-HOST1** window, in the left pane, click **Network Adapter**, in the **Virtual Switch** drop-down box, click **Internal Network**, and then click **OK**.
12. In **LON-SVR3**, in Windows PowerShell, run the following two commands:

```
Set-NetIPInterface -InterfaceAlias Ethernet -Dhcp Enabled
Ping LON-DC1
```

13. Explain that the first cmdlet configures **LON-SVR3** to obtain an IP address automatically from a Dynamic Host Configuration Protocol (DHCP) server. Point out that the ping command confirms that **LON-SVR3** has network connectivity to **LON-DC1**.
14. On **LON-HOST1**, in Hyper-V Manager, right-click **20745B-LON-SVR3**, and then click **Settings**.
15. In **Settings for 20745B-LON-SVR3 on LON-HOST1**, in the left pane, click **Network Adapter**, and then in the right pane, click **Enable virtual LAN identification**.
16. Verify that the **VLAN ID** is **2**, and then click **OK**.

17. On **LON-SVR3**, in the Windows PowerShell window, run the following command:

```
ping 172.16.0.10
```

18. Point out that the destination host is not reachable, because **LON-SVR3** is connected to a different VLAN than **LON-DC1**.
19. On **LON-HOST1**, in Hyper-V Manager, right-click **20745B-LON-SVR3**, and then click **Settings**.
20. In **Settings for 20745B-LON-SVR3 on LON-HOST1**, in the left pane, click **Network Adapter**, in the right pane, clear the **Enable virtual LAN identification** checkbox and then click **OK**.
21. On **LON-SVR3**, in the Windows PowerShell window, run the following command, and explain why the hosts can now communicate again:

```
ping LON-DC1
```

Demonstration: Configuring advanced virtual switch features

Demonstration Steps

1. On **LON-SVR1**, on the taskbar, click **File Explorer**.
2. In File Explorer, in the navigation pane, expand **This PC**, expand **Local Disk (C:)**, and then click **Windows**.
3. In the details pane, right-click the **INF** folder, and then click **Copy**.
4. In File Explorer, in the navigation pane, click the down arrow, type **\\LON-SVR3\share**, and then press Enter.
5. In File Explorer, in the details pane, right-click anywhere, and then click **Paste**.
6. When a window showing the progress of the copy process displays, note the copy speed and how long the process takes.
7. When the copy process completes, right-click the **INF** folder, click **Delete**, and then in the **Delete Folder** confirmation message box, click **Yes**.
8. On **LON-HOST1**, in Hyper-V Manager, right-click **20745B-LON-SVR1**, and then click **Settings**.
9. In **Settings for 20745B-LON-SVR1 on LON-HOST1**, in the left pane, click the **Network Adapter** that is connected to Internal Network, and then in the details pane, click **Enable bandwidth management**. In the **Minimum bandwidth** text box, type **10**, in the **Maximum bandwidth** text box, type **10**, and then click **OK**.
10. On **LON-SVR1**, in File Explorer, right-click in the details pane, and then click **Paste**.
11. When the window showing the progress of the copy process displays, note out that the copy process takes noticeably longer to complete.
12. On **LON-SVR3**, in the Windows PowerShell window, run the following commands, pressing Enter at the end of each line:

```
ipconfig /release  
ipconfig /renew
```

13. Review the output, and point out that TCP/IP settings on **LON-SVR3** were obtained successfully.
14. On **LON-HOST1**, in Hyper-V Manager, right-click **20745B-LON-DC1**, and then click **Settings**.
15. In **Settings for 20745B-LON-DC1 on LON-HOST1**, in the left pane, expand **Network Adapter**, click **Advanced Features**, in the right pane, select the **Enable DHCP guard** check box, and then click **OK**.

16. On **LON-SVR3**, in a Windows PowerShell window, run the following commands, pressing Enter at the end of each line:

```
ipconfig /release  
ipconfig /renew
```

17. Explain that this time process takes considerably longer, and **LON-SVR3** will not obtain TCP/IP settings. This is because when you enable DHCP guard on the virtual machine on which the DHCP server is running, you cannot retrieve TCP/IP settings from that virtual machine.

Lesson 4

Implementing failover clustering with Hyper-V

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Question and Answers

Question: Can you have Windows Server 2012 R2 and Windows Server 2016 nodes in the same failover cluster?

Answer: Yes. Windows Server 2016 supports cluster functional level, which enables you to have Windows Server 2012 R2 and Windows Server 2016 nodes in the same failover cluster. This enables you to upgrade the operating system on failover cluster nodes without any downtime of the services that by a cluster offers.

Question: Is shared storage required for a failover cluster?

Answer: Although shared storage is commonly used, it is not required for a failover cluster. With Windows Server 2016, you can use Storage Spaces Direct, which can use local storage on the nodes as a CSV.

Question: Can you ensure high availability by copying the virtual machine that is providing a critical service, and making both the original virtual machine and the copy available on the network?

Answer: No. Redundancy can provide high availability, but providing a copy of the virtual machine is often not enough to make a service highly available.

Question: How can you make a critical service available during the maintenance of the server that offers the service?

Answer: Server maintenance and server downtime are unavoidable, and therefore, critical services must be available from multiple servers. If one of the servers is in maintenance mode or restarted, service is still available on other servers. An alternative is that the service is available as a highly available role in a failover cluster that automatically moves the service to a different failover cluster node if necessary.

Question: Can you configure virtual machine guest clustering only if iSCSI or Fibre Channel SAN is available as a shared storage?

Answer: No. Internet small computer system interface (iSCSI) and Fibre Channel storage are not the only two available storage options for clustering. You also can use virtual hard disk sharing as shared storage, and you can store a shared virtual hard disk on an SMB3 share or Cluster Shared Volumes (CSV).

Question: What must you do if you want to use storage replica on a Hyper-V host that is running the Windows Server 2016 Standard edition?

Answer: Storage Replica is available only in Windows Server 2016 Datacenter edition. If you want to use that feature with Hyper-V, you must upgrade the server to the Windows Server 2016 Datacenter edition.

Question: If you want to make a virtual machine highly available by using failover clustering, must the virtual machine's operating system support failover?

Answer: You can provide failover clustering at two different levels: at the Hyper-V host level and on the virtual machine level. If you want to implement failover clustering on the virtual machines to protect some of the services included in the virtual machines, then the operating system on the virtual machines must include failover clustering. However, if you want to make the entire virtual machine highly available, you must implement failover clustering at the Hyper-V host level, and the virtual machine operating system does not need to support it. For example, you can make a virtual machine that is running Windows 10 highly available with failover clustering at the Hyper-V host level, even though failover clustering is not a part of Windows 10.

Question: Must all nodes in a failover cluster run the same version of the Windows Server operating system?

Answer: No. Windows Server 2016 introduces the cluster functional level that enables you to have Windows Server 2012 R2 and Windows Server 2016 nodes in the same failover cluster. This is especially useful when you want to upgrade the cluster, because you can upgrade individual nodes of the cluster without any downtime. After you update the cluster functional level to the Windows Server 2016 level, that cluster cannot have Windows Server 2012 R2 nodes. Updating the cluster functional level is irreversible.

Question: Will clients still be able to connect to a cluster role if the failover cluster has three nodes and the internode network fails?

Answer: You should plan your failover cluster in such a way that it provides redundancy and that the internode network never fails. If the internode network were to fail, the nodes cannot communicate or participate in the voting, although they still have access to the shared storage and to the clients. Depending on the quorum model, it is possible that a single node continues to run the cluster role and clients can still connect to it.

Question: Can a failover cluster that originally had six nodes still run cluster roles if three nodes fail and only three nodes remain online?

Answer: It depends. Based on the quorum model used, and whether all three nodes failed simultaneously or whether there was time between each failure, the remaining three nodes might still run cluster roles. The nodes must have enough resources and use the default dynamic quorum model.

Question: Can you format a CSV by using a CSV file system?

Answer: Although CSVs on Windows Server 2016 display as though they are formatted with the CSV file system, they are actually formatted with the NTFS file system. The CSV file system makes the application aware that it is running in a failover cluster and is stored on a CSV, but the CSV file system is not the actual file system.

Question: Where can you access CSV on a Windows Server 2016 failover cluster node?

Answer: CSV is mounted in the C:\ClusterStorage folder on each failover cluster node. If you want to access the first CSV in the failover cluster, you can access it in the **C:\ClusterStorage\Volume1** folder on any failover cluster node.

Question: Do you need to install anything onto the virtual machine to enable virtual hard disk sharing?

Answer: To use a shared virtual disk, a virtual machine must be running Windows Server 2012 or newer Windows Server operating system. You should also ensure that the latest version of Integration Services is installed on the virtual machine that will use a shared virtual hard disk. Technically, you do not need to install anything onto the virtual machines to add a shared virtual disk.

Question: In Windows Server 2016, can you back up a shared virtual hard disk while the virtual machines that are using it are running?

Answer: Yes. In Windows Server 2016, you can back up a shared virtual hard disk while virtual machines that are using it are running. The disks must be in the .vhds format.

Question: While you were on vacation, your coworker implemented failover clustering. What must you do to be sure that the failover clustering is supported by Microsoft?

Answer: For the cluster to be supported by Microsoft, it must pass all the cluster validation tests. You must either verify the validation test results that your coworker performed or run the validation tests yourself.

Question: You have a failover cluster with three nodes. The Hyper-V role is installed only on one node. Can you create a virtual machine role on the cluster?

Answer: Yes, you can create a virtual machine role on the cluster. But a virtual machine can run only on a single node, and only on the node that has the Hyper-V role installed. Therefore, it is not highly available. You should also install the Hyper-V role on the other failover cluster nodes.

Question: Why is it important that all failover cluster nodes have processors from the same manufacturer?

Answer: You can move virtual machines between failover cluster nodes. If the source and target nodes use processors from different vendors, you cannot move a running virtual machine between them. For example, if the source node has Intel processors and the destination node has AMD processors, you would have to restart the virtual machine on the target node.

Question: Why is it important that failover cluster nodes have the same virtual switches?

Answer: If you move a virtual machine between the nodes or if failover occurs, the virtual machine will run on a different node. If on that node there is no virtual switch with the name that the virtual machine is configured to use, the virtual machine will not have network connectivity.

Question: Will a virtual machine ever fail over to a node that is not on either its preferred owners list or its possible owners list?

Answer: If any of the preferred owners is online and has available resources, the virtual machine fails over to one of those nodes. If no node from the preferred owners list is available, then the virtual machine fails over to one of the nodes on the possible owners list. If no node from either owners list is available, then the virtual machine fails over to any other node, but it will not start on that node.

Question: Why is virtual machine startup priority and start order important?

Answer: Virtual machines run different loads, and some loads are dependent on each other. For example, a web application can be dependent on a SQL database that it uses for generating webpages and stores user data. You can use start order to control the order in which the virtual machines start, and ensure that the virtual machines that others depend on start first.

Question: How can you monitor an application that is installed in a highly available Windows Server 2016 virtual machine but is not running as a service?

Answer: You can configure virtual machine monitoring to act up events in the System, Application, or Security logs. If an application is writing events in one of those logs, you can monitor that application in the virtual machine.

Question: If you plan to monitor a service in a highly available virtual machine in a failover cluster, how should you configure that service in Service Control Manager?

Answer: If you plan to monitor a service in a virtual machine, you should configure one of the recovery options for this service in Service Control Manager as Take no action.

Resources

What is a failover cluster?



Additional Reading: Windows Server 2016 includes support for Storage Spaces Direct. You can use Storage Spaces Direct to build highly available and scalable storage for failover cluster from local storage that is attached to the cluster nodes. To read more about Storage Spaces Direct, refer to: "Storage Spaces Direct in Windows Server 2016" at: <https://aka.ms/kv76r1>.

What is the Cluster Shared Volumes feature?



Additional Reading: To read more about CSV, refer to: “Use Cluster Shared Volumes in a Failover Cluster” at: <https://aka.ms/hghmdv>.

Using virtual hard disk sharing as shared storage



Additional Reading: To read more about using a shared virtual hard disk, refer to: “Deploy a Guest Cluster Using a Shared Virtual Hard Disk” at: <https://aka.ms/irm8io>.

Implementing a failover cluster



Additional Reading: To learn more about deploying a Hyper-V cluster, refer to: “Deploy a Hyper-V Cluster” at: <https://aka.ms/dx9tzk>.

Hyper-V validation tests



Additional Reading: To read more about hardware validation tests for a failover cluster, refer to: “Validate Hardware for a Failover Cluster” at: <https://aka.ms/ay5xf8>.

Demonstration: Creating a failover cluster

Demonstration Steps

1. On **LON-SVR1**, in Server Manager, click **Tools**, and then click **Failover Cluster Manager**.



Note: If the **Microsoft Windows** dialog box is shown in LON-SVR1, click **Cancel**.

2. In the Failover Cluster Manager, in the **Actions** pane, click **Create Cluster**.
3. In the **Create Cluster Wizard**, on the **Before You Begin** page, click **Next**.
4. On the **Select Servers** page, in the **Enter server name** box, type **LON-SVR1; LON-SVR2**, click **Add**, and then click **Next**.
5. On the **Validation Warning** page, click **Next**.
6. In the **Validate a Configuration Wizard**, on the **Before You Begin** page, click **Next**.
7. On the **Testing Options** page, click **Next**.
8. On the **Confirmation** page, click **Next**. Point out that during validation, several warnings are detected.
9. After all validation tests are performed, click **View Report**. Show the Failover cluster validation report, and then close Internet Explorer.
10. On the **Summary** page, click **Finish**.
11. On the **Access Point for Administering the Cluster** page, in the **Cluster Name** box, type **LON-CLUST**, in the **Address** box, type **172.16.1.100**, and then click **Next**.
12. On the **Confirmation** page, review the settings, and then click **Next**.

13. On the **Summary** page click **Finish**.
14. On **LON-DC1**, on the taskbar, click **Start**, and then click **Server Manager**.
15. In Server Manager, click **Tools**, and then click **Active Directory Users and Computers**.
16. In Active Directory Users and Computers, in the navigation pane, expand the **Adatum.com** domain, click the **Computers** container, and point out that it contains computer accounts for **LON-SVR1**, **LON-SVR2**, and **LON-CLUST**, which were added when you created the failover cluster.
17. Close Active Directory Users and Computers.
18. On **LON-SVR1**, on the taskbar, click **File Explorer**.
19. In File Explorer, in the navigation pane, click **Local Disk (C:)**. In the details pane, double-click the **ClusterStorage** folder, and point out that the folder is empty.
20. In Failover Cluster Manager, in the navigation pane, expand **LON-CLUST.Adatum.com**, expand **Storage**, and click **Disks**.
21. In the Failover Cluster Manager, verify that you see two disks in the details pane. Right-click **Cluster Disk 2**, and then click **Add to Cluster Shared Volumes**.
22. In File Explorer, point out that the **ClusterStorage** folder now contains a mounted volume for **Volume1**, which was added when you added the disk to the CSV.

Demonstration: Creating a virtual machine role and performing live migration

Demonstration Steps

1. On **LON-SVR1**, in Failover Cluster Manager, in the navigation pane, right-click **Roles**, and then select **Configure Role**.
2. In the **High Availability Wizard**, on the **Before You Begin** page, click **Next**.
3. On the **Select Role** page, click the **Virtual Machine** role, and then click **Next**.
4. On the **Select Virtual Machine** page, select the **LON-TEST1** virtual machine, and then click **Next**.
5. On the **Confirmation** page, click **Next**.
6. On the **Summary** page, point out that the virtual machine hard disk is not stored on cluster storage, and then click **Finish**.
7. In Failover Cluster Manager, in the navigation pane, click **Roles**. In the details pane, right-click **LON-TEST1**, click **Move**, and then click **Virtual Machine Storage**.
8. In the **Move Virtual Machine Storage** box, in the lower-left window, click **Volume1**. In the top window, click the **Virtual Machine LON-TEST1** object, and while holding down the mouse button, drag it to the lower right window. After you release the mouse button, click **Start**.
9. In Failover Cluster Manager, in the details pane, point out that the **Owner node** for the **LON-TEST1** virtual machine is **LON-SVR1**.
10. Right-click **LON-TEST1**, and then click **Start**.
11. Right-click **LON-TEST1**, and click **Connect**. At the command prompt, type **ping 172.16.0.10 -t**, and press Enter. Explain that 172.16.0.10 is the IP address of **LON-DC1**, and then minimize the **LON-TEST1** window.
12. In Failover Cluster Manager, right-click **LON-TEST1**, click **Move**, click **Live Migration**, and then click **Select Node**.

13. In **Move Virtual Machine**, confirm that **LON-SVR2** is selected, and then click **OK**.
14. In Failover Cluster Manager, point out that **Live Migration** is moving **LON-TEST1**, and that **LON-SVR2** is now its **Owner Node**.
15. On the taskbar, maximize **LON-TEST1** windows, and point out that no ping was lost while the virtual machine was moved between nodes.

Module Review and Takeaways

Review Question

Question: What must you do if you want a Windows Server failover cluster to be Microsoft supported?

Answer: If you want a Windows Server failover cluster to be Microsoft supported, all failover cluster hardware components must be certified for Windows Server. In addition, the failover cluster configuration, which includes servers, network, and storage, must pass all tests in the **Validate Cluster Configuration Wizard**.

Lab Review Questions and Answers

Lab A: Creating and managing virtual hard disks and virtual machines

Question and Answers

Question: How can you use a virtual hard disk with the installed operating system as a template for a new virtual machine?

Answer: You first should generalize the operating system on the virtual hard disk by running the **Sysprep** command. Then, you can copy the virtual hard disk and add the copy to the new virtual machine, or you can create a differencing virtual hard disk and then use the existing virtual hard disk as a parent. In the second scenario, you should not modify the parent disk, and you should be aware of the performance implications.

Question: A Windows Server 2016 server named **Server1** is running in a virtual machine named **VM1**. **Server1** has the Hyper-V role installed.

When connecting and administering the Hyper-V role in **VM1**, what is the difference between running **Enter-PSsession -ComputerName Server1** and running **Enter-PSsession -VMName VM1**?

Answer: Both cmdlets connect to the same target, but the first uses PowerShell Remoting, whereas the second uses PowerShell Direct. PowerShell Remoting requires network connectivity to the target, which can be anywhere on the network and can be a VM or a physical server. PowerShell Direct uses VMBus. You can use it to connect only to virtual machines that are running on the same Windows Server 2016 Hyper-V host, even if you do not have network connectivity to those VMs.

Question: Can you install a Hyper-V role in a Windows Server 2016 virtual machine?

Answer: By default, nested virtualization is not enabled, and you cannot install Hyper-V role in a virtual machine. But if virtual machine is running on a Windows Server 2016 Hyper-V host, you can enable nested virtualization, and then you will be able to install Hyper-V role in virtual machine.

Lab B: Implementing failover clustering with Hyper-V

Question and Answers

Question: How can you control which servers can access iSCSI virtual disks?

Answer: Servers can access iSCSI virtual disks only if they are assigned to an iSCSI target. One of the iSCSI target properties is a list of initiators that can view the iSCSI target and connect to it.

Question: When creating failover clustering in virtual machines, which storage types can virtual machines use as shared storage?

Answer: When creating failover clustering, virtual machines can use iSCSI SAN, Fibre Channel SAN, or shared virtual hard disks as shared storage.

Module 3

Installing and configuring Virtual Machine Manager

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Lesson 1

Overview of Virtual Machine Manager

Contents:

Question and Answers

3

Question and Answers

Question: Categorize each item below.

Items	
1	PXE
2	Port Profiles
3	Arrays
4	Infrastructure
5	MAC Address Pools
6	QoS Policies
7	All Hosts
8	VIP Templates
9	Providers
10	vCenter
11	Load Balancers
12	Fibre Channel Fabrics

Category 1		Category 2		Category 3
Servers		Networking		Storage

Answer:

Category 1		Category 2		Category 3
Servers		Networking		Storage
PXE Infrastructure All Hosts vCenter		Port Profiles MAC Address Pools VIP Templates Load Balancers		Arrays QoS Policies Providers Fibre Channel Fabrics

Lesson 2

Installing Virtual Machine Manager

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Question and Answers

Question: Which of the following is not a requirement to install the Virtual Machine Manager management server?

- () Windows ADK
- () Microsoft .NET Framework 4 (or newer)
- () Microsoft SQL Server 2012 SP4 (or newer)
- () Microsoft Deployment Toolkit
- () Windows PowerShell

Answer:

- () Windows ADK
- () Microsoft .NET Framework 4 (or newer)
- () Microsoft SQL Server 2012 SP4 (or newer)
- (v) Microsoft Deployment Toolkit
- () Windows PowerShell

Feedback: Review the “Virtual Machine Manager system requirements” topic. You require all the above items for the installation of the Virtual Machine Manager management server, except for Microsoft Deployment Toolkit.

Resources

Virtual Machine Manager deployment topology

 **Additional Reading:** For more information, refer to System Requirements for System Center: <https://aka.ms/nq57r5>.

 **Additional Reading:** For more information, refer to Microsoft Azure Stack: <https://aka.ms/aj5sua>.

 **Additional Reading:** For more information, refer to Virtual Machine Manager ports and protocols: <https://aka.ms/xrf0d8>.

Virtual Machine Manager system requirements

 **Additional Reading:** For more information, refer to Windows Assessment and Deployment Kit (ADK) for Windows 10: <https://aka.ms/n2tz8a>.

Upgrading Virtual Machine Manager from previous versions

 **Additional Reading:** For more information on upgrading to Virtual Machine Manager, refer to <https://aka.ms/lwaebi>.

Demonstration: Installing Virtual Machine Manager

Demonstration Steps

1. On LON-SVR3, on the taskbar, click File Explorer.

2. In File Explorer, in the navigation pane, click **DVD Drive (E:)**, and then in the details pane, double-click **setup.exe**.
3. In the **System Center Virtual Machine Manager** window, click the **Install** hyperlink, and then wait until the **Microsoft System Center Virtual Machine Manager Setup Wizard** window opens.
4. On the **Select Features to install** page, select the **VMM management server** check box.
5. In the **Microsoft System Center VMM Setup** window, click **Yes**. Point out that the **VMM console** option is also selected, and then click **Next**.
6. On the **Product registration information** page, in the **Name** text box, type **Administrator**, and then in the **Organization** text box, type **Adatum Corporation**.
7. Explain that you can install Virtual Machine Manager as an evaluation edition by leaving the **Product Key** text box blank and that you can also provide the product key after installation. Click **Next**.
8. On the **Please read this license agreement** page, select the **I have read, understood and agree with the terms of the license agreement** check box, and then click **Next**.
9. On the **Diagnostic and Usage Data** page, click **Next**.
10. On the **Installation location** page, click **Next**.
11. On the **Prerequisites** page, point out the "SQL Server Command Line Utilities are not installed on this computer" warning message. Explain that those tools are not required, and then click **Next**.
12. On the **Database configuration** page, point out that in the **Server name** text box, the value is **LON-VMM**.



Note: The **Existing database** text box is automatically populated with the **VirtualManagerDB** value.

13. Explain that you cannot modify the server name and database because you are installing Virtual Machine Manager on a failover cluster, and then click **Next**.
14. On the **Configure service account and distributed key management** page, in the **Password** box, type **Pa55w.rd**.



Note: Point out that the **Store my keys in the Active Directory** check box isn't available because this action was already performed on **LON-VMM**.



Note: Point out that under the **Distributed Key Management** section, you can store encryption keys for Virtual Machine Manager in AD DS instead of on the local machine. You must use this option for highly available Virtual Machine Manager installations.



Note: Emphasize that administrators cannot change the service account after they install Virtual Machine Manager. If required, they can remove Virtual Machine Manager from the server, make the necessary changes, and then reinstall it. However, they can, as part of the removal procedures, retain the Virtual Machine Manager database and then use it again after reinstalling Virtual Machine Manager. In addition, explain that when you install a highly available Virtual Machine Manager management server, you must use a domain account. This domain account needs to have local administrator access on all host and management servers in the domain.

15. Click **Next**.
16. On the **Port configuration** page, make note of the ports shown, but do not change them.



Note: Point out the default port numbers that are assigned to various entities and functions. Do not make any changes but ask students about the circumstances in which they might make changes.

17. After reviewing this information, click **Next**.
18. On the **Library configuration** page, click **Next**.
19. On the **Installation summary** page, point out the options that you selected in the wizard, and then click **Install**. The installation starts.
20. While Virtual Machine Manager is being installed on **LON-SVR3**, go to **LON-HOST1**, and then on the taskbar, click **File Explorer**.
21. In File Explorer, navigate to **D:\Program Files\Microsoft Learning\20745\Drives**, and then double-click **VMM1801_EVAL.iso**. This mounts the ISO onto the next available drive letter and opens the DVD drive in File Explorer. Make a note of the drive letter.



Note: If the images for the course were extracted to a different drive, use that drive letter instead of **D**.

22. In File Explorer, in the details pane, double-click **setup.exe**.
23. In the **System Center Virtual Machine Manager** window, click the **Install** hyperlink.
24. On the **Select Features to install** page, click the **VMM console**, and then click **Next**.
25. On the **Please read this notice** page, select the **I agree with the terms of this notice** check box, and then click **Next**.
26. On the **Diagnostic and Usage Data** page, click **Next**.
27. On the **Installation location** page, click **Next**.



Note: If the **Please review these prerequisite warnings** page appears, click **Next** and do not restart **LON-HOST1**.

28. On the **Port configuration** page, note the port number in use, and then click **Next**.
29. On the **Installation summary** page, review the selections, and then click **Install**.
30. On the **Microsoft System Center Virtual Machine Manager** screen, clear the **Check for the latest Virtual Machine Manager updates** and **Open VMM console when this wizard closes** check boxes, and then click **Close**.
31. On the **System Center** screen, click **Close**.
32. In File Explorer, in the navigation pane, right-click the drive letter used for the mounted .iso image, and then click **Eject**.
33. On **LON-HOST1**, on the desktop, right-click **Virtual Machine Manager Console**, and then click **Pin to taskbar**.
34. On **LON-SVR3**, on the **Microsoft System Center Virtual Machine Manager** screen, point out that Virtual Machine Manager is installed.

35. On the **Setup completed successfully** page, clear the **Check for the latest Virtual Machine Manager updates** and **Open VMM console when this wizard closes** check boxes, and then click **Close**.
36. In the **Microsoft System Center Virtual Machine Manager** window, click **Close**.

Lesson 3

Adding hosts and managing host groups

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Question and Answers

Question: Categorize each item below.

Items	
1	Allow unencrypted files transfers to the group
2	Machine conversion process to convert a VMware-based virtual machine to a Hyper-V virtual machine.
3	Uses a subscription ID
4	Enables Virtual Machine Manager to balance the virtual machine loads automatically within a host cluster
5	Library file types include vmfsPassthroughRawDeviceMap
6	Can only perform basic actions
7	Assign different resource types including IP pools, load balancers, logical networks, and MAC pools.
8	Supports Live Storage Migration using Storage vMotion
9	Allows Virtual Machine Manager to use the service management API

Category 1		Category 2		Category 3
Host group properties		VMware ESX hosts		Azure subscription

Answer:

Category 1	Category 2	Category 3
Host group properties	VMware ESX hosts	Azure subscription
<p>Allow unencrypted files transfers to the group</p> <p>Enables Virtual Machine Manager to balance the virtual machine loads automatically within a host cluster</p> <p>Assign different resource types including IP pools, load balancers, logical networks, and MAC pools.</p>	<p>Machine conversion process to convert a VMware-based virtual machine to a Hyper-V virtual machine.</p> <p>Library file types include vmfsPassthroughRawDeviceMap</p> <p>Supports Live Storage Migration using Storage vMotion</p>	<p>Uses a subscription ID</p> <p>Can only perform basic actions</p> <p>Allows Virtual Machine Manager to use the service management API</p>

Resources**Adding VMware ESX virtualization resources**

Additional Reading: For more information, refer to System Requirements: VMware ESX Hosts: <https://aka.ms/cjxobj>.

Demonstration: Using the Virtual Machine Manager console**Demonstration Steps**

1. On **LON-HOST1**, on the taskbar, click **Virtual Machine Manager**.
2. In the **Connect to Server** window, in the **Server name** text box, type **VMM-HA2.adatum.com:8100**.
3. On the **Connect to Server** page, explain why you are using **VMM-HA2.adatum.com**, even though you installed Virtual Machine Manager on **LON-SVR3**.



Note: The **Server name** text box displays **VMM-HA2.adatum.com:8100** as the server to which you want to connect. However, you installed Virtual Machine Manager on another computer, **LON-SVR3**, which is a node in the failover cluster. Therefore, you use the fully qualified domain name (FQDN) of the cluster role and not the name of the server on which Virtual Machine Manager is running.

4. At the bottom of the **Connect to Server** page, point out the **Credentials** section and explain the difference between the two available options: **Use current Microsoft Windows session identity** and **Specify credentials**. Also point out that, by default, the **Use current Microsoft Windows session identity** option is selected.



Note: Explain that if you want to sign in by using alternate credentials, you can select the second option, and then supply the user domain and name in the **User name** text box and the

corresponding password in the **Password** text box. This can be useful when an administrator is testing user roles and permissions.

5. The last item at the bottom of the page is the **Automatically connect with these settings** check box. Without making any changes, click **Connect**.

 **Note:** When the **Virtual Machine Manager** console opens, mention that it always opens to the last node that you used before closing the console. Point out the main areas of the console: workspace, console tree, details pane, and ribbon.

6. In the **Workspace** area, point out the five workspaces: **VMs and Services**, **Fabric**, **Library**, **Jobs**, and **Settings**.
7. Select each of the five workspaces and show how the navigation pane changes. Do not expand any items in the tree yet.

 **Note:** In the details pane, show students that different details panes appear in the center and to the right, depending on the selected workspace and the selected item in that workspace's console tree. Mention that sometimes two details panes appear, one on top of the other.

 **Note:** Point to the ribbon at the top of the console. Explain that all the System Center components have a ribbon at the top of their respective consoles. Explain that the **Virtual Machine Manager** console ribbon has different items, icons, buttons, and tabs on it, depending on the workspace selected and the item selected in that workspace's console tree.

8. In the lower left, click the **Library** workspace. In the **Library** console tree (the area to the left, directly above the workspaces), click **Templates**.
9. On the ribbon, on the **Home** tab, click **Create Service Template**.

 **Note:** In the **New Service Template** window, explain that you can start a service template from several different patterns, depending on what you select in the **Patterns** area.

10. In the **New Service Template** window, click **View Script**.

 **Note:** Point out to the class that this opens a Notepad file which lists the Windows PowerShell cmdlets. You can use these cmdlets to create the same items that the user interface can create. Explain that you can also save these cmdlets as a Windows PowerShell script, so that you can alter and run them later, document your configuration or learn how to write Windows PowerShell scripts. Point out that most of the **Create** items within the **Virtual Machine Manager** console will have a **View Script** button located within them. Explain that some of the more advanced Virtual Machine Manager wizards will have several pages, and that you will often find the **View Script** option on the last page.

11. Close Notepad without saving.
12. In the **New Service Template** window, click **Cancel**.
13. Do not close the **Virtual Machine Manager** console because you will use it again in the next demonstration.

Demonstration: Adding Run As account and Hyper-V host to Virtual Machine Manager

Demonstration Steps

1. On **LON-DC1**, on the taskbar, click **Start**, and then click **Server Manager**.
 2. In **Server Manager**, click **Tools**, and then click **Active Directory Users and Computers**.
 3. In the **Active Directory Users and Computers** console tree, expand **Adatum.com**, right-click **Users**, select **New**, and then click **User**.
 4. In the **New Object – User** window, in the **First name** and **User logon name** text boxes, type **VMMRunas**, and then click **Next**.
 5. In the **Password** and **Confirm password** text boxes, type **Pa55w.rd**, clear the **User must change password at next logon** check box, select the **Password never expires** check box, and then click **Next**.
 6. Click **Finish**.
 7. In the **Active Directory Users and Computers** console, click the **Users** container, and then in the details pane, double-click **VMMRunas**.
 8. In the **VMMRunas Properties** window, click the **Member Of** tab, and then click **Add**.
 9. In the **Select Groups** window, in the **Enter the object names to select** text box, type **domain admins**, click **Check Names**, and then click **OK** twice. Close **Active Directory Users and Computers**.
 10. On **LON-HOST1**, in the **Virtual Machine Manager** console, click the **Settings** workspace.
 11. In the **Settings** pane, right-click **Run As Accounts**, and then click **Create Run As Account**.
 12. In the **Create Run As Account** window, in the **Name**, **Description** and **User name** text boxes, type **Adatum\VMMRunas**, in the **Password** and **Confirm password** text boxes, type **Pa55w.rd**, and then click **Finish**.
-  **Note:** A Run As account is a named set of stored credentials that you can provide instead of manually entering a username and password to run a process. Only administrators and delegated administrators can create and manage the Run As accounts.
13. Click the **VMs and Services** workspace.
 14. In the **VMs and Services** pane, click **All Hosts**.
 15. Right-click **All Hosts**, and then click **Add Hyper-V Hosts and Clusters**.
 16. In **Add Resource Wizard**, on the **Resource Location** page, explain the available options. Point out that the **Windows Server computers in a trusted Active Directory domain** option is selected by default, and then click **Next**.
 17. On the **Credentials** page, point out and discuss the two available options.
 18. In the **Use an existing Run As Account** section, click **Browse**, in the **Select a Run As Account** window, select the **Adatum\VMMRunas** item, click **OK**, and then click **Next**.
 19. On the **Discovery Scope** page, describe the two available options. Point out that the **Specify Windows Server computers by names** option is selected by default. In the **Computer names** text box, type **LON-HOST1.adatum.com**, and then click **Next**.
 20. On the **Target resources** page, in the **Discovered computers** section, select the **LON-HOST1.adatum.com** check box, and then click **Next**.



Note: If you receive the **Target server is not recognized** error, press F5 to refresh.

21. If a **Virtual Machine Manager** dialog box appears warning you that if Hyper-V is not enabled on the selected server, Virtual Machine Manager will do so, click **OK**.



Note: On the **Host Settings** page, point out that in the **Host group** list box there is only one option, **All Hosts**.

22. After reviewing this page, click **Next**.
23. On the **Summary** page, on the upper right part of the page, click **View Script**.
24. In the Notepad file that opens, point out the Windows PowerShell script required to add the **LON-HOST1** host to this Virtual Machine Manager management server, and then close Notepad.
25. On the **Summary** page, click **Finish**.



Note: When the **Jobs** dialog box appears, point out that it shows all the individual steps for adding the host. The final step, **Add virtual machine host**, takes the longest.

26. When the job finishes, close the **Jobs** dialog box. If a warning icon (yellow triangle) appears with the "Add virtual machine host Completed w/ info" message, it is because Multipath I/O (MPIO) is not enabled for known storage arrays.
27. In the **VMs and Services** console tree, under **All Hosts**, point out that **LON-HOST1** is listed.



Note: Point out the virtual machines that now appear in the **VMs** pane. Explain that from here you can select the virtual machines and perform a variety of actions on them.

28. With **LON-HOST1** still selected, on the ribbon, click the **Folder** tab, and then click **Properties**.
29. In the **Properties** dialog box, review and briefly describe the contents of the following tabs:
 - o **General.** This tab provides extensive information, including the system management BIOS (SMBIOS) ID and the Virtual Machine Manager agent version.
 - o **Status.** This tab shows all the jobs that have run on this host. If any jobs have failed, you can select them and then click **Repair All**. When you select any failed jobs or jobs with the **completed with information** status, the detailed information appears in the **Error** details pane. Use the **Copy Errors** option to copy and paste the error details into another program.
 - o **Hardware.** This tab shows the options for managing hardware settings. Most of the settings that appear on the **Hardware** tab are for information only, and you cannot change them. However, there are a few settings that you can change. Point out to the class that in the **CPU** section, there is a **NUMA modes** check box that you can use to allow virtual machines to span non-uniform memory access (NUMA) nodes. In the **Network adapters** section, you can select the adapters, logical networks, and switches (if they exist), and edit them. In the **Advanced** section, under the **Baseboard Management Controller (BMC) Settings** area, you can also make other changes. Show this as well.
 - o **Host Access.** This tab lets you provide different host management credentials such as Run As accounts. You can also specify whether the host is available for placement and set the remote connection port.

- **Virtual Machine Paths.** This tab shows detailed information about every virtual machine on the host. You can also register additional virtual machine paths.
- **Reserves.** This tab lists the options to manage reserved resources. If you do not want to use the **host reserves** settings from the parent host group, you can use the **Override host reserve settings from parent host group** check box to turn off inheritance, and change the resources reserved for this host. When you select this option, several configurable items appear that you can use to set the reserved resources. Show this to the class but don't make any changes.
- **Storage.** This tab lets you make extensive changes to various storage elements, including disks, Internet SCSI (iSCSI), Fibre Channel, Serial Attached SCSI (SAS) arrays, and file shares. You can also add and remove storage elements; however, the various disks and arrays must already be available.
- **Virtual Switches.** This tab lets you manage virtual switches. Similar to the **Storage** tab, you can make many changes on the **Virtual Switches** tab, including creating new logical and standard switches. Review the parameters with the class but make no changes.
- **Migration settings.** This table lets you configure a number of migration settings, including live storage migration, live migration settings, performance options, and authentication protocols to use when migrating.
- **Placement paths.** This tab lets you specify both of the default virtual machine paths. The default parent disk paths use running virtual machine placement.
- **Servicing Windows.** This tab lets you add or remove servicing windows, if they exist.
- **Host Guardian Service.** This tab lets you enable **Host Guardian Service** and use **Code Integrity policy** to restrict software that can run on the host. This tab is new to Virtual Machine Manager.
- **Custom Properties.** This tab lets you assign and manage custom properties. Click **Manage Custom Properties** to show the students the various object types that they can select. Explain that by clicking **Create**, students can create custom properties.



Note: Point out the **View Script** option. Explain that this option lets you create a Windows PowerShell script by using cmdlets that will make the same changes that you can make with the **Properties** dialog box. You can save the Windows PowerShell script, and edit or run it later, or simply keep it for documentation.

30. Click **Cancel**.

31. Leave the **Virtual Machine Manager** console running on **LON-HOST1**.

Demonstration: Managing host groups

Demonstration Steps

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, click the **VMs and Services** workspace.
2. In the **VMs and Services** pane, click **All Hosts**.
3. On the ribbon, on the **Home** tab, click **Create Host Group**, type **London Host Group**, and then press Enter.
4. In the **VMs and Services** pane, click **LON-HOST1**, and then on the ribbon, click the **Host** tab.
5. On the ribbon, click **Move to Host Group**.
6. In the **Move Host Group** dialog box, in the **Parent host group** list box, select **London Host Group**, and then click **OK**.

7. Right-click **London Host Group**, and then click **Properties**.
8. In the **London Host Group Properties** dialog box, review and explain the various configurable pages.
9. On the **London Host Group Properties** page, point out the **View Script** button in the lower-left corner and explain why you would use it.
10. In the **London Host Group Properties** dialog box, click **Cancel**.
11. In the **Virtual Machine Manager** console, in the **VMs** pane, right-click **20745B-LON-DC1**, and then click **Properties**.
12. In the **20745B-LON-DC1 Properties** window, click the **Custom Properties** tab, point out that only 10 custom properties are listed, and then click **OK**.
13. In **Virtual Machine Manager**, in the navigation pane, right-click **London Host Group**, and then click **Properties**.
14. In the **London Host Group Properties** window, click the **Custom Properties** tab.
15. On the **Custom Properties** page, click **Manage Custom Properties**.
16. In the **Manage Custom Properties** window, in the **Object type** list box, select **Virtual Machine**, and then click **Create**.
17. In the **Create Custom Property** window, in the **Name** text box, type **Cost Center**, and then click **OK**.
18. In the **Manage Custom Properties** window, in the **Available properties** section, click **Cost Center**.
19. Click **Add**. Point out that **Cost Center** is now in the **Assigned properties** section.
20. In the **Object type** list box, select **Host Group**.
21. In the **Available Properties** section, click **Cost Center**, click **Add**, and then click **OK**.
22. On the **Custom Properties** page, in the **Cost Center** text box, type **1804**, and then click **OK**.
23. In the **VMs** pane, right-click **20745B-LON-DC1**, and then click **Properties**.
24. In the **20745B-LON-DC1 Properties** window, click the **Custom Properties** tab.
25. On the **Custom Properties** page, point out that the **Cost Center** property is available, in addition to 10 custom properties.
26. On the **Custom Properties** page, in the **Cost Center** text box, type **1804**, and then click **OK**.
27. In the navigation pane, right-click **London Host Group**, and then click **Properties**.
28. In the **London Host Group Properties** window, click the **Placement Rules** tab.
29. On the **Placement Rules** page, clear the **Use the placement settings from the parent host group** check box, and then click **Add**.
30. In the **Create Custom Requirement** window, point out that in the **Custom property** list box, **Cost Center** is selected.
31. Point out that in the **Requirement** list box, **Virtual machine must match host** is selected, and then click **OK** twice.



Note: Explain that by creating this placement rule, you ensure that the virtualization hosts in **London Host Group** can be placed only on virtual machines that have the same **Cost Center** value.

Module Review and Takeaways

Best Practice

Always use the Distributed Key Management feature to store the DPAPI encrypted Run As account credentials and passwords into the Active Directory.

In a complex Virtual Machine Manager environment with many Hyper-V hosts in multiple locations, take advantage of host groups nesting and inheritance. For example, you could use a geographic order to the top level of your host groups, with functional host groups under them. Properties set at the higher levels will propagate to the lower levels.

Review Questions

Question: Which major Virtual Machine Manager component are the three main groups of resources — compute, networking, and storage—all part of?

Answer: The Virtual Machine Manager fabric.

Question: What does dynamic optimization do?

Answer: Dynamic optimization enables Virtual Machine Manager to balance the virtual machine loads automatically within a host cluster.

Question: Which virtual machine actions can you perform on Azure virtual machines by using the **Virtual Machine Manager** console?

Answer: You can use Virtual Machine Manager to start, shut down, stop, restart, and connect to an Azure virtual machine by using Remote Desktop.

Real-world Issues and Scenarios

When installing the Virtual Machine Manager management server, be aware that once you enter in the service account after you install Virtual Machine Manager, you cannot change it. If you must, you will need to remove Virtual Machine Manager from the server, make the necessary change, and then reinstall Virtual Machine Manager.

Common Issues and Troubleshooting Tips

Common Issue	Troubleshooting Tip
Prerequisites for installing Virtual Machine Manager cause failures.	Ensure all prerequisites are met, to include Windows ADK and the proper service account and permissions.
Host group Run As account does not work properly.	Ensure the host group Run As account is not the same as the Virtual Machine Manager service account.

Lab Review Questions and Answers

Lab: Installing and configuring Virtual Machine Manager

Question and Answers

Question: Why did the Virtual Machine Manager management server installation on **LON-SVR3** prompt you about installing Virtual Machine Manager on a cluster node?

Answer: Earlier, you added **LON-SVR3** as an additional node to the failover cluster. When you run **Microsoft System Center Virtual Machine Manager Setup Wizard**, it detects that it is running on a failover cluster node and it prompts you about that.

Question: Can you manage Azure virtual machines that you deployed by Azure Resource Manager in the **Virtual Machine Manager** console?

Answer: It depends. You can add an Azure subscription to Virtual Machine Manager in two ways: by using Azure AD authentication or by using a management certificate. If you use a management certificate, you will be able to manage only Azure classic portal virtual machines. If you use Azure AD authentication, you will be able to manage Resource Manager based and Classic virtual machines.

Module 4

Managing storage fabric and fabric updates

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Lesson 1

Overview of server virtualization storage technologies

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Question and Answers

What is Storage Spaces Direct?

Question: Would you choose a disaggregated or hyper-converged architectural model when deploying Storage Spaces Direct in a Virtual Machine Manager environment?

Answer: When deploying Storage Spaces Direct in a Virtual Machine Manager environment, it is possible to use either the disaggregated approach or hyper-converged approach. The answers might vary, but the two main factors to consider are scalability and operational simplicity. The disaggregated approach allows you to scale the compute and storage components independently, while the hyper-converged model scales the compute and storage components together. On the other hand, the disaggregated approach involves deployment of two separate clusters which must closely interact with each other. The hyper-converged model includes a single cluster only.

What is Storage Replica?

Question: What factors would you consider when choosing between synchronous and asynchronous Storage Replica implementation?

Answer: Answers might vary. When choosing between the two replication methods, you should consider performance and potential for data loss. Synchronous replication ensures that the content of the source and the replication target is crash-consistent. However, to accomplish this, the source must wait for the acknowledgement of the successful write completed at the target, which affects its performance. Asynchronous replication eliminates the impact of writes at the target on the source's performance, but it introduces potential for data loss if the source fails before its data fully replicates to the target.

Resources

What is Offloaded Data Transfer?

 **Additional Reading:** For more information, refer to "Windows Offloaded Data Transfers Overview" at: <https://aka.ms/u5epuc>.

What is a Scale-Out File Server?

 **Additional Reading:** Virtual Machine Manager simplifies deployment of Scale-Out File Server clusters by supporting the addition of bare-metal nodes directly to a Scale-Out File Server cluster.

For more information, refer to: "Provision a scale-out file server (SOFS) cluster from bare metal computers in the VMM fabric" at: <https://aka.ms/oit11y>.

 **Additional Reading:** For more information, refer to: "Manage scale-out file server (SOFS) in the VMM fabric" at: <https://aka.ms/li602f>.

What is Virtual Fibre Channel?

 **Additional Reading:** For more information, refer to "Implement Hyper-V Virtual Fibre Channel" at: <https://aka.ms/agsmwi>.

What is Storage Spaces Direct?



Additional Reading: For more information, refer to: "Storage Spaces Direct in Windows Server 2016" at: <https://aka.ms/rrac66>.

What is Storage Replica?



Additional Reading: For more information, refer to: "Storage Replica overview" at: <https://aka.ms/lwi8w6>.

Demonstration: Configuring an iSCSI target server

Demonstration Steps

1. On **LON-HOST1**, on the taskbar, click **Start**, and then click **Server Manager**.
2. In **Server Manager**, click **Manage**, and then click **Add Servers**.
3. In the **Add Servers** dialog box, click **Find Now**, click **LON-SS**, click the arrow to add it to the **Selected** list, and then click **OK**.
4. In the **Server Manager** navigation pane, click **File and Storage Services**. In the **SERVERS** section, select **LON-SS**, and then in the navigation pane, click **iSCSI**.
5. In the **iSCSI VIRTUAL DISKS** section, click **TASKS**, and then click **New iSCSI Virtual Disk**.
6. In the **New iSCSI Virtual Disk Wizard**, on the **Select iSCSI virtual disk location** page, click **C:**, and then click **Next**.
7. On the **Specify iSCSI virtual disk name** page, in the **Name** text box, type **LUN1**, and then click **Next**.
8. On the **Specify iSCSI virtual disk size** page, in the **Size** text box, type **15**, verify that **Dynamically expanding** is selected, and then click **Next**.
9. On the **Assign iSCSI target** page, verify that **New iSCSI target** is selected, and then click **Next**.
10. On the **Specify target name** page, in the **Name** text box, type **Lab4-Target1**, and then click **Next**.
11. On the **Specify access servers** page, click **Add**. In the **Select a method to identify the initiator** dialog box, click **Browse**. In the text box, type **LON-HOST1**, and then click **OK**.
12. Click **OK**, and then click **Next**.
13. On the **Enable Authentication** page, click **Next**.
14. On the **Confirm selections** page, click **Create**.
15. On the **View Results** page, click **Close**.
16. In the **iSCSI VIRTUAL DISKS** section, click **TASKS**, click **New iSCSI Virtual Disk**, and then click **Next**.
17. On the **Specify iSCSI virtual disk name** page, in the **Name** text box, type **LUN2**, and then click **Next**.
18. On the **Specify iSCSI virtual disk size** page, in the **Size** text box, type **20**, click **Next** twice, click **Create**, and then click **Close**.
19. On **LON-HOST1**, on the taskbar, right-click **Start**, and then click **Disk Management**.
20. In Disk Management, point out the number of disks that are connected to **LON-HOST1**.

21. In **Server Manager**, click **Tools**, and then click **iSCSI Initiator**. In the **Microsoft iSCSI** dialog box, click **Yes**.
22. In the **iSCSI Initiator Properties** dialog box, in the **Target** text box, type **LON-SS**, click **Quick Connect**, click **Done**, and then click **OK**.
23. On the taskbar, click **Disk Management**.
24. In Disk Management, in the details pane, point out that two disks are added. The first added disk is 15 gigabytes (GB), the second added disk is 20 GB, and both disks are offline. Explain that these are the virtual disks that you just added on the iSCSI target.
25. On the taskbar, click **Server Manager**.
26. In **Server Manager**, in the **iSCSI VIRTUAL DISKS** section, right-click **C:\iSCSIVirtualDisks\LUN1.vhdx**, and then click **Extend iSCSI Virtual Disk**.
27. In the **New Size** text box, type **25**, and then click **OK**.
28. On the taskbar, click **Disk Management**.
29. In Disk Management, click **Action**, and then click **Rescan Disks**.
30. After the disks are rescanned, point out that Disk2 has increased from 15 to 25 GB. Close Disk Management.

Lesson 2

Managing storage fabric

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Question and Answers

Question: Which three of the following scenarios support centralized policy-based Storage QoS in a VMM environment?

- Hyper-V using a Scale-Out File Server for virtual disk storage
- Nonclustered Hyper-V with local virtual disk storage
- Nonclustered Hyper-V using nonclustered SMB file share for virtual disk storage
- Hyper-V using CSV for virtual disk storage
- Storage Spaces Direct in disaggregated mode

Answer:

- Hyper-V using a Scale-Out File Server for virtual disk storage
- Nonclustered Hyper-V with local virtual disk storage
- Nonclustered Hyper-V using nonclustered SMB file share for virtual disk storage
- Hyper-V using CSV for virtual disk storage
- Storage Spaces Direct in disaggregated mode

Feedback: Starting with Windows Server 2016, failover clustering incorporates storage Quality of Service (QoS) policies, which are stored in the cluster database. Windows Server 2016 supports storage QoS in two scenarios:

- Nonclustered or clustered Hyper-V hosts serving as the compute tier with Scale-Out File Servers serving as the storage tier.
- Clustered Hyper-V hosts with Cluster Shared Volumes (CSVs)

Storage Spaces Direct in disaggregated mode relies on Scale-Out File Servers for storing virtual disk files, so it is one of the supported scenarios.

Resources

Implementing VMM storage

 **Additional Reading:** For more information, refer to: "Set up a Virtual Fibre Channel in the VMM storage fabric" at: <https://aka.ms/szv9fd>.

 **Additional Reading:** For more information, refer to: "Provision a scale-out file server (SOFS) cluster from bare metal computers in the VMM fabric" at: <https://aka.ms/oit11y>.

 **Additional Reading:** For more information, refer to: "Provision a scale-out file server (SOFS) from standalone file servers in the VMM fabric" at: <https://aka.ms/k84ce9>.

 **Additional Reading:** For more information, refer to: "Manage Storage Spaces Direct in VMM" at: <https://aka.ms/n23ezd>.

Demonstration: Deploying and managing VMM storage

Demonstration Steps

Add an iSCSI storage provider

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **Fabric** pane, right-click **Storage**, and then click **Add Storage Devices**.

2. On the **Select Provider Type** page, click **SAN and NAS devices discovered and managed by a SMI-S provider**, and then click **Next**.
3. In the **Protocol** drop-down list box, select **SMI-S WMI**.
4. In the **Provider IP address or FQDN:** text box, type **lon-ss.adatum.com**, and then click **Browse**.
5. On the **Select a Run As account** page, click **DomainAdmin**, and then click **OK**.
6. On the **Specify Discovery Scope** page, click **Next**.
7. On the **Gather Information** page, point out the discovery result, and then click **Next**.
8. On the **Select Storage Devices** page, select the **iSCSITarget: LON-SS:C** checkbox.
9. Click **Create classification**, in the **Name** text box, type **Silver**, and then click **Add**.
10. Click the **Classification** drop-down list box, click **Silver**, and then in the **Host Group** drop-down list box, click **All Hosts**, and then click **Next**.
11. On the **Summary** page, click **Finish**.
12. Wait for the job to finish, and then close the **Jobs** window. You can ignore the **Warning** status of the job.

Deploy block storage

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **Fabric** navigation pane, click **Storage**, and then on the ribbon, click **Create Logical Unit**.
2. Make sure that **iSCSITarget: LON-SS:C** is selected in the **Storage pool** drop-down list box.
3. In the **Name** text box, type **LON-APP1_C**, and then in the **Size (GB)** text box, type **20**.
4. In the **Host group:** drop-down list box, select **All Hosts**, and then click **OK**.
5. In the **Fabric** navigation pane, click **Classifications and Pools**.
6. In the details pane, expand **iSCSITarget LON-SS: C**: and verify that the added logical unit number (LUN) named **LON-APP1_C** with a size of **20 GB** is listed. Point out that the iSCSI virtual disks that you created in previous demonstration are listed.
7. On the taskbar, click **Server Manager**.
8. In **Server Manager**, click **Refresh** and point out that the new iSCSI virtual disk is listed and that its name starts with **LON-APP1_C**.

Lesson 3

Managing fabric updates

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Question and Answers

Question: You have identified a potential problem with the compatibility between a Windows security update and the antivirus software that you are using to protect your Hyper-V hosts. What could you do in VMM to prevent this issue from affecting your Hyper-V hosts?

Answer: You must identify the Knowledge Base (KB) number of the update and then create an update exception.

Question: VMM can share the same WSUS server with System Center Configuration Manager.

True

False

Answer:

True

False

Resources

Windows Server 2016 servicing models



Additional Reading: To read more about the Windows Server release model and servicing options, refer to “Windows Server Semi-Annual Channel overview” at <https://aka.ms/Dg8n14>.

Demonstration: Implementing fabric updates

Demonstration Steps

Integrate WSUS and VMM

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **Fabric** pane, expand the **Infrastructure** node, and then click **Update Server**.
2. Right-click **Update Server**, and then click **Add Update Server**.
3. In the **Add Windows Server Update Services Server** dialog box, in the **Computer name** text box, type **LON-WSUS**, and then in the **TCP/IP port** text box, type **8530**.
4. Click **Browse**, select **DomainAdmin**, and then click **OK**.
5. In the **Add Windows Server Update Services Server** dialog box, click **Add**.
6. In the **Jobs** window, click the **Add Update Server** job. On the **Summary** and **Details** tabs, monitor the status of the configuration job.
7. When the job displays as **Completed w/info**, close the **Jobs** window. Disregard any error messages.



Note: Explain that an error message displays because the Update Server does not have Internet connectivity and cannot synchronize updates. It would take considerable time and disk space to synchronize it.

8. With the **Update Server** node selected, point out that **LON-WSUS.adatum.com** displays in the details pane, and that the **Agent Status** is **Responding**.

Create a baseline

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, click the **Library** workspace.
2. In the navigation pane, expand the **Update Catalog and Baselines** node, and then click **Update Baselines**.
3. On the ribbon, on the **Home** tab, click **Create**, and then click **Baseline**.
4. In the **Update Baseline Wizard**, in the **Name** text box, type **LON Base1**, click **Next**, and then click **Add**.
5. In the **Add Updates to Baseline** window, select all the updates, and then click **Add**.
6. In the wizard, click **Next**. Select the **All Hosts** and **LON-VMM.Adatum.com** check boxes, and then click **Next**.
7. On the **Summary** page, click **Finish**.
8. In the **Jobs** window, click the **Change properties of a baseline** job.
9. On the **Summary** and **Details** tabs, monitor the status of the configuration job.
10. When the job displays as **Completed**, close the **Jobs** window.
11. With the **Update Baselines** node selected, point out that **LON Base1** displays in the **Baselines** pane with **Assignments** set to **2**.

Module Review and Takeaways

Review Question

Question: What should you consider when deciding whether to use Storage Spaces Direct in your VMM environment?

Answer: The answers might vary, but students will probably mention the capabilities of Storage Spaces Direct. From a performance standpoint, Storage Spaces Direct offers an alternative to a storage area network (SAN). It removes scalability limitations associated with the Scale-Out File Server in Windows Server 2012 R2. Instead of relying on external Just a Bunch of Disks (JBODs), it provides the ability to share directly attached serial attached SCSI (SAS), Serial ATA (SATA), or Non-Volatile Memory Express (NVMe) drives across up to 16 servers in the same Windows Server 2016 failover cluster. One disadvantage is that Storage Spaces Direct requires the use of Windows Server 2016 Datacenter Edition, which involves a significant licensing cost.

Lab Review Questions and Answers

Lab: Managing storage fabric and fabric updates

Question: The United Kingdom branch of Adatum Corporation has decided to implement Hyper-V virtualization with System Center, and uses Windows file storage for the virtual machines. You have created update baselines for the VMM fabric and for Hyper-V hosts. What can you do to ensure that the scope of your new baseline includes the new file server?

Answer: To ensure that the scope of the baseline includes the new file server, you must configure the **Assignment Scope** setting of the VMM fabric baseline.

Module 5

Configuring and managing the Virtual Machine Manager library and library objects

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Lesson 1

Overview of the Virtual Machine Manager library

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Question and Answers

Question: Is a file-based resource that you copy to a library share immediately visible in the Virtual Machine Manager console?

Answer: No, file-based resources that you copy to the library are not immediately visible in the Virtual Machine Manager console. Virtual Machine Manager must first refresh the view and index the content, which happens once per hour by default but can also be triggered manually. You should also be aware that not all resources appear in the Virtual Machine Manager console.

Question: Do you need to use Virtual Machine Manager installation media to add a file server as a Virtual Machine Manager library server to the fabric?

Answer: No, you do not need Virtual Machine Manager installation media to add a file server as a Virtual Machine Manager library server to the fabric. You can add a file server as a library server to the fabric by using the Virtual Machine Manager console and Windows PowerShell; this will take care of all file server configurations.

What is the Virtual Machine Manager library?

Question: What is the primary purpose of the Virtual Machine Manager library?

Answer: The primary purpose of the Virtual Machine Manager library is to store, catalog, and index various resources that you can reuse for deploying VMs and configuring a datacenter fabric.

Question: Why would an organization have multiple Virtual Machine Manager library servers?

Answer: Library servers store reusable objects that can be quite large; for example, a virtual hard disk with generalized installation of Windows Server 2016. If you are deploying a new VM that uses a virtual hard disk, you must copy a virtual hard disk from the library share to Hyper-V storage. When you are deploying the VM, it is most efficient if a virtual hard disk is available on the library server that has a fast network connection to the Hyper-V host. If the organization has multiple locations where Hyper-V virtualization is used, you must also have multiple Virtual Machine Manager library servers.

Overview of Virtual Machine Manager library resources

Question: Why are some resource types, such as virtual hard disks or .iso images, stored on library shares and not in the Virtual Machine Manager database?

Answer: It does not make sense to store certain resource types in the Virtual Machine Manager database. Virtual hard disks, .iso images, and other reusable resource types can be large and unstructured, so they are stored on library shares. Storing resources on library shares enables you to store anything that is important and can be reused as a custom resource on the share.

Question: Does the Virtual Machine Manager library include a replication mechanism that can be used for replicating library content to multiple library servers?

Answer: No, the Virtual Machine Manager library does not include a replication mechanism. If you want to replicate resources between library servers, either copy them manually, implement a scheduled task to replicate them automatically, or implement a feature such as storage replica.

Library server and host group association

Question: What is the benefit of associating a library server with a host group?

Answer: When you associate a library server with a host group, you make the Virtual Machine Manager aware that the library server is physically close to the Hyper-V hosts in that host group and that its primary use is to copy library resources to the Hyper-V hosts in that host group.

Question: How can you prevent remote Hyper-V hosts from accessing and copying resources from the library server?

Answer: You can configure the library server properties to include information about VM networks to which the library server is connected.

Considerations for highly available library servers

Question: What are two ways to make the content of Virtual Machine Manager library servers highly available?

Answer: To make the Virtual Machine Manager library content highly available, you can have either multiple library servers that store equivalent objects or deploy the Virtual Machine Manager library server in a failover cluster.

Question: How can you replicate the Virtual Machine Manager library resources between multiple library servers?

Answer: Virtual Machine Manager does not include any replication or synchronization functionality that would replicate content between library servers. You can either manually add resources individually to each library server, use a script to copy it among library servers, use a scheduled task that would trigger copy operation, or implement a storage replica feature.

Demonstration: Working with the Virtual Machine Manager library

Demonstration Steps

1. On **LON-SVR3**, on the taskbar, click **File Explorer**.
 2. In File Explorer, in the navigation pane, expand **This PC**, and then click **Allfiles (D:)**.
 3. In the details pane, right-click **VMMLibrary**, select **Share with**, and then click **Specific People**. In the text box, type **domain users**, click **Add**, click the down arrow near **Read**, click **Read/Write**, click **Share**, click **Change settings**, and then click **Done**.
 4. On **LON-HOST1**, on the taskbar, click **Virtual Machine Manager**, and then click **Connect**.
 5. In the **Virtual Machine Manager** console, click the **Library** workspace.
 6. In the **Library** pane, scroll down, right-click **Library Servers**, and then click **Add Library Server**.
 7. In **Add Library Server** wizard, on the **Enter Credentials** page, click **Browse**, click the **DomainAdmin** Run As account, click **OK**, and then click **Next**.
 8. On the **Select Library Servers** page, in the **Computer name** text box, type **LON-HOST1**, and then click **Add**. In the **Computer name** text box type **LON-SVR3**, and then click **Add** again. Verify that both hosts are added in the **Selected servers** section, and then click **Next**.
 9. On the **Add Library Shares** page, in the **Select library shares to add** section, select the **Base** and **VMMLibrary** check boxes. Select the **Add default Resources** check box for **VMMLibrary**, and then click **Next**.
-  **Note:** The **Default Resources** option adds the **ApplicationsFrameworks** folder to the share.
10. On the **Summary** page, point out the **View Script** button and explain that clicking it will bring up the **Notepad** with the Windows PowerShell script that will recreate all the selections that you made in the wizard. Click the **Add Library Servers** button.



Note: This is a very useful file that can help you document your administrative actions and recreate your environment.

11. When the **Jobs** window opens, point out the two **Add library server** jobs. When both jobs are complete, close the **Jobs** window.
12. In the **Virtual Machine Manager** console, in the **Library** pane, point out that two library servers are added. Below the **LON-HOST1.adatum.com** library server, point to the **Base** folder, and below the **lon-svr3.adatum.com** library server, expand the **VMMLibrary** folder. Point out that only the **VMMLibrary** folder below the **Lon-svr3.adatum.com** library server has the **ApplicationFrameworks** folder.
13. Right-click the **LON-HOST1.adatum.com** library server, and then select **Properties**.
14. On the **General** page, in the **Host Group** drop-down list box, select **London Host Group**, click **View Script** and then, on the **LON-HOST1.adatum.com Properties** dialog box, click **OK**.
15. In the **Notepad** click **File**, click **Save As**; in the **Save as type** drop-down list box, select **All files (*.*)**; in the **File name** text box type `\\LON-SVR3\VMMLibrary\LibraryAssociation1.ps1`; click **Save**, and then close the **Notepad**.
16. In the **Library** pane, right-click **lon-svr3.adatum.com**, and then click **Refresh**.
17. In the **Library** pane, under the **VMMLibrary** node, under the **lon-svr3.adatum.com** node, click **Scripts**.
18. In the details pane, right-click **script1.ps1**, and then click **Properties**.
19. On the **script1.ps1 Properties** page, in the **Family** text box, type **VMM Management**, in the **Release** text box type **1.0**, point out the value of the **Path property**, and then click **OK**.
20. In **Library** pane, click **VMMLibrary** below the **lon-svr3.adatum.com** node.
21. In the details pane, right-click **LibraryAssociation1.ps1**, and then click **Properties**.
22. On the **LibraryAssociation1.ps1 Properties** page, click the down arrow in the **Family** drop-down list box, and then select **VMM Management**.
23. Click the down arrow in the **Release** drop-down list box, select **1.0**, and then click **View equivalent resources**.
24. In the **Equivalent Library Objects** window, point out that **script1.ps1** is listed and explain that this is because it has the same Family and Release value. Mention that you can also view objects with different values, then click **OK** twice.

Lesson 2

Preparing Windows for deployment in Virtual Machine Manager

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Question and Answers

Question: Select which of the following Windows setup configuration passes occur during the default Windows Server 2016 installation?

- Windows PE
- offlineServicing
- specialize
- generalize
- oobeSystem

Answer:

- Windows PE
- offlineServicing
- specialize
- generalize
- oobeSystem

Feedback: During the default Windows Server 2016 installation, the following four Windows setup configuration passes occur:

- Windows PE
- offlineServicing
- specialize
- oobeSystem

The generalize configuration pass occurs only if you generalize a Windows image and not during the default Windows Server 2016 installation.

Question: Which tools can be used for generalizing Windows installation and for applying a Windows image to a volume? Where you can get those tools?

Answer: You can generalize a Windows installation by using `sysprep.exe`, and you can apply a Windows image to a volume by using the **Expand-WindowsImage** cmdlet. Both are part of the default Windows Server 2016 or Windows 10 installation.

Overview of Sysprep

Question: Why would you run `sysprep.exe` to generalize an operating system in the virtual hard disk that will be used for deploying new VMs?

Answer: `Sysprep.exe` generalizes an operating system by removing all settings that are specific to current installation. For example, it will remove the name of the computer—its SID—and empty the Recycle Bin and all events in Event Viewer. You would run `sysprep.exe` because a virtual hard disk with the installed operating system will be deployed multiple times, and you do not want multiple computers on the network to have the same identity, as this would cause conflicts.

Question: Can you generalize Windows Server 2016 if the computer is a domain member? Can the Windows Server 2016 VM that you deploy from the generalized image be an AD DS member?

Answer: Yes, you can generalize Windows Server 2016 whether a computer is in a workgroup or a domain. A generalized image does not include information about AD DS membership, but you

can provide that information during deployment, typically by using an answer file. This means that the Windows Server 2016 VM that you deploy from the generalized image can be an AD DS member, which is a common scenario.

Using Sysprep with an answer file

Question: Which tool can you use to create a Windows answer file, and where can you obtain this tool?

Answer: You can create a Windows answer file by using the Windows Image System Manager. This tool is part of Windows ADK, and you can download it from the Microsoft portal.

Question: Why would you want to use an answer file with a generalized Windows image?

Answer: You create a generalized Windows image by running Sysprep, which deletes all computer-specific settings that are unique to installed Windows, such as the computer SID and the computer name. Windows system cannot run without these settings. You can provide them interactively through **Windows Setup Wizard** when the Windows system starts for the first time, but very often administrators prefer to use an answer file to provide those settings.

Preparing an operating system for deployment

Question: How can you build the reference installation that will be later used for cloning?

Answer: If you want to build a reference installation, you must first install the Windows operating system. You then must customize the installation, apply updates, install apps, and customize them. At the end, you must generalize the reference installation by running the Sysprep.

Question: Should you use the DISM tool for capturing the reference installation of Windows if you plan to deploy it to VMs?

Answer: No, you should run DISM only if you plan to deploy a generalized Windows image to physical computers. If you deploy it to VMs, you can simply copy the virtual hard disk with a generalized installation of Windows to the Virtual Machine Manager library.

Applying .wim to a virtual hard disk

Question: In which situation, would you rather apply a Windows image to a virtual hard disk than use Windows setup to install it to virtual hard disk?

Answer: If you use Windows setup, you can customize the Windows operating system, install and customize additional applications, and create additional partitions during installation. But before you can use such installation for VM deployment, you must first generalize it. If you apply a Windows image to the virtual disk installation, it is already generalized and you can immediately use it for VM deployment, assuming that the Windows image was generalized.

Question: Do you need to obtain an additional tool to apply a Windows image from an install.wim file to a virtual hard disk?

Answer: Although you can use additional tools for applying a Windows image to a virtual hard disk, doing so is not required. Windows Server 2016 and Windows 10 include the Windows PowerShell cmdlet **Expand-WindowsImage**, which can be used for applying a Windows image to a physical or virtual hard disk.

Resources

Using Sysprep with an answer file

 **Additional Reading:** For more information, refer to How configuration passes work: <https://aka.ms/d0q30p>.

 **Additional Reading:** For more information, refer to Download the Windows ADK: <https://aka.ms/ol85tb>.

Applying .wim to a virtual hard disk

 **Reference Links:** You can download Convert-WindowsImage.ps1 script from following URL: <https://aka.ms/mmez6k>.

Demonstration: Using Sysprep to prepare a Windows image

Demonstration Steps

1. On **LON-HOST1**, in **Hyper-V Manager**, in the details pane, double-click **LON-SYSPREP**.
2. In **LON-SYSPREP**, on the taskbar, click **File Explorer**.
3. In File Explorer, navigate to the **C:\Windows\System32\Sysprep** folder.
4. In the details pane, right-click **Unattend**, and then click **Delete**.
5. In the details pane, double-click **sysprep**.
6. The **System Preparation Tool 3.14** dialog box explains the different available options and their meaning. Select the **Generalize** check box; in the **Shutdown Options** drop-down list box, select **Shutdown**; verify that in the **System Cleanup Action** drop-down list box **Enter System Out-Of-Box Experience (OOBE)** is selected; and then click **OK**.
7. Wait until **LON-SYSPREP** is shut down.
8. On **LON-HOST1**, in **Hyper-V Manager**, right-click **LON-SYSPREP**, and then click **Export**. In the **Location** text box, type **C:\Exported**, and then click **Export**.
9. Wait until **LON-SYSPREP** is exported. Point out that you can follow the progress in the **Status** column in **Hyper-V Manager**.
10. In File Explorer, navigate to the **C:\Exported\LON-SYSPREP\Virtual Hard Disks** folder, and point out that it contains two .vhd files. Explain that these are parent and differencing disks and that they contain the generalized Windows Server 2016 installation.
11. Explain that you can merge the differencing disk with its parent, such as when using the **Edit Disk** option in **Hyper-V Manager**, and then copy the merged .vhd file to the Virtual Machine Manager library.
12. In **Hyper-V Manager**, in the details pane, double-click **LON-SYSPREP**, click the **Action** menu, and then click **Start**. While the VM is starting, explain that Sysprep has removed its identity and, as a result, you can use it for deploying many VMs. Emphasize that the settings that Sysprep has removed, including many additional settings, can be provided by Virtual Machine Manager and/or an answer file.
13. In **LON-SYSPREP**, on the **Hi there** page, click **Next**.

14. On the **License terms** page, click **Accept**.
15. On the **Customize settings** page, in the **Password** and **Reenter password** text boxes, type **Pa55w.rd**, and then click **Finish**.
16. Sign in to **LON-SYSPREP** as user **Administrator** by using the password **Pa55w.rd**. Emphasize that the VM was deployed considerably faster than if you were to install Windows Server 2016 from the installation media.
17. Minimize **Server Manager** and point out that the computer name has changed and that it starts with the letters **WIN**.

Lesson 3

Working with profiles

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Question and Answers

Question: When would you use a physical computer profile?

Answer: As its name suggests, you would use a physical computer profile when you need to deploy a physical computer; for example, a Hyper-V cluster or a scale-out file server. Even when you are deploying physical computers by using Virtual Machine Manager, virtual hard disks are still required, as they are deployed to physical computers, on which the boot from a virtual hard disk feature is used.

Overview of the hardware profile

Question: What is the main benefit of using hardware profiles in Virtual Machine Manager?

Answer: Hardware profiles can be used as templates for hardware configuration of VMs. They enable you to perform rapid VM deployment with consistent hardware configuration.

Question: Is a hardware profile stored on the Virtual Machine Manager library share or in the Virtual Machine Manager database?

Answer: A hardware profile is one of the resource types that is stored in the Virtual Machine Manager database.

Overview of the guest OS profile

Question: What is the benefit of using guest OS profiles?

Answer: The guest OS profile contains configuration settings for operating system setup and other settings that provide a consistent operating system environment.

Question: Can you modify settings of the operating system that runs in a VM by modifying the guest OS profile?

Answer: You can use Guest OS profile settings when you deploy a new VM. After the VM is deployed, modifications of the guest OS profile have no effect on the operating system that runs in the VM. Modifications of the guest OS profile has an effect only on the operating system of the VMs that are deployed after you perform the modification.

Overview of the SQL Server profile

Question: Can you use the SQL Server profile for configuring SQL Server in a VM that is deployed by using the VM template?

Answer: It depends. If the VM was deployed as a standalone VM and not as part of the service, the SQL Server profile will not be applied, although the VM was deployed based on the VM template. If the VM was deployed as part of the service, the SQL Server profile will apply to it.

Question: You have a virtual hard disk that contains a generalized installation of Windows Server 2016 and three instances of SQL Server 2016. How many SQL Server profiles do you need to configure all three SQL Server instances?

Answer: You can use the SQL Server profile to configure multiple instances of the SQL Server on the same VM. In each scenario, you need a single SQL Server profile that must include the configuration settings for three deployments of SQL Server.

Preparing an SQL Server image

Question: What is the difference between performing a standard installation of the SQL Server and preparing the SQL Server to be deployed as part of a service?

Answer: In a standard installation of the SQL Server, all server binaries are copied, and the SQL Server is configured so that you can immediately start using the server. Be aware that an SQL Server, similar to a Windows operating system, has several unique settings that should not be used by other servers on the network. When you are preparing SQL Server to be deployed as part of a service, only SQL Server binaries are copied, but SQL Server is not configured. SQL Server receives its unique configuration during service deployment from the SQL Server profile or from the SQL Server configuration file.

Question: Do you need to run sysprep.exe to prepare the SQL Server to be deployed as part of a service?

Answer: You must prepare the SQL Server for deployment differently than you would when generalizing the Windows operating system. While you generalize Windows by running sysprep.exe, which removes some of the Windows settings, you prepare SQL Server by selecting the image preparation of a stand-alone instance of the SQL Server setup option.

Overview of the application profile

Question: Where must you store the web application to deploy it by using the application profile?

Answer: Web applications are one of the application types that can be deployed by using the application profile. You can add and deploy web application to the application profile only if it is stored in the Virtual Machine Manager library.

Question: How can you ensure that only the first VM in the service will have additional files? Those files are not available in a generalized virtual hard disk that is used for deploying VMs in a service.

Answer: You can achieve this goal by creating an application package, specify the script that will copy additional files, and specify that the script should be triggered only when the first VM in the service is created.

Overview of the VM shielding data profile

Question: Is a VM shielding data library object created in the same way as all other profiles in the library?

Answer: No. While you can create other library profiles by defining their settings in the Virtual Machine Manager console, you must create the VM shielding data outside the Virtual Machine Manager console by using **Shielding Data File Wizard**, and you use the Virtual Machine Manager console only for importing the VM shielding data to the library.

Question: Which library object must you create before you can create the VM shielding data library object?

Answer: You can create the VM shielding data library object independently from other objects in the library. This means that you can create the VM shielding data library object whether or not there is any other object in the library.

Overview of capability profiles and physical computer profiles

Question: Can you use a hardware profile or a guest OS profile to provide configuration for a physical computer profile? Can you use virtual hard disks with a physical computer profile?

Answer: You can use hardware profiles and guest OS profiles only for configuring a VM template or when deploying VMs; you cannot use them with a physical computer profile. But you can—actually, you must—use a virtual hard disk with a physical computer profile. A virtual hard disk must include a generalized installation of the Windows Server operating system, and it must support boot from a .vhd.

Question: Can you use a capability profile for deploying a VM?

Answer: A capability profile does not specify configuration; it specifies a range for each resource that can be included in a VM. Capability profiles can be added to private clouds to control if VMs and services that you want to deploy to the cloud meet the limitations of a capability profile. Hardware profiles and hardware configuration in a VM template can be validated against a capability profile to verify if a VM with such a hardware configuration could be deployed to the cloud.

Resources

Preparing an SQL Server image



Additional Reading: For more information, refer to Install SQL Server 2016 using Sysprep: <https://aka.ms/yztb7a>.

Demonstration: Creating a hardware profile and guest OS profile

Demonstration Steps

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **Library** workspace, right-click **Hardware Profiles**, and then select **Create Hardware Profile**.
2. In the **New Hardware Profile** window, on the **General** tab, in the **Name** text box, type **HW Profile1**. Point out that you can create Generation 1 and Generation 2 profiles, and then click the **Hardware Profile** tab.
3. On the **Hardware Profile** tab, click **Processor**, and then, in the **Number of processors** text box, type **2**. Point out the check box in the details pane, and explain when it can be beneficial.
4. Click **Memory**, and then set the **Virtual machine memory** to **2 GB**.
5. Below **Bus Configuration**, click **Virtual DVD drive**, click **Remove**, and then click **Yes**.
6. Below **Network Adapters**, click **Network Adapter 1**, and explain the available options in details pane.
7. In the **Advanced** section, click **Availability**, select the **Make this virtual machine highly available** check box, explain the effect of this setting, and then click **OK** to create the hardware profile.
8. In the **Virtual Machine Manager** console, in the **Library** workspace, right-click **Guest OS Profiles**, and then select **Create Guest OS Profile**.
9. In the **New Guest OS Profile** window, on the **General** tab, in **Name** text box, type **Guest OS Profile1**, explain the options in **Compatibility** drop-down list box, and then click the **Guest OS Profile** tab.
10. On the **Guest OS Profile** tab, in **Operating system** drop-down list box, select **Windows Server 2016 Datacenter**.
11. Click **Identity Information**, and explain why you must use wildcards when specifying identity information. In the **Computer** name box, type **LON-FS##** and point out that **##** are replaced with two digits during VM deployment.
12. Click **Admin Password**, select **Specify the password of the local administrator account**, and then, in the **Password** and **Confirm** text boxes, type **Pa55w.rd**.
13. Below **Roles and Features**, click **Roles**, point out the available roles, and then select the **DNS Server** check box.

14. Below **Roles and Features**, click **Features**, and then point out the available features.
15. Below **Networking**, click **Domain/Workgroup**. In the details pane, select **Domain**, and then, in the **Domain** text box, type **adatum.com**.
16. Select **Select the Run As account to use for joining the domain**, click **Browse**, click the **DomainAdmin** Run As account, and then click **OK**. Explain why it is better to use a Run As account than to specify credentials for joining the domain.
17. Below **Scripts**, point out the **Answer File** and **[GUIRunOnce] Commands** sections, explain why they can be used, and then click **OK** to create a guest OS profile.
18. In the **Virtual Machine Manager** console, point out that **Guest OS Profile1** is listed in the details pane.

Lesson 4

Working with VM templates

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Question and Answers

Question: Are VM templates stored on the library share or in the Virtual Machine Manager database?

Answer: The VM template is one of the resource types that is stored in the Virtual Machine Manager database. VM templates are not stored as files on library shares.

Question: How can you transfer a VM template between the Virtual Machine Manager management server that manages the demonstration environment and the Virtual Machine Manager management server that manages the production environment?

Answer: Because the VM template is stored in a Virtual Machine Manager database, you cannot simply copy it as a file between Virtual Machine Manager library servers that are used by Virtual Machine Manager deployments. You must first export the VM template into a .xml file, transfer the .xml file to another library server, and then import it into Virtual Machine Manager.

Overview of VM templates

Question: Does every VM template include an OS configuration, an application configuration, and an SQL Server configuration?

Answer: Although the VM template can include the above-mentioned configurations, including them in the VM template is not mandatory. When you create a new VM template, you can select that the guest OS profile is not required, which is the default configuration, in which case the VM profile will not include an OS configuration, an application configuration, or an SQL Server configuration.

Question: Do you need to manually configure all the settings in the VM profile?

Answer: It depends. If the Virtual Machine Manager library includes hardware profiles, guest OS profiles, application profiles and SQL Server profiles, you can import settings from those profiles in to the VM template, and you do not need to configure them manually.

Methods for creating VM templates

Question: Can you use a VM that is deployed on a host as a source for creating multiple VM templates?

Answer: No, you can use a deployed VM as a source for a single VM template. If you create a VM template based on the running VM, that VM is deleted from the virtualization host, and its virtual hard disk is generalized and stored in the library. After you create the first VM template, the running VM that you used as a source for the VM template no longer exists.

Question: Can you create a VM template for a Generation 2 VM if you use a VM template for a Generation 1 VM as the source?

Answer: No. You can select the Generation of VM if you are creating a new VM template that is based on the virtual hard disk. If the VM template is based on an existing VM template, then it must be for the same VM Generation as the source. In this situation, the source VM template is for deploying Generation 2 VMs; a new VM template can also be used for deploying Generation 2 VMs only.

Shielded VM templates

Question: How is a template for deploying shielded VMs different from a VM template for deploying standard, non-shielded VMs?

Answer: A template for deploying standard, nonshielded VMs can be used for deploying Generation 1 or Generation 2 VMs, references a standard virtual hard disk in .vhd or .vhdx format, and includes all configuration settings for VM deployment. A VM template for deploying shielded VMs can deploy only a Generation 2 VM, it references an encrypted and signed virtual hard disk

in .vhdx format, and it does not include all configuration settings, as sensitive information is stored in the encrypted VM shielding data file.

Question: Can you deploy and run standard, nonshielded VMs to guarded fabric?

Answer: Yes, guarded fabric can run standard, nonshielded VMs, and encrypted VMs that are not shielded and shielded VMs.

Planning profiles and templates

Question: How can you verify if a hardware profile is referenced and used by any Virtual Machine Manager objects?

Answer: You can verify if a hardware profile is referenced and used by any other Virtual Machine Manager objects by opening its property page and checking if any Virtual Machine Manager object is listed on the dependency tab.

Question: Can you remove a hardware profile and a guest OS profile from the library if they will not be used in the future but were used for deploying several VMs in the last year?

Answer: Before removing any resource from the library, you should first verify that it is not referenced and used by other objects. If there is no dependency and the resource will not be used in the future, you can remove it from the library. Hardware profiles and guest OS profiles are not linked to VMs that were deployed by using them. Removing the hardware profile of a guest OS profile has no effect on the existing VMs.

Resources

Shielded VM templates



Additional Reading: For more information, refer to the Guarded Fabric Deployment Guide for Windows Server 2016: <https://aka.ms/b1rcvc>.

Demonstration: Creating a VM template

Demonstration Steps

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **Library** workspace, right-click **VM Templates**, and then select **Create VM Template**.
2. In **Create VM Template Wizard**, on the **Select Source** page, click **Browse**. Point out that you can select among the existing VM templates, .vhd, and .vhdx files in the library. Click **Base17C-WS16-1607.vhd**, click **OK**, and then click **Next**.
3. On the **Identity** page, in the **VM Template name** text box, type **VM Template1**, and then click **Next**.
4. On the **Configure Hardware** page, in the **Hardware Profile** drop-down list box, select **HW Profile1**. Point out the hardware configuration that is inherited from the selected profile, and then click **Next**.
5. On the **Configure Operating System** page, in the **Guest OS profile** drop-down list box, select **Guest OS Profile1**. Point out settings that are inherited from the selected profile. Emphasize that you can modify the settings, and then click **Next**.
6. On the **Application Configuration** page, point out available options, mention that they are applied only if a VM is deployed as part of the service, and then click **Next**.

7. On the **SQL Server configuration** page explain when you would use this setting, emphasize that SQL Server should already be included in the image, mention that these settings are applied only if a VM is deployed as part of the service, and then click **Next**.
8. On the **Summary** page, click **View Script**, and explain how scripts can be used to automate object creation.
9. In **Notepad**, click **File**, and then click **Save As**. In the **Save as type** drop-down list box, select **All files (*.*)**. In the **File name** text box, type `\\LON-SVR3\VMMLibrary\Scripts\VMTemplate1.ps1`, click **Save**, and then close **Notepad**.
10. On the **Summary** page, click **Create**, and then close the **Jobs** window after the VM template is created.
11. In the **Virtual Machine Manager** console, in the details pane, right-click **VM Template1**, and then click **Properties**.
12. Show and discuss the settings on the **General**, **Hardware Configuration** and **OS Configuration** tabs, and point out that you configured those settings in **HW Profile1** and the **Guest OS Profile1** profiles.
13. Click the **Settings** tab and, in the **Quota Points** text box, enter **3**. Explain when and why quota points are used.
14. Show the information on the **Dependencies** tab and **Access** tabs, and then click **OK**.

Module Review and Takeaways

Review Questions

Question: What is the Virtual Machine Manager library, and what kind of resources can be in it?

Answer: The Virtual Machine Manager library is a repository that contains file-based resources, such as answer files, .iso images, and virtual hard disks that are stored on library servers. The Virtual Machine Manager library also provides access to VM templates, guest OS profiles, and hardware profiles that are stored in the Virtual Machine Manager database.

Question: Do you need to have a hardware profile and a guest OS profile in the Virtual Machine Manager library to create a VM template?

Answer: No. You can use a hardware profile and a guest OS profile as a source for the hardware configuration and operating system configuration that is specified in the VM template. But if you do not have those profiles or you want the settings in VM template to be considerably different than those that are specified in the hardware profile and the guest OS profile, you can specify those settings in the VM template, without referencing or inheriting them from the profiles.

Question: Can you use an application profile and an SQL Server profile when deploying an individual VM?

Answer: You can configure an application configuration and an SQL Server configuration in a VM template. But those settings are applied only if the VM is deployed as part of the service. If you deploy an individual VM, then those settings do not apply.

Real-world Issues and Scenarios

When adding objects to a Virtual Machine Manager library server, you might find that they do not appear in the Virtual Machine Manager console. There can be many reasons for this. For example, by default, Virtual Machine Manager refreshes the library every 60 minutes. You can manually refresh a **Library Server** or **Library Share** by right-clicking it in the **Virtual Machine Manager** console and then clicking **Refresh**. You can also change the default **Refresh** value by editing the **Library Settings** in the **Settings** workspace in the **Virtual Machine Manager** console. Another reason why objects might not appear in the Virtual Machine Manager library is due to their file type. Virtual Machine Manager supports many different file types for the library, but if the file added to the Library Server is not supported, it will not be made available in the Virtual Machine Manager library when viewed in the Virtual Machine Manager console. For a list of supported files type for the Virtual Machine Manager library visit the website: <https://aka.ms/bydxiip>.

When managing synchronization between library servers in Virtual Machine Manager, it is important that the folder structure between library servers is kept in sync. This is especially important when managing empty folders that tenants might use to store VMs. When synchronizing content between library servers, some file copying utilities might skip folders if they are empty. This might result in tenants being unable to store VMs in the library.

Lab Review Questions and Answers

Lab: Configuring and managing the Virtual Machine Manager library and library objects

Question and Answers

Question: Why did you use a # sign (LON-FS##) when specifying identity information in a guest OS profile?

Answer: A guest OS profile provides a configuration that is used when deploying VMs. If you do not use wildcards such as # or *, the operating system name in all VMs that are deployed by using the guest OS profile are the same. As you typically want to use a different name for each VM operating system, you use wildcards for identity information.

Question: Why would you associate a library server with the host group?

Answer: If you have multiple locations, you want the resources from the local Virtual Machine Manager library to be used. When you associate a library server with the host group, the Virtual Machine Manager management server will primarily use resources from that library server when deploying VMs to virtualization hosts that are in the associated host group.

Module 6

Managing the networking fabric

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Lesson 1

Networking concepts in VMM

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Question and Answers

Question: The VM network in an HNV environment is considered an isolation boundary.

True

False

Answer:

True

False

Feedback: A VM network is an isolation boundary within an HNV environment. A virtual subnet in an HNV VM network is a broadcast boundary.

Resources

Overview of Hyper-V Network Virtualization



Additional Reading: For more information regarding OVSDB, refer to <https://aka.ms/l2iq51>.

Lesson 2

Managing Software Defined Networking

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Question and Answers

Question: What is the recommended approach to configuring virtual ports that are part of a logical switch definition?

Answer: When defining a logical switch, you should consider including virtual ports in its settings. This involves adding one or more port classifications, which you should map to one or more virtual port profiles. Port classifications are descriptive labels, which tenant admins can select when deploying their VMs. You, as a fabric admin, can control specifically what that label represents by managing the virtual port profiles that the port classifications map to.

Virtual port profiles allow you to control such settings as:

1. Offload settings:
 - Virtual Machine Queue (VMQ)
 - Internet Protocol security (IPsec) task offloading
 - Single-root I/O virtualization (SR-IOV)
 - Virtual Receive Side Scaling (vRSS)
 - Remote Direct Memory Access (RDMA)
2. Security settings:
 - MAC spoofing
 - DHCP guard
 - Router guard
 - Guest teaming
 - Institute of Electrical and Electronic Engineers (IEEE) priority tagging
 - Guest-specified IP addresses (used in HNV to allow tenants to create guest clusters)
3. Bandwidth settings:
 - Minimum bandwidth—one of two bandwidth allocation types:
 - Absolute—expressed in megabits per second (Mbps)
 - Weighted—expressed as a value from 0 through 100
 - Maximum bandwidth—expressed in Mbps

Resources

Creating a logical network

 **Additional Reading:** For a description of the syntax of the **New-SCLogicalNetwork** cmdlet, refer to: <https://aka.ms/pye8tv>.

Implementing logical switch extensibility

 **Additional Reading:** You can install virtual switch extension managers and network managers in your VMM environment. For details regarding this procedure, refer to: <https://aka.ms/onj11y>.

Lesson 3

Understanding network function virtualization

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Question and Answers

Question: Can you use network virtualization to allow overlapping IP address spaces across different virtual networks?

Answer: Yes. This is one of the benefits of the HNV. VMs on different virtual networks can have overlapping IP addresses. They can communicate with other VMs on the same virtual network.

Resources

Understanding Windows Server Gateway



Additional Reading: For more information about planning an SDN infrastructure, refer to: <https://aka.ms/phopj1>.

Understanding Datacenter Firewall



Additional Reading: For the steps involved in configuring Access Control Lists for Datacenter Firewall on per virtual subnet level, refer to; <https://aka.ms/qu709y>. For the steps involved in configuring Access Control Lists for Datacenter Firewall on per virtual network interface level, refer to <https://aka.ms/yw5z0u>.

Module Review and Takeaways

Best Practices

- Do not rely on automatically generated names that VMM assigns to logical networks. This functionality is enabled by default, but you can control it by modifying the **Automatic creation of logical networks** setting in the **Settings** workspace of the **Virtual Machine Manager** console. Instead, create a custom naming convention for your logical network, logical network sites, IP address pools, uplink port profiles, and other SDN objects. This will help you to identify them during configuration and troubleshooting tasks.
- After you deploy Network Controller, modify its logging configuration. By default, logs are stored in the `%systemdrive%\SDNDiagnostics` folder. We recommend that you change the log location to a remote file share. To accomplish this, run the **Set-NetworkControllerDiagnostic** cmdlet, and use the *DiagnosticLocation* parameter to specify the target folder.

Review Question

Question: Where does Software Defined Networking (SDN) fit into your organization's plans?

Answer: The answers might vary, but, in general, enterprises should be looking to move toward a Software Defined Networking (SDN) infrastructure because it allows for rapid changes to the ever-increasing IT demands of business. By using SDN, enterprises can create new environments and dismantle them as required, without the need for lengthy change impact analyses.

Tools

The diagnostic tools that are available in HNV based on Windows Server 2016 belong to the **RSAT-NetworkController** server feature. As stated earlier in the "Common Issues and Troubleshooting Tips" section, you need to install this feature and import the **NetworkControllerDiagnostics** and **hnvdiagnostics** Windows PowerShell modules to make the tools described here available. The tools are implemented as Windows PowerShell cmdlets or scripts.

You can use the following tools to perform diagnostics related to Network Controller:

- **Debug-NetworkControllerConfigurationState.** You can run this script from the VMM server or from any server that is able to communicate with the REST IP address of Network Controller and that has the private key of the Network Controller REST certificate installed in its personal certificate store. The script returns a list of tenant and fabric resources in a failure or warning configuration state.
- **Debug-SlbConfigState.** You can run this script from any Network Controller node. Its purpose is to diagnose the Network Controller SLB Manager functionality. It stores the results of this diagnosis in the `C:\Tools\SlbConfigState.txt` file and includes such information as the state of the SLBM MUX instances, the BGP peering status, advertised routes, and a list of VIPs.
- **Debug-WinFabNodeStatus.** You can run this script from any Network Controller node. Its purpose is to diagnose the replication status and health state of all the Network Controller nodes.
- **Get-Replica.** You can run this script from any Network Controller node. Its purpose is to identify the primary nodes hosting Network Controller modules, such as **SlbManagerService** or **SDNAPI**.
- **Get-ConnectivityResults.ps1.** You can run this script from any Network Controller node. This allows you to collect the results of running the following scripts:
 - **Test-VNetPing.ps1.** This script tests the connectivity between two CA IP addresses.
 - **Test-LogicalNetworkPing.ps1.** This script tests the connectivity between two PA IP addresses.

You can use the following tools to run diagnostics from Hyper-V hosts:

- **Get-PACAMapping.** You can run this script from any Hyper-V host that is connected to the HNV provider logical network. The script displays a table containing a list of VMs on the local host, including their CAs, PAs, VSIDs, and MAC addresses.

- **Get-CustomerRoute.** You can run this script from any Hyper-V host that is connected to the HNV provider logical network. The script displays a table containing the CA routing information. Each table row contains an RDID with its corresponding VSID, CA IP address prefix, and CA IP address next hop, which represents the default gateway associated with the HNV distributed router.
- **Test-LogicalNetworkConnection.** You can run this script from any Hyper-V host that is connected to the HNV provider logical network. The script tests the connectivity to the PA IP address of a remote Hyper-V host that you specify.

Common Issues and Troubleshooting Tips

Common Issue	Troubleshooting Tip
You cannot deploy a VM on a specific VM network to a VM host.	Check that the uplink port profile includes the required logical network site.
You cannot deploy a VM with the chosen port classification.	Ensure that the logical switch has the required port classification included in its definition.
You are unable to create a VM in an HNV network.	Ensure that enough IP addresses exists in the IP address pool of the HNV provider logical network.
No network connectivity exists between two Windows Server tenant VMs on the same virtual network.	<p>Verify that Windows Firewall is not blocking the network traffic.</p> <p>Ensure that each VM has an IP address within the tenant's virtual network IP address space.</p> <p>On both VMs, run Test-VNetPing.sp1 to perform the connectivity test. Use the Get-NCVirtualNetwork cmdlet to identify the virtual network resource ID corresponding to the tenant's virtual network.</p> <p>Verify that no distributed firewall policies are in place that apply to the virtual network adapters of the VMs or the virtual subnets where the VMs reside.</p> <p>Run the Debug-NetworkControllerConfigurationScript cmdlet to identify resources that return error codes. Use the error codes to determine recovery actions based on the information provided at https://aka.ms/dxv9rb.</p> <p>If the two VMs do not reside on the same physical computer, check the connectivity between their respective Hyper-V hosts. To accomplish this, start by running the Get-ProviderAddress cmdlet on both hosts to identify their respective PA IP addresses. Use the Get-NCLogicalNetwork cmdlet to determine the resource ID of the HNV provider logical network connecting the two hosts.</p> <p>Verify that the physical switches on the physical network carrying the encapsulated packets support an MTU size of at least 1,674 bytes. To confirm whether this is the case, run the Test-EncapOverheadValue cmdlet from each Hyper-V host.</p> <p>Use the Get-PACAMapping cmdlet to determine whether the Network Controller policies that apply encapsulation rules and assign the CA-PA mappings to Hyper-V host agents took effect.</p> <p>Verify that the Network Controller host agent on each</p>

Common Issue	Troubleshooting Tip
	<p>Hyper-V host can communicate with Network Controller by running the following command.</p> <pre>Netstat -anp tcp findstr 6640</pre> <p>Confirm that the port profile ID on the hosts matches the instance ID of the VM network interfaces of the tenant VMs.</p>
<p>No connectivity exists to tenant VMs via SLB.</p>	<p>Verify that SLB Manager on Network Controller is operational.</p> <p>Check the connectivity among the SLB infrastructure components, including SLB Manager, the SLB Manager MUX instances, and the SLB host agents.</p> <p>Run the Debug-SlbConfigState cmdlet on Network Controller.</p> <p>Use Windows Performance Monitor to track the SDN SLBM counters, including:</p> <ul style="list-style-type: none"> • SLBM LEngine Configurations Total. Make sure that its value is greater than zero. • VIP Endpoints Total. Make sure that its value is greater than or equal to 2. • HP Clients connected. Make sure that its value is equal to the number of Hyper-V hosts. • Muxes Connected and Muxes reporting healthy. Make sure that these values are equal to the number of MUX instances. <p>Ensure that routers can exchange routes with SLB MUXs by using BGP peering. Reference the vendor's documentation for details regarding this procedure.</p> <p>Verify that the VIPs assigned to SLB Manager and the tenant-facing VIPs are within the SLB VIP ranges you defined.</p>
<p>Network Controller cannot communicate with Hyper-V hosts.</p>	<p>Verify basic IP connectivity over the management logical network by using the Test-NetConnection cmdlet.</p> <p>Identify the configuration state of Network Controller by running the Debug-NetworkControllerConfigurationState cmdlet.</p> <p>Test the connectivity from the Hyper-V hosts to the REST IP address of Network Controller over port 6640.</p> <p>After the tenant VMs are deployed, test the connectivity from the Hyper-V hosts to Network Controller over Windows Communication Foundation.</p>

Lab Review Questions and Answers

Lab A: Creating and configuring the networking fabric

Question and Answers

Question: Does Network Controller require connectivity to the VMs running on the tenant virtual networks?

Answer: No. Network Controller must be able to connect to the VMM infrastructure, including the Hyper V hosts that will host tenant VMs. It does not require direct connectivity to the VMs.

Question: How can you customize the deployment of Network Controller in the VMM environment?

Answer: You can modify the .xml file that serves as the basis of the VMM service template. This is the approach included in the lab to account for the resource limitations of the lab environment.

Lab B: Configuring and testing Hyper-V Network Virtualization

Question and Answers

Question: How can you identify the IP address that VMM assigned to a tenant VM on a VM network from its IP address pool?

Answer: You can identify it by viewing the properties of the tenant VM from the **VMs and Services** workspace in the **Virtual Machine Manager** console.

Question: How can you control which port classifications will be available when provisioning a tenant VM to a VM network?

Answer: You can control which port classifications will be available during the provisioning a tenant VM by deploying a logical switch to the Hyper V hosts where the tenant VMs will reside. As part of defining the logical switch, you can specify port classifications along with the corresponding virtual ports.

Module 7

Creating and managing virtual machines by using Virtual Machine Manager

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Lesson 1

VM management tasks

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Question and Answers

Categorize each item below.

Items	
1	Start
2	Select integration services
3	Add Fibre Channel array
4	Pause
5	Set smart page file location
6	Add or remove servicing windows
7	Store in library
8	Adjust RAM while VM is running
9	Set self-service quota points

Category 1		Category 2		Category 3
VM ribbon tasks in the VMM console		VM settings in the Hyper-V console		VM properties in the VMM console

Answer:

Category 1		Category 2		Category 3
VM ribbon tasks in the VMM console		VM settings in the Hyper-V console		VM properties in the VMM console
Start Pause Store in library		Select integration services Set smart page file location Adjust RAM while VM is running		Add Fibre Channel array Add or remove servicing windows Set self-service quota points

Demonstration: Operating VMs**Demonstration Steps****Set the Management network on LON-SVR1 and LON-SVR2**

1. On **LON-HOST1**, on the desktop, double-click the **Virtual Machine Manager Console**, and then click **Connect**.
2. In the **Virtual Machine Manager** console, in the **Fabric** workspace, click the **All Hosts** node.
3. In the details pane, right-click **lon-svr1.adatum.com**, and then click **Properties**.
4. In the **lon-svr1.adatum.com Properties** window, click **Hardware**.
5. In the **Hardware** pane, scroll to the **Network adapters** section, and then click the network adapter corresponding to **Microsoft Hyper-V Network Adapter – Ethernet**.
6. On the **Network adapter details** page, ensure that both the **Used by management** and **Available for placement** check boxes are selected.
7. Expand **Microsoft Hyper-V Network Adapter – Ethernet** and then click **Logical network connectivity**.
8. In the **Logical network connectivity** pane, select the **Management** check box, click **OK**, and then click **OK** to close the **lon-svr1.adatum.com Properties** window.
9. In the **Details** pane, right-click **lon-svr2.adatum.com**, and then click **Properties**.
10. In the **lon-svr2.adatum.com Properties** window, click **Hardware**.
11. In the **Hardware** pane, scroll to the **Network adapters** section, and then click the network adapter corresponding to **Microsoft Hyper-V Network Adapter – Ethernet**.
12. On the **Network adapter details** page, ensure that both the **Used by management** and **Available for placement** check boxes are selected.
13. Expand **Microsoft Hyper-V Network Adapter – Ethernet**, and then click **Logical network connectivity**.
14. In the **Logical network connectivity** pane, select the **Management** check box, click **OK**, and then click **OK** to close the **lon-svr2.adatum.com Properties** window.

Use the VMM console to operate virtual machines

1. On **LON-HOST1**, in the **VMM** console, select the **VMs and Services** workspace. Ensure that the **VMs** object is selected in the ribbon.

2. In the **VMs and Services** pane, expand **All Hosts**, expand **London Hosts 1**, and then click **LON-SVR1**.
3. In the **VMs** pane, click **LON-TEST1**. Explain that clicking the VM in the **VM's details** pane opens the **Virtual Machine** tab in the ribbon. Explain that you can also click the **Virtual Machine** tab directly to open it.
4. Show the options available in the ribbon on **LON-TEST1**. Because the VM is not running, many icons will appear dimmed.
5. In the ribbon, click the **Power On** icon.
6. While **LON-TEST1** is starting up, point out the lower details pane, which gives a summary of information about the selected VM.
7. In the ribbon, click the **Connect or View** icon, and then in the drop-down list box, click **Connect via Console**.
8. In the **Virtual Machine Viewer – LON-TEST1 on server LON-SVR1.adatum.com** window, in the command window, type the following command, and then press Enter:

```
ipconfig /all
```

9. Minimize the **Virtual Machine Viewer – LON-TEST1 on server LON-SVR1.adatum.com** window.
10. In the **VMM** console, in the ribbon, click the **Pause** button.
11. In the pop-up window, click **Yes**.
12. Verify that the status indicates **Paused**, which might take a moment or two. In the ribbon, you can also click the **Refresh** icon.
13. Switch to the **Virtual Machine Viewer – LON-TEST1 on server LON-SVR1.adatum.com**, which is the single server icon on the taskbar. Point out that the VM appears dimmed, and cannot be accessed.
14. Minimize the **Virtual Machine Viewer – LON-TEST1 on server LON-SVR1.adatum.com**.
15. In the **VMM** console, verify that **LON-TEST1** is still selected, and then in the ribbon, click the **Resume** icon.
16. Return to the **Virtual Machine Viewer – LON-TEST1 on server LON-SVR1.adatum.com**, and note that the VM is accessible now (it no longer appear dimmed).
17. On the top bar of the **Virtual Machine Viewer – LON-TEST1 on server LON-SVR1.adatum.com**, click **File**, and then click **Exit**.
18. In the ribbon, click the **Manage Checkpoints** icon. Explain to the students that you will discuss more about checkpoints in a later topic.
19. In **LON-TEST1 Properties**, in the console tree, beginning with the **General** tab, go through each tab and provide students with a broad overview of what actions they can take on that tab.
20. After reviewing the tabs, click **Cancel**.
21. Point out to students that the **Delete** icon on the ribbon appears dimmed, as it is still running and has yet not been shut down. Explain that selecting **Delete** removes the VM from both the console and the host, and it deletes the VM's virtual hard disk (or disks) and files.
22. As time permits, click any additional icons on the ribbon and describe their functionality.
23. Explain that on the ribbon, students can click the **Shutdown** icon to turn off a VM that is running a full operating system. Mention that this is the proper way to turn off a VM that is running a full

operating system. For the demonstration, even though **LON-TEST1** is running Windows Preinstallation Environment (Windows PE), click **Shutdown**. A pop-up window appears explaining that any connected users will lose service. In the pop-up window, click **Yes**. The shutdown attempt will fail. Because **LON-TEST1** is running Windows PE, it does not have the Integration Services installed, and it cannot process the shutdown operation from the VMM console. Click the **Power Off** button on the **Virtual Machine** tab in the **VMs and Services** workspace. In the pop-up window, click **Yes**.

24. After **LON-TEST1** stops, on the ribbon, click the **Create** icon.
25. Explain to students that in this case you cannot make a VM template from **LON-TEST1**, as it is running only Windows PE.
26. On the ribbon, click the **Home** tab, and then click the **Create Virtual Machine** icon.
27. Explain to students how you can make a new VM from here. Tell them that you will explain the process for creating VMs, cloning, and templates functionality in a later topic.

Demonstration: Migrating VM storage

Demonstration Steps

1. On **LON-HOST1**, open **Hyper-V Manager**, right-click **LON-MOVE1**, and then click **Settings**.
2. In **Settings for LON-MOVE1 on LON-HOST1**, under **IDE Controller 0**, click **Hard Drive**.
3. In the **Hard Drive** section, point out that **LON-MOVE1** is using the **LON-MOVE1.vhdx** virtual hard disk that is stored locally, and then click **OK**.
4. In **Hyper-V Manager**, right-click **LON-MOVE1**, and then click **Move**.
5. In the **Move "LON-MOVE1" Wizard**, on the **Before You Begin** page, click **Next**.
6. On the **Choose Move Type** page, select **Move the virtual machine's storage**, and then click **Next**.
7. On the **Choose Options for Moving Storage** page, select **Move only the virtual machine's virtual hard disks**, and then click **Next**.
8. On the **Select Items to Move** page, point out that disk **LON-MOVE1.vhdx** is selected, and then click **Next**.
9. On the **Choose a new location for attached virtual hard disk** page, in the **Folder** text box, type **\\LON-SVR3\Share\LON-MOVE1**, and then click **Next**.
10. On the **Completing Move Wizard** page, click **Finish**.
11. In **Hyper-V Manager**, right-click **LON-MOVE1**, and then click **Settings**.
12. In **Settings for LON-MOVE1 on LON-HOST1**, under **IDE Controller 0**, click **Hard Drive**, and point out that **LON-MOVE1.vhdx** is stored on a network share on **LON-SVR3**. Click **Cancel** in the **Settings for LON-MOVE1** window.
13. In **Hyper-V Manager**, right-click **LON-MOVE2**, and then click **Settings**.
14. In **Settings for LON-MOVE2 on LON-HOST1**, under **IDE Controller 0**, click **Hard Drive**. Point out that the hard drive is stored on drive **C**.
15. In the navigation pane, click **Checkpoints**.
16. Point out that checkpoints are stored on drive **C**, and then click **OK**.
17. In the **VMM** console, in the **VMs and Services** pane, click **All Hosts**.
18. In the **VMs** pane, right-click **LON-MOVE2**, and then click **Migrate Storage**.

19. In the **Migrate Storage Wizard**, in the **Storage location for VM configuration** text box, type the drive to which the course images were expanded, followed by **:**. For example, if the course images were extracted to drive **E**, type **E:**.
20. Select **Automatically place all VHDs with the configuration**, click **Next**, and then click **Move**.
21. On **LON-HOST1**, in **Hyper-V Manager**, right-click **LON-MOVE2**, and then click **Settings**.
22. In **Settings for LON-MOVE2 on LON-HOST1**, under **IDE Controller 0**, click **Hard Drive**. Point out that the hard drive is no longer stored on drive **C**.
23. In the navigation pane, click **Checkpoints**.
24. Point out that checkpoints have also been moved and are no longer stored on drive **C**. Click **OK**.



Note: Emphasize that the virtual hard disk and checkpoints were moved while the VM was running.

Demonstration: Working with checkpoints

Demonstration Steps

Examine checkpoint properties and create production checkpoints

1. On **LON-SVR1**, open **Hyper-V Manager**.
2. In the **Hyper-V manager** console, in the details pane, right-click **LON-TEST1**, and then click **Settings**.
3. In the **Settings for LON-TEST1 on LON-SVR1** window, point out the **IDE Controller 0**, and note the virtual hard disk is **LON-TEST1.vhd**.
4. While still in **Settings**, in the **Management** section of the console tree, click **Checkpoints**.
5. In the details pane, note that the checkpoint type selected is **Production checkpoints**. Explain to the class that this is the default setting in Windows Server 2016, but you can change it here by selecting **Standard checkpoints**. Go over the other items in the window, explaining how you can turn off checkpoints entirely, or change the location in the file system where the production checkpoints are kept. Click **Cancel** when finished explaining.
6. On **LON-HOST1**, in the **VMM** console, in the workspace area, in the lower-left corner, click **VMs and Services**.
7. In the **VMs and Services** console tree, expand **All Hosts**, expand **London Hosts 1**, and then click **LON-SVR1**.
8. In the VMs details pane, click **LON-TEST1**, and in the ribbon, click the **Power On** icon.
9. In the ribbon, with **LON-TEST1** still selected, click **Create Checkpoint**.
10. In the **New Checkpoint** pop-up dialog box, in the **Description** text box, type **Demonstration of a running system's checkpoint**, and then click **Create**.
11. In the lower-left corner of the **VMM** console, click the **Jobs** workspace.
12. Explain to the students that in the **Jobs** workspace, they can see when a checkpoint is created. They can watch the job in real time by clicking the **Running** node. If the checkpoint is finished, the **Running** node will be empty. Point out selecting the **History** node which displays whether the checkpoint succeeded or failed. If a failure occurred, they can see what caused it, and ways to troubleshoot or correct that failure.
13. In the **Workspace** area, in the lower-left corner, click **VMs and Services**.

14. In **VMs and Services**, in the **London Hosts 2** host group, click the **LON-SVR2** VM.
15. In the details pane, select the **LON-TEST2** VM.
16. In the ribbon, click the **Manage Checkpoints** icon.
17. On the **LON-TEST2 Properties** page, click the **Create** button.
18. In the **New Checkpoint** pop-up dialog box, in the **Description** text box, type **Demonstration of a stopped system's checkpoint**, and then click **Create**. Point out that you can also check the **Jobs** workspace for the job status.
19. On the **Checkpoints** page, click **OK**.
20. Return to **London Hosts 1**, click the **LON-SVR1** VM, and then in the details pane, select **LON-TEST1**.
21. In the ribbon, click the **Manage Checkpoints** icon.
22. Move the cursor over the last checkpoint (timeline). Point out that the context line pop-up window has the description **Demonstration of a running system's checkpoint**. Note how it shows a green triangle. This indicates that you took the checkpoint when the system was online. Click **OK**.
23. Return to **London Hosts 2** and **LON-SVR2**.
24. In the details pane, select the **LON-TEST2** VM.
25. In the ribbon, click the **Manage Checkpoints** icon.
26. Move the cursor over the last timeline, and point out that the context line pop-up window displays the description **Demonstration of a stopped system's checkpoint**. Also, point out the red square icon, which indicates that you took the checkpoint while the system was stopped.
27. In the **LON-TEST2 Properties** dialog box, click **OK**.

Observe the checkpoint files

1. Switch back to the **20745B-LON-SVR1** VM connection window.
2. In the **Hyper-V Manager** console, click the **LON-TEST1** VM.
3. In the **Checkpoints** details pane, highlight the last timeline.
4. Right-click the **LON-TEST1** VM, and then click **Settings**. Observe the **IDE controller 0** object and note that the virtual hard disk now contains a differencing drive, with a name that starts with **LON-TEST1**, includes unique ID and ends with **.avhd** extension.

Change checkpoint to Standard, create a checkpoint, and observe files created

1. In the **Settings for LON-TEST1 on LON-SVR1** window, in the **Management** section of the console tree, click **Checkpoints**.
2. In the details pane, select **Standard checkpoints**, and then click **OK**.
3. Return to **LON-HOST1**, and in the **VMM** console, in the **VMs and Services** console tree, expand **All Hosts**, expand **London Hosts 1**, and then click **LON-SVR1**.
4. In the VMs details pane, click **LON-TEST1**, and in the ribbon, click **Manage Checkpoints**.
5. With the **Demonstration of a running system's checkpoint** object created earlier selected, click the **Delete** button, and then click **Yes** in the **Virtual Machine Manager** window, and then click **OK**.
6. Wait for the **Job Status** to show **Completed**, and then in the ribbon, click **Create Checkpoint**.
7. In the **Description** text box, type **Demonstration of a Standard running checkpoint**, and then click **Create**.
8. On **LON-HOST1**, leave the **VMM** console, open for the next demonstration.

Lesson 2

Creating, cloning, and converting VMs

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Question and Answers

Question: What source can you use to create a VM in VMM? Choose all answers that apply.

- An existing .vhd or .vhdx file (blank or preconfigured)
- An existing physical computer
- A VM template
- A service template
- A Citrix XenServer

Answer:

- An existing .vhd or .vhdx file (blank or preconfigured)
- An existing physical computer
- A VM template
- A service template
- A Citrix XenServer

Feedback: Answers 1, 3 and 4 are correct. You can deploy the new VM from an existing .vhd or .vhdx file (blank or preconfigured), a VM template, or a service template. You cannot create a VM via P2V in VMM. VMM no longer supports Citrix XenServer.

Resources

Converting a VM (V2V)



Additional Reading: To download Disk2vhd v2.01, go to "Disk2vhd v2.01" at: <https://aka.ms/as8kkc>

Demonstration: Creating and placing a new VM

Demonstration Steps

1. On **LON-HOST1**, in the **VMM** console, select **VMs and Services** workspace.
2. In the **VMs and Services** pane, expand **All Hosts**, expand **London Hosts 2** host group, and then click **All Hosts**.
3. In the ribbon, click the **Home** tab.
4. On the ribbon, click **Create Virtual Machine** and then click **Create Virtual Machine**.
5. In the **Create Virtual Machine Wizard**, on the **Select Source** page, click **Create the new virtual machine with a blank virtual hard disk**, and then click **Next**.



Note: Explain to the class that if you chose the option to use an existing VM, VM template, or virtual hard disk, then those items would have to exist already. However, in this demonstration, you are going to make a new VM.

Tell the students that four blank virtual hard disks pre-exist, created by VMM: a large and small blank.vhd, and a large and small blank.vhdx.

6. On the **Identity** page, in the **Virtual machine name** text box, type **Win2016test**.

7. In the **Description** text box, type **Test of create virtual machine functionality**, and then click **Next**.
8. On the **Configure Hardware** page, explain the various options to the students, configure **Memory** to be **512** megabytes (MB), and then click **Next**.
9. On the **Select Destination** page, note the options available.
10. Explain to the students that the option to **Deploy the virtual machine to a private cloud** appears dimmed, because you have not yet set up private cloud functionality.
11. Point out the bottom option. Explain that if you did not want to start the VM immediately, you could store it in the library for later use. In this case, the VM is not assigned to a host. If you wish to start the VM at a future date, you would need to assign it at that time to a host or cloud. Because you are placing the VM on a host, accept the default **Place the virtual machine on a host** option, and then click **Next**.
12. On the **Select Host** page, wait until VMM rates the hosts. Point out that **All Hosts** is selected, and that you can see all three virtualization hosts in your environment.
13. Point out the graphical star **Rating** column. The intelligent placement functionality of VMM considers various factors such as performance, space, and number of VMs on each host, to determine the rating. The stars are colored to show how one host compares to another.
14. Select **LON-SVR2**, and then click **Next**.
15. Point out to students that on the **Configure Settings** page you can select the VM path—that is, the location on the host hard drive where you want the VM files to reside. Explain to students that you can have multiple paths, and you can pre-populate them, so they appear in the drop-down list box. You can also use the **Browse** button to browse to any location in which you want to store the VM files. Accept the defaults on this page, and then click **Next**.
16. Point out that on the **Select Networks** page, you can assign your network adapter to a VM network, virtual switch, port classification, and virtual local area network (VLAN). Explain that you did not do so at this point because you can address it later. After explaining the settings on this page, click **Next**.
17. Discuss the fact that on the **Add Properties** page, you can specify the behavior that you want the VM to take when the host machine starts or stops. You can also specify the operating system that you can install on the VM. Explain that if the operating system choice you are looking for is not available, you should select the **Other** category. After explaining the settings on this page, click **Next**.
18. On the **Summary** page, in the **Confirm the settings** section, click the **View Script** button.
19. Show students that this opens **Notepad** and displays the Windows PowerShell script that is used to create the VM, and cmdlets and parameters for all the options that you have chosen. Save the script for documentation purposes, or to recreate the VM again later. You can also save the script, and by altering a few parameters, use it for a different VM.
20. In **Notepad**, on the **File** menu, click **Save As**.
21. In the **Save As** pop-up window, in **File name** text box, type **CreateDemoVM.ps1**.
22. In the **Save as type** drop-down list, select **All Files (*.*)**, click **Save** and then close **Notepad**.
23. Point out the **Start the virtual machine after deploying it** check box at the bottom of the page.
24. Explain that that if you added the .iso image in the virtual DVD in the **Configure Hardware** page, you can have the VM begin to install the operating system as soon as it is created. For the purposes of this demonstration, you will not do so.
25. Click the **Create** button. Point out that a job starts, with multiple steps to create the VM, and a **Jobs** pop-up window will display.

26. When the last job completes, close the **Jobs** pop-up window.
27. In the **VMM** console, in the **VMs and Services** pane, click **LON-SVR2**.
28. In the **VMs** details pane, point out that **Win2016test** VM is listed.

Demonstration: Performing VM cloning

Demonstration Steps

1. On **LON-HOST1**, in the **VMM** console, select **VMs and Services** workspace.
2. In the **VMs and Services** pane, expand **All Hosts**, expand **London Hosts 2**, and then click **LON-SVR2**.
3. In the **VMs** pane, click **LON-PROD2**, and then point out that on the ribbon the **Virtual Machine** tab is shown and selected.
4. In the ribbon, click **Create** and then click **Clone**.
5. In the **Create Virtual Machine Wizard**, point out that the wizard does not have as many nodes in its console tree as the wizard that you would use to create a new VM.
6. On the **Identity** page, point out how you can add a VM name that identifies the VM to VMM. The name does not have to match the computer name of the VM.
7. In the **Virtual machine name** text box, type **LON-CLONE** and then click **Next**.
8. Point out that the **Configure Hardware** page has a considerable amount of options. However, these options appear dimmed because they are set from the Default profile. Explain to the students that they still can change the hardware profile in the drop-down list box, if any other profiles aside from the Default profile exist. Then click **Next**.
9. On the **Select Destination** page, point out that you can deploy the cloned VM to a cloud, to a host, or you can store it in a library. Explain that the option to deploy the VM to the cloud is currently not available because no cloud is managed by Virtual Machine Manager. In this case, you will place it on a host, which is the default setting. Click **Next**.
10. On the **Select Host** page, explain how VMM rates the hosts. Select **LON-SVR1**, and then click **Next**.



Note: If any of the host Hyper-V servers, (**LON-SVR1**, **LON-SVR2** or **LON-HOST1**) fail to appear in **the Select Host** page, click **All Hosts** at the top right dropdown list. This should refresh the list of available virtualization hosts.

11. Point out that because you are making copies of the virtual hard disk and configuration files, it is best to deploy these copies in a different directory. For this demonstration, accept the VMM selection on the **Select Path** page, and then click **Next**.
12. On the **Select Networks** page, point out that you can select options that are like the options that were available when you created a new VM. Click **Next**.
13. On the **Add Properties** page, point out that you can set the actions to take when the Hyper-V host starts, and select the operating system for the cloned VM. Click **Next**.
14. On the **Summary** page, point out the **View Script** button in the upper-right corner. VM
15. Point out the **Start the virtual machine after deploying it** check box. In this demonstration, we will not start the VM.
16. On the **Summary** page, click **Create**.

17. Verify that the **Jobs** pop-up window displays, and in it are several steps detailing the VM cloning steps.
18. While you wait for the cloning job to finish, talk about some of the steps you might take to uniquely identify the cloned VM.



Note: You will see a “Completed w/Info” warning about hardware changes being ignored. This is normal behavior, and you may proceed.

19. After the cloned VM is created successfully, close the **Jobs** window.
20. In the **VMM** console, in **VMs and Services** pane, click **LON-SVR1**.
21. Point out that the **LON-CLONE** VM is listed. Point out as well that it is not running, as we did not select that option in the **Summary** page. The VM **Status** is **Stopped**.

Module Review and Takeaways

Best Practice

When deploying a clone from the VMM library to a host, use answer files and profiles to reduce administration overhead.

Use the Azure Site Recovery tool for converting physical and VMs.

Review Question

Question: Can you create a production checkpoint of a VM that you imported from Windows Server 2012 R2?

Answer: No. You can create a production checkpoint only of VMs with configuration version 6.2 or newer. VMs on Windows Server 2012 R2 use configuration version 5.0. After you import the VM to Windows Server 2016, you must first upgrade its configuration version before you can create a production checkpoint.

Tools

The following list are tools that you need for this module:

- Checkpoint tool. You can find this in the **Hyper-V Manager** console.
- Live cloning. You can find this in the **VMM** console.
- Sysprep.exe. This is a part of the Windows operating system for Windows Clients and Servers. You can find this in the Windows\System32\Sysprep directory.

Common Issues and Troubleshooting Tips

Common Issue	Troubleshooting Tip
When deploying a clone from the VMM library, the host file location cannot be found.	Ensure that the destination host has been installed as a host in VMM.

Lab Review Questions and Answers

Lab: Creating and managing VMs by using System Center VM Manager

Question and Answers

Question: After you complete the deployment of the clone in the lab, it was no longer a part of the domain. What are some ways you could have provided domain membership without configuring it manually?

Answer: You could apply an answer file during deployment.

Question: You create a production checkpoint of the running VM. What will happen if you later revert the VM to that production checkpoint? What will happen if you revert the VM to a standard checkpoint?

Answer: A standard checkpoint includes the memory state of the running VM. Later, if you revert to the standard checkpoint, the VM will be in the exact same state, and it will be running.

A production checkpoint does not include VM memory. When creating a production checkpoint, the Hyper-V Manager utilizes VSS in VM to flush VM memory to the disk, and then creates the checkpoint. A production checkpoint is crash consistent. When you revert to a production checkpoint, the VM is turned off.

Module 8

Managing clouds in Microsoft System Center Virtual Machine Manager

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Lesson 1

Introduction to clouds

Contents:

Question and Answers

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Question and Answers

Question: What are some of the benefits of cloud computing compared to classic physical server configurations?

Answer: Answers might vary. However, the responses should cover increased elasticity, pooled resources, and the direct offering of specific services without the requirements of traditional datacenter structures.

Question: What is the main difference between on-premises private clouds and hosted private clouds? How do hosted private clouds differ from hybrid clouds?

Answer: On-premises private clouds are built from components within the organization's datacenters. Hosted private clouds are built with components that an external provider outside the business hosts. Hybrid clouds combine components from both an organization's datacenter and an external provider.

Lesson 2

Creating and managing a cloud

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Question and Answers

Question: How does chargeback benefit application owners?

Answer: Chargeback helps application owners to understand exactly which cloud resources they consume and then adjust that consumption to better reflect their business needs.

Resources

Managing a cloud

 **Additional Reading:** For more information, refer to Application Performance Monitoring using Application Insights for SCOM: <https://aka.ms/drcir6>.

Demonstration: Creating a cloud

Demonstration Steps

1. On **LON-HOST1**, on the taskbar, click **Virtual Machine Manager**, and then click **Connect**.
2. In the **VMs and Services** pane, expand **All Hosts**, expand **London Hosts 1**, right-click **LON-SVR1**, and then click **Properties**.
3. In the **LON-SVR1.Adatum.com Properties** window, click **Hardware**.
4. In the **Hardware** pane, scroll to the **Network adapters** section. Below **Microsoft Hyper-V Network Adapter – Ethernet**, click **Logical network connectivity**.
5. In the **Logical network connectivity** pane, select the **Management** check box, click **OK**, and then click **OK** to close the **LON-SVR1.Adatum.com Properties** window.
6. In the **VMs and Services** pane, expand **London Hosts 2**, right-click **LON-SVR2**, and then click **Properties**.
7. In the **LON-SVR2.Adatum.com Properties** window, click **Hardware**.
8. In the **Hardware** pane, scroll to the **Network adapters** section. Below **Microsoft Hyper-V Network Adapter – Ethernet**, click **Logical network connectivity**.
9. In the **Logical network connectivity** pane, select the **Management** check box, click **OK**, and then click **OK** to close the **LON-SVR2.Adatum.com Properties** window.
10. In the **Virtual Machine Manager** console, on the ribbon, click **Create Cloud**.
11. In **Create Cloud Wizard**, on the **General** page, in the **Name** text box, type **DemoCloud**, and then click **Next**.
12. On the **Resources** page, in the **Select the resources for this cloud** section, select the **All Hosts** check box, and then click **Next**.
13. On the **Logical Networks** page, point out the available logical network. In the **Logical networks** area, select the **Management** check box, and then click **Next**.
14. On the **Load Balancers** page, point out that the only selectable item on this page is **Microsoft Network Load Balancing (NLB)**, and then click **Next**.
15. On the **VIP Templates** page, click **Next**.
16. Point out that the **Port Classifications** page has many classifications that are available to use for the VMs that you deploy from this private cloud. Select the following check boxes, and then click **Next**:
 - o **Guest Dynamic IP**

- **Host management**
 - **Low bandwidth**
 - **Medium bandwidth**
 - **High bandwidth**
17. On the **Storage** page, in the **Storage classifications** area, select the **Local Storage** check box, and then click **Next**.
 18. On the **Library** page, point out that you can assign read-only shares to the private cloud on this page. These read-only shares are where administrators can store read-only resources (such as .iso files) that they want to make available to self-service users.
 19. Next to the **Stored VM path** area, click **Browse**.
 20. Under **LON-HOST1.Adatum.com**, click the **Base** share, click **OK**, and then click **Next**.
 21. On the **Capacity** page, point out that you can view and set the aggregate capacity for the cloud.
 22. For the purpose of creating the **DemoCloud** cloud, clear the **Use Maximum** check boxes, configure the following values, and then click **Next**:
 - **Memory (GB): 8**
 - **Storage (GB): 500**
 - **Virtual machines: 3**
 23. On the **Capability Profiles** page, point out the profiles (**ESX Server** and **Hyper-V**). Select the **Hyper-V** check box, and then click **Next**.
 24. On the **Replication Groups** page, click **Next**.
 25. On the **Storage QoS Policies** page, click **Next**.
 26. On the **Summary** page, in the upper-right corner, click **View Script**.
 27. In Notepad, explain the PowerShell cmdlets that are used in the script, but do not save the script.
 28. Close Notepad.
 29. On the **Summary** page, click **Finish**.
 30. In the **Jobs** window, when the **Create new Cloud** task completes, close this window.
 31. In the console tree, under **VMs and Services**, under the **Clouds** node, click **DemoCloud**. On the ribbon, click the **Overview** icon. This populates the details pane with information about the cloud. Many of these fields will have no values until you start using the cloud and adding items such as VMs and services to them.

Lesson 3

Creating user roles in Virtual Machine Manager

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Question and Answers

Question: You have allocated 900 GB of memory in the Virtual Machine Manager cloud that will be used by the Development team. Based on your estimates, this should be sufficient to deploy all of the necessary Development team VMs. You have configured a role-level quota as part of the role definition for the Development users. However, soon afterward, you find out that half of the Development team members cannot deploy their VMs because of a lack of available memory. What is most likely happening, and how would you resolve the issue?

Answer: Most likely, some of the Development users consumed all the allocated memory when deploying their VMs. You should consider creating member-level quotas to prevent the users from using more memory than originally intended for their VMs. In addition, you could create a VM template with the amount of memory per VM that you used for your estimate and restrict the permissions of the Development users to deploy (only from a template).

Demonstration: Creating and using a user role in Virtual Machine Manager

Demonstration Steps

1. On **LON-HOST1**, on the taskbar, click **Virtual Machine Manager**.
2. In the **Virtual Machine Manager** console, select the **Settings** workspace.
3. In the **Settings** pane, click **User Roles**. Point out that only one user role, the **Administrator** role, currently exists.
4. Point out and discuss the various graphical interface elements appearing on the **Home** tab of the ribbon:
 - **Create User Role.** Starts **Create User Role Wizard**.
 - **Create Run As Account.** Creates a **Run As** account, which allows you to specify the necessary credentials for specific functions.
 - **Create Servicing Window.** Provides a method for scheduling servicing outside of Virtual Machine Manager.
 - **Import Console Add-in.** Lets you install add-ins from the **Virtual Machine Manager** console to allow customers and partners to create extensions for the **Virtual Machine Manager** console.

These extensions perform specific actions or display custom views.

- **Backup.** Backs up Virtual Machine Manager to a Universal Naming Convention share or to a local path in Microsoft SQL Server.
 - **PowerShell.** Opens a PowerShell command window, which connects to the same Virtual Machine Manager server as the console.
 - **Jobs.** Opens a window that displays information about actions taken.
 - **PRO.** Opens the **Performance and Resource Optimization (PRO) tips** window.
 - **Delete.** Deletes the user role that you selected in the **User Roles** details pane.
This button is dimmed unless a user role has been selected. You cannot select the **Administrator** role.
 - **Properties.** Opens the **Properties** dialog box for the user role selected in the **User Roles** details pane.
5. On the **Home** tab, click **Create User Role**.
 6. In **Create User Role Wizard**, on the **Name and description** page, in the **Name** text box, type **DemoRole**, and then click **Next**.

7. On the **Profile** page, point out the four options: **Fabric Administrator (Delegated Administrator)**, **Read-Only Administrator**, **Tenant Administrator**, and **Application Administrator (Self-Service User)**. Select **Application Administrator (Self-Service User)**, and then click **Next**.
8. On the **Members** page, explain that although members can include Active Directory user accounts, it is always preferable to use group accounts.
9. To open the **Select Users, Computers, or Groups** dialog box, click **Add**. In the **Enter the object names to select (examples)** text box, type **IT**, click **OK**, and then click **Next**.
10. On the **Scope** page, in the **Scope** pane, select the **DemoCloud** check box, and then click **Next**.
11. On the **Quotas for the DemoCloud cloud** page, explain that this page is where you specify quotas for various resources that apply to user role members. Click **Next**.
12. On the **Networking** page, click **Next**.
13. On the **Resources** page, click **Browse**, click the **VMMLibrary** share, click **OK**, and then click **Next**.
14. On the **Permissions** page, discuss different permissions that you can delegate. Don't select any check boxes and click **Next**.
15. On the **Summary** page, point out that this is the last page of the wizard. Point out the **View Script** button in the upper-right corner and explain its use.
16. On the **Summary** page, click **Finish**.
17. When the **Jobs** pop-up window appears, wait for all the jobs to complete, and then close the window.
18. In the **Settings** workspace, in the **User Roles** details pane, point out that the **DemoRole** object is listed.
19. Select the **VMs and Services** workspace and point out that the **Administrator** role can see **DemoCloud**, in addition to the **London Hosts 1** and **London Hosts 2** host groups.
20. On **LON-HOST1**, on the taskbar, right-click **Virtual Machine Manager**, and then click **Virtual Machine Manager Console**.
21. In the **Connect to Server** window, select **Specify credentials**.
22. In the **User name** text box, type **Adatum\Abbi**, in the **Password** text box, type **Pa55w.rd**, and then click **Connect**.
23. In the **Virtual Machine Manager** console, point out the title bar, which starts with **DemoRole**. Explain that this is because you connected as a user in that role.
24. Point out that in the **VMs and Services** pane, you can see the **DemoCloud** cloud. In addition, point out that you cannot see any host group or virtualization servers.
25. Right-click **DemoCloud** and point out that the **Create Virtual Machine** option is dimmed. Explain that this is because you didn't assign permissions to the **DemoRole** user role.

Module Review and Takeaways

Review Questions

Question: What is the main difference between private clouds and a set of virtual machines that users can access and administer?

Answer: With a private cloud, you can offer resources to users when they need them and automate all or some of the virtual machine provisioning. Rather than requiring human interaction to make a new set of virtual machines available for users, a new resource can be allocated from a private cloud's predefined resource pool.

Question: What aspects should you consider before you delete a private cloud?

Answer: Before you delete a private cloud, you must ensure that no objects exist that reference the private cloud. These objects can include services, service deployment configurations, user roles, and deployed or stored VMs.

Question: You need to allow non-IT users to make their own virtual machines, but you want to restrict the amount of computing resources that the users will be able to consume. What would be the appropriate user role profile to use, and what specific settings should you apply?

Answer: You should use the Application Administrator profile and ensure that on the **Quotas for the CloudName cloud** page, you clear the **Maximum** selection for the **Virtual Machines** rows.

Tools

- Use **Create Cloud Wizard** to create a private cloud in Virtual Machine Manager
- Use **Create User Roles Wizard** to create collections of users that can be assigned permissions to all or some private clouds. You can also select permission for what can be done by the user role on resources in that private cloud.

Common Issues and Troubleshooting Tips

Common Issue	Troubleshooting Tip
A user cannot create a VM in a specific cloud.	<p>Make sure that the user belongs to a user role assigned to that cloud.</p> <p>Make sure that the quotas for that cloud have not been exceeded.</p> <p>Make sure that the user role has the permissions to create a VM.</p>
You cannot delete a cloud because it has s that you want to keep.	On the General page of the virtual machine properties, use the Cloud drop-down list box to select None – not associated .
You have set the quotas for a particular cloud, and the self-service users have consumed them all, but need to use more. You have added a new host, but they still cannot create more virtual machines.	Check the user role's quotas properties for that cloud and adjust them accordingly.

Lab Review Questions and Answers

Lab: Managing clouds in Virtual Machine Manager

Question and Answers

Question: Why was Dawn's first attempt to create **DevCloudVM2** fail?

Answer: Dawn is member of the **DevRole** user role that was assigned a virtual machine quota of 1. So you were able to create only one virtual machine – when you tried to create a second virtual machine, the attempt failed.

After modifying the virtual machine quota for the **DevRole** user role, you were able to create a second virtual machine, **DevCloudVM2**.

Question: Why wasn't Dawn able to see and access many objects in the Virtual Machine Manager console, while Administrator was able to see and access these objects?

Answer: This was because Dawn was assigned the **Application Administrator** user role. The functionality available from the **Virtual Machine Manager** console always depends on the user role's permissions. Items in the user interface are automatically removed if the current user does not have the permissions to run the corresponding actions.

Module 9

Managing services in Virtual Machine Manager

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Lesson 1

Overview of services in VMM

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Question and Answers

Question: A prominent challenge to using apps on VMs is over subscribing. What does this concept refer to?

- () Having to wait for the physical host to start before you can start the virtual machine.
- () The need to carefully attend to resource allocation to ensure you're properly utilizing your virtual resources when they're needed.
- () The security concerns when running apps in a private cloud.
- () Upgrading apps on a failover cluster.
- () Patching apps on multiple systems.

Answer:

- () Having to wait for the physical host to start before you can start the virtual machine.
- (✓) The need to carefully attend to resource allocation to ensure you're properly utilizing your virtual resources when they're needed.
- () The security concerns when running apps in a private cloud.
- () Upgrading apps on a failover cluster.
- () Patching apps on multiple systems.

Resources

Common scenarios for using services



Additional Reading: For more information about these common scenarios, refer to Common Scenarios for Services in VMM: <https://aka.ms/iujamj>.

Lesson 2

Creating and managing services in VMM

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Question and Answers

Question: Put the following steps in the correct order.

	Steps
	Select the tier based on the deployment order
	Create a new virtual machine from a template
	Power on and wait for the virtual machine to start
	Install the VMM guest agent
	Application profile level preinstall GCE
	Application preinstall GCE
	Install the application
	Application post-install GCE
	Application profile level post-install GCE

Answer:

	Steps
1	Select the tier based on the deployment order
2	Create a new virtual machine from a template
3	Power on and wait for the virtual machine to start
4	Install the VMM guest agent
5	Application profile level preinstall GCE
6	Application preinstall GCE
7	Install the application
8	Application post-install GCE
9	Application profile level post-install GCE

Demonstration: Working with Service Designer

Demonstration Steps

1. On **LON-HOST1**, on the taskbar, double-click the **Virtual Machine Manager** console, select the **Use current Microsoft Windows session identity** option, and then click **Connect**.
2. In the **VMM** console, click the **Library** workspace.
3. On the ribbon, on the **Home** tab, click the **Create Service Template** icon.
4. In the **New Service Template** dialog box, review the various configurable items with the class. Point out the **View Script** button. Explain how you can use this to save a script of the various Windows

PowerShell cmdlets that would perform the same actions as this user interface. Point out the different patterns in the **Patterns** section. Show students how, as you click each pattern, the **Description** line gives a brief explanation of the pattern's functionality.

5. In the **New Service Template** dialog box, in the **Name** field, type **Demo Service Template**. In the **Release** section, type **1**. In the **Patterns** section, click the **Single Machine (v1.0)** icon, and then click **OK**.
6. In the **Virtual Machine Manager Service Template Designer – Demo Service Template 1** console, point out the name that you selected, **Demo Service Template**. It should be part of the overall name, as this is what you are currently designing.
7. Point out the **Designer canvas** area. Explain to students that this is the console's central part and that it has various blocks that connect to each other. Point out the text that appears dimmed with a large down arrow. This provides advice on how you can drag and drop various virtual machine templates into the designer, either in the blank canvas area itself to make a new tier, or onto the existing template to replace its tier.
8. Note the box labeled **Single Tier**. Point out the red circle with an exclamation mark on it, click the red mark, and then observe the text below that explains why it has this warning. There is no virtual hard disk or virtual machine network present in the template. You can make one by changing the properties of the **Single Tier** virtual machine.
9. Right-click the **Single Tier** virtual machine name, and then click **Properties**.
10. In the **Single Tier Properties** window, explain that this is where you make changes to the **Single Tier** hardware configuration. Select the various pages in the properties as follows:
 - a. **General**. Use this page to set the name and description, and prevent the virtual machine from migrating automatically. Additionally, use this page to allow the scaling out of a single tier, and to create and set the tier's availability. In the **Name:** box, type **DemoServiceVM**.
 - b. Select the **This machine tier can be scaled out** option, and then in the **Maximum instance count**, type **3**.
 - c. **Hardware Configuration**. Use this page to set the various hardware configurations that you typically set for a new virtual machine in the **VMM** console, including:
 - i. In the **Compatibility** section, select the **Hyper-V** check box.
 - ii. In the console tree, in the **Bus Configuration** section, click **IDE Devices**.
 - iii. Click the green plus sign named **New**, and then click **Disk**.
 - iv. In the **Virtual Hard Disk** details area, click **Browse**.
 - v. In the **Select a virtual hard disk** pop-up window, click **Base17C-WS16-1607.vhd** that is stored on the **lon-svr3.adatum.com** server, and then click **OK**.
 - vi. Select **Create a differencing disk using the specified disk as the parent**.
 - vii. In the **Hardware Configuration** console tree, scroll down, and in the **Network Adapters** section, click **Network Adapter 1: Not connected**.
 - viii. In the **Network Adapter 1** details pane, click the **Connected to a VM network** option, and then click **Browse**.
 - ix. In the **Select a VM Network** dialog box, click **Management**, and then click **OK**.
 - d. **OS Configuration**. Use this page to set the various OS configurations that you typically set for a new virtual machine, including:

- i. In the **Operating system** drop-down list, click **Windows Server 2016 Datacenter**. Point out the other items that you can select, including the name of the computer, the local administrator password, the product key, and a time zone. Note the **Roles and Features** area, in which you can add roles and features that can run on a computer running Windows Server. Also, explain that you can join a domain and appear in a workgroup. Point out the **Scripts** area, where you can provide Answer File and even Run Once commands.
 - ii. **Identity Information**. Type **LON-DEMO##**
 - iii. **Admin Password**. Select the **Specify the password of the local administrator account** option.
 - iv. **Password** and **Confirm Password**. Type **Pa55w.rd**
 - e. **Application Configuration**. Explain that you can use this page to add applications and scripts that will run on the virtual machine. Under the **Application profile** list, point out three sections—**OS Compatibility**, **Applications**, and **Scripts**—and explain the available options. In the **Application profile** drop-down list, select **None – do not install any applications**.
 - f. **SQL Server Configuration**. By default, the **SQL Server profile** drop-down list is set to **None – no SQL Server configuration settings**. For the purpose of this demonstration, click **Default – create new SQL Server configuration settings**. Click the **SQL Server Deployment** icon, and note the various settings that you can configure. Point out the **Instance name** area that lets you specify a **SQL Server Instance**. Change the drop-down list box selection back to **None – no SQL Server configuration settings**.
 - g. **Custom Properties**. You can use this page to add various custom properties. Click the **Manage Custom Properties** button, and show the various configurable items in the pop-up window. Click **Cancel** when done.
 - h. **Settings**. You can use this page to specify the number of points to apply towards an owner's virtual machine quota, when a virtual machine is assigned to a self-service user.
 - i. **Dependencies**. Because this is a default template, note that it displays **No dependencies found**.
 - j. **Validation Errors**. This section lists any validation errors. Finally, point out the **View Script** button in the lower left part of the window. Explain the usefulness of keeping Windows PowerShell scripts to document the settings. At the bottom of the **Single Tier Properties** window, click **OK**.
11. In the **Virtual Machine Manager Service Template Designer – Demo Service Template 1** console, point out that the **Management** block has an arrow connected to the **NIC 1** box, and the arrow is crossing over the **DemoServiceVM** box. Move the **Management** box and slide it straight down so it is alongside and parallel to the **NIC 1** box so that the arrow is not crossing over the **DemoServiceVM** box.
 12. Do not close any windows, but end the demonstration at this point. Explain that you will continue deploying the service in a subsequent demonstration.

Demonstration: Deploying a service

Demonstration Steps

1. On **LON-HOST1**, in **Virtual Machine Manager Service Template Designer – Demo Service Template 1**, on the **Home** tab, click the **Save and Validate** icon, and then click the **Configure Deployment** icon.
2. In the **Select name and destination** window, in the **Name** text box, type **Demo Service**, in the **Destination** drop-down list, select **London Hosts 1**, and then click **OK**.

3. In the **Deploy Service – Demo Service** window, click **Refresh Preview**. Point out that refreshing the preview updates the display and removes the warning indicating that no suitable host is available.
4. Point out that placement ratings dictate which host is selected for the deployment. In this case, the selected host is **LON-SVR1**.
5. On the ribbon, click the **Deploy Service** icon.
6. In the **Deploy service** dialog box, point out the **View Script** button, and then click **Deploy**.
7. When the **Jobs** window appears, point out that you can see that the **Create Service Instance** job is running. Note that this step takes several minutes to complete.
8. On **20745B-LON-SVR1**, open the **Hyper-V Manager** console, where you should see the virtual machine name listed as **LON-DEMO01**.
9. On **LON-HOST1**, close the **Jobs** window, but leave the **VMM** console open for the next demonstration.

Demonstration: Scaling out and updating a service

Demonstration Steps

1. On **LON-HOST1**, in the **VMM** console, select the **VMs and Services** workspace.
2. In the **VMs and Services** pane, click **All Hosts**.
3. On the **Home** tab of the ribbon, click the **Services** icon.
4. In the **Services** pane, click **Demo Service**. Point out that you want to scale out the service.
5. On the **Service** tab of the ribbon, click the **Scale Out** icon. This opens the **Scale Out Tier Wizard**.
6. On the **Select Tier** page, point out the **Tier details** section and explain that it shows the number of virtual machines currently deployed. It also shows the minimum and maximum tier sizes.
7. On the **Select Tier** page, click the **Tier** drop-down list box, point out that only the **DemoServiceVM** tier is available, and then click **Next**.
8. On the **Specify Virtual Machine Identity** page, do not enter a name for the new virtual machine that you are creating, and then click **Next**.
9. On the **Select host** page, ensure that **LON-SVR1.Adatum.com** is selected, and then click **Next**.
10. On the **Configure Settings** page, click **Identity Information** in the settings tree, and in the **Computer name** text box, type **LON-SCALE01**, and then click **Next**.
11. On the **Add Properties** page, click **Next**.
12. On the **Summary** page, click **Scale Out**.
13. The **Jobs** window opens and shows the **Create virtual machine** task.
14. On **LON-SVR1**, in **Hyper-V Manager**, point out that the additional virtual machine, named **LON-DEMO02**, was created when the service scaled out.



Note: Because the scale-out process can take several minutes, do not wait for it to finish. Instruct students to start the lab.

Module Review and Takeaways

Best Practice

When you create a tier, you specify the default, minimum, and maximum values for the number of virtual machine instances that you will allow in the tier. Use more than one for a maximum instance if you ever plan on using the template again.

By enabling automatic scale-out, you can manage application peak loads easily by adding more virtual machines to run an application as load increases.

Review Question

Question: In VMM, what is an upgrade domain?

Answer: An upgrade domain is an object that allows you to minimize service interruptions when you perform an in-place update of a tier.

Common Issues and Troubleshooting Tips

Common Issue	Troubleshooting Tip
Service template fails to create virtual machine and results in a 12700 error.	Ensure the proper destination is set. Destinations are always listed alphabetically, so in the case of the lab, the first destination that is selected could be DevCloud .

Lab Review Questions and Answers

Lab: Managing services in VMM

Question and Answers

Question: When you first opened Service Designer, the Single Tier virtual machine has a red circle with an exclamation mark warning on it. Why was that?

Answer: It had not been assigned a virtual hard disk or a network adapter. Once that was done, the warning went away.

Question: What must you do to update or modify a service template?

Answer: You must create a new release with a greater number. Completed releases are read only.

Module 10

Monitoring a virtualization infrastructure by using System Center Operations Manager

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Lesson 1

Operations Manager architecture and security

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Question and Answers

Question: You need to create an Operations Manager role that will allow its members to resolve alerts and create overrides of rules and monitors. You must comply with the principle of least privilege. Which profile should you use?

- Administrator
- Operator
- Advanced Operator
- Author
- Application Monitoring Operator

Answer:

- Administrator
- Operator
- Advanced Operator
- Author
- Application Monitoring Operator

Feedback: Advanced Operator grants the permissions required to access and resolve alerts, access views, and run tasks. It also allows users to create overrides of rules and monitors. Although the Administrator profile would allow you to perform the same actions, this option violates the principle of least privilege.

Resources

Deploying the Operations Manager agent



Additional Reading: For more information on discovering computers for agent installation, refer to Install Agent on Windows Using the Discovery Wizard: <https://aka.ms/Xgjf0x>.

Demonstration: Using the Operations Manager console

Demonstration Steps

1. On **LON-OM**, on the taskbar, click the **Operations Console** icon.
2. In the **Operations Manager** console, describe the **Monitoring Overview** page. Point out the **States and Alerts** section, and then explain the **Required Configurations Tasks**.
3. In the monitoring navigation pane on the left side of the screen, click **Active Alerts**, and then click any alert. Review the **Alert Details** section at the bottom of the screen, and then review the alert actions and tasks in the **Tasks** pane on the right side.
4. Right-click an alert, review the options that display, and then click **Properties**.
5. In the **Alert Properties** dialog box, click some of the **Alert Property** tabs, and then discuss the page content.
6. Click **Cancel** to close the **Alert Properties** dialog box.

7. Click the **Authoring** workspace, and then explain that this is where you can create customized management packs. Remind students that management packs can include components such as discoveries, tasks, knowledge, Run As profiles, reports monitors, rules, and groups.
8. Click the **Reporting** workspace. Explain that this is where you can review and schedule reports, which are often included in management packs.
9. Click the **Administration** workspace. Explain that this is where you can run discoveries, deploy agents, create notifications, import management packs, and configure security and accounts.
10. Click **My Workspace**. Explain that this is where you can customize and save console settings, including commonly used views and searches.

Demonstration: Deploying the Operations Manager agent

Demonstration Steps

1. On **LON-OM**, in the **Operations Manager** console, click the **Administration** workspace.
2. In the **Administration** workspace, below the navigation pane, click **Discovery Wizard**.
3. In **Computer and Device Management Wizard**, on the **Discovery Type** page, point out that **Windows computers** is selected, and then click **Next**.
4. On the **Auto or Advanced** page, explain the differences between the available options. Click **Advanced Discovery**, and then click **Next**.
5. On the **Discovery Method** page, select the **Browse for, or type-in computer names** option. In the text box, type **LON-HOST1,LON-SVR1,LON-SVR2,LON-VMM**, and then click **Next**. Explain that this lets you install the monitoring agent on multiple computers simultaneously.
6. On the **Administrator Account** page, click **Discover**.
7. On the **Select Objects to Manage** page, point out that all four servers are discovered.
8. To select all the discovered servers, click **Select All**, and then click **Next**.
9. On the **Summary** page, explain the available settings, and then click **Finish**.
10. Wait for the task to complete successfully, and then click **Close**.

Lesson 2

Using Operations Manager for monitoring and reporting

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Question and Answers

Question: For which Operations Manager objects can you create overrides?

- Monitors
- Attributes
- Object discoveries
- Notifications
- Rules

Answer:

- Monitors
- Attributes
- Object discoveries
- Notifications
- Rules

Feedback: You can create overrides for:

- Monitors
- Attributes
- Object discoveries
- Rules

You cannot create overrides for notifications.

Demonstration: Configuring notifications

Demonstration Steps

Create a notification channel

1. On **LON-OM**, in the **Operations Manager** console, in the **Administration** workspace, under **Notifications**, click **Channels**.
2. In the **Tasks** pane, click **New**. Point out the available options and then select **E-mail (SMTP)**.
3. In the **E-mail Notification Channel** window, on the **Description** page, click **Next** to accept the default channel name and description.
4. On the **Settings** page, click **Add**.
5. In the **Add SMTP Server** window, enter the following information, and then click **OK**:
 - SMTP server (FQDN): **smtp.adatum.com**
 - Port number: **25**
 - Authentication method: **Anonymous**
6. On the **Settings** page, in the **Return address** text box, type **SCAlerts@adatum.com**, and then click **Next**.
7. On the **Format** page, explain how email notification is composed. Click **Finish** to accept the default message format.
8. After the saving the channel, click **Close**.

Create a notification subscriber

1. In the **Operations Manager** console, in the **Administration** workspace, under **Notifications**, click **Subscribers**.
2. In the **Tasks** pane, click **New**.
3. In **Notification Subscriber Wizard**, on the **Description** page, in the **Subscriber Name** text box, type **Administrator**, and then click **Next**.
4. On the **Schedule** page, point out that the **Always send notifications** option is selected, and then click **Next**.
5. To create a new subscriber address, on the **Addresses** page, click **Add**.
6. In **Subscriber Address** wizard, on the **General** page, in the **Address name** text box, type **Work E-mail**, and then click **Next**.
7. On the **Channel** page, in the **Channel Type** list box, select **E-mail (SMTP)**.
8. In the **Delivery address for the selected channel** text box, type **administrator@adatum.com**, and then click **Next**.
9. On the **Schedule** page, point out the default values and then click **Finish**.
10. In **Notification Subscriber Wizard**, click **Finish**, and then click **Close**.

Create a notification subscription

1. In **Operations Manager** console, in the **Administration** workspace, under **Notifications**, click **Subscriptions**.
2. In the **Tasks** pane, click **New**.
3. In **Notification Subscription Wizard**, on the **Description** page, in the **Subscription name** text box, type **Windows Server 2012 notifications**, and then click **Next**.
4. On the **Criteria** page, in the **Conditions** box, select the **raised by any instance in a specific group** check box.
5. In the **Criteria description** box, click **specific**.
6. In the **Group Search** window, in the **Filter by** text box, type **2012**, and then click **Search**.
7. Click **Windows Server 2012 Computer Group**, click **Add**, and then click **OK**.
8. On the **Criteria** page, click **Next**.
9. On the **Subscribers** page, click **Add**.
10. In the **Subscriber Search** window, click **Search**, click **Administrator**, click **Add**, and then click **OK**.
11. On the **Subscribers** page, click **Next**.
12. On the **Channels** page, click **Add**.
13. In the **Channel Search** window, click **Search**, click **SMTP Channel**, click **Add**, and then click **OK**.
14. On the **Channels** page, click **Delay sending notifications if conditions remain unchanged for longer than (in minutes)**, type **10**, and then click **Next**.
15. On the **Summary** page, click **Finish**, and then click **Close**.

Lesson 3

Integrating Operations Manager with Virtual Machine Manager and Data Protection Manager

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Question and Answers

Question: You want to delegate the permission to re-run backup jobs via the Data Protection Manager Central Console to your support staff. Which default Data Protection Manager user role can you use? Your choice must comply with the principle of least privilege.

- Data Protection Manager Admin
- Data Protection Manager Tier-1 Support
- Data Protection Manager Tier-2 Support
- Data Protection Manager Tape Operator
- Data Protection Manager Tape Admin

Answer:

- Data Protection Manager Admin
- Data Protection Manager Tier-1 Support
- Data Protection Manager Tier-2 Support
- Data Protection Manager Tape Operator
- Data Protection Manager Tape Admin

Feedback: The Data Protection Manager Tier-1 Support role allows users to see alerts and job information. It also allows users to perform simple tasks such as rerunning a backup job.

Demonstration: Integrating Operations Manager with Virtual Machine Manager

Demonstration Steps

Explore Operations Manager before integration with Virtual Machine Manager

1. On **LON-OM**, in the **Operations Manager** console, click the **Monitoring** workspace.
2. In the Monitoring workspace, expand Microsoft System Center Virtual Machine Manager, expand Cloud Health Dashboard, and then click Cloud Health.
3. In the **Cloud Health** pane, point out that no cloud is listed. Also, point out that there are no tasks available in the **Tasks** pane.



Note: Because it is not integrated with Virtual Machine Manager, Operations Manager does not discover or monitor Virtual Machine Manager clouds.

4. In the **Operations Manager** console, click the **Reporting** workspace.
5. In the Reporting pane, verify and point out that the Microsoft System Center Virtual Machine Manager 1801+ Reports node is not available.
6. Close the Operations Manager console.

Install the Operations Manager console on a Virtual Machine Manager server

1. On **LON-VMM**, on the taskbar, click the **File Explorer** icon.
2. In File Explorer, click drive **E**, and then in the details pane, double-click **Setup.exe**.
3. In the **Operations Manager** window, click **Install**.

4. On the **Select features to install** page, select the **Operations console** check box, and then click **Next**.
5. On the **Select installation location** page, click **Next**.
6. On the **Proceed with Setup** page, point out that all the prerequisites have been satisfied, and then click **Next**.
7. On the **Please read the license terms** page, review the license, click **I have read, understood and agree with the license terms**, and then click **Next**.
8. On the **Diagnostics and Usage Data** page, click **Next**.
9. On the **Microsoft Update** page, click **Off**, and then click **Next**.
10. On the **Installation Summary** page, click **Install**.
11. After installation is complete, clear the **Start the Operations Manager console when the wizard closes** check box, click **Close**, and then click **Exit** in the **Operations Manager** window.

Enable Virtual Machine Manager integration with Operations Manager

1. On **LON-HOST1**, on the taskbar, click **Virtual Machine Manager**, and then click **Connect**.
2. In the **Virtual Machine Manager** console, click the **Settings** workspace.
3. In the navigation pane, click **System Center Settings**, in the details pane, right-click **Operations Manager Server**, and then click **Properties**.
4. In **Add Operations Manager** wizard, on the **Introduction** page, point out the requirements for integration. Explain that the required management packs were installed as part of the initial environment, and then click **Next**.
5. On the **Connection to Operations Manager** page, in the **Server name** text box, type **LON-OM.adatum.com**. Review the options, do not change the defaults, and then click **Next**.
6. On the **Connection to VMM** page, in the **User name** text box, type **adatum\scservice**. In the **Password** text box, type **Pa55w.rd**, and then click **Next**.
7. On the **Summary** page, click **Finish**.
8. In the **Jobs** window, click **New Operations Manager connection**, and then wait for the job to complete. This will take a minute or two.
9. When the job completes, close the **Jobs** window.

Explore Operations Manager after integration with Virtual Machine Manager

1. On **LON-OM**, on the taskbar, click **Operations Manager**.
2. In the **Operations Manager** console, click the **Reporting** workspace.
3. In the Reporting workspace, in the navigation pane, click Microsoft System Center Virtual Machine Manager 1801+ Reports.
4. In the **Reports** pane, right-click **Host Utilization**, and then click **Open**.
5. In the Host Utilization – Operations Manager – Report - Adatum window, click Add Group. In the Group Name text box, type all hosts, and then click Search.
6. Point out that **All Hosts** was found because Operations Manager is integrated with Virtual Machine Manager.
7. In the **Available items** section, click **All Hosts**, click **Add**, and then click **OK**.
8. At the top left of the **Host Utilization** window, click **Run**.

9. Expand **Description** and explain why no data is available yet.



Note: Because the virtual environment is recreated for each lab, no data is available yet for the report. If the environment had been running for some time, you would have been able to review the **Host Utilization** report here.

10. Close the Host Utilization – Operations Manager – Report - Adatum window.
11. Select the **Monitoring** workspace.
12. In the Monitoring pane, click Cloud Health, which is located below Cloud Health Dashboard, which is below the Microsoft System Center Virtual Machine Manager node.
13. In the **Cloud Health** pane, point out that Virtual Machine Manager clouds are listed. Also, point out that there are many tasks available in the **Tasks** pane.

Module Review and Takeaways

Best Practice

Use Virtual Machine Manager Dynamic Optimization and Power Optimization instead of relying on PRO tips for load balancing of Hyper-V workloads in Virtual Machine Manager environments.

Review Question

Question: What method would you choose to deploy Operations Manager agents in your environment?

Answer: Choosing an agent deployment method is an important part of implementing Operations Manager. Using the **Computer and Device Management Wizard** is the simplest way, if the necessary network connectivity and security provisions are in place. Many organizations install the agent manually when new servers are deployed to avoid security problems during deployment. For example, many organizations do not want to enable the file and printer sharing feature on servers on which it is not otherwise required.

Lab Review Questions and Answers

Lab: Monitoring a virtualization infrastructure by using Operations Manager

Question and Answers

Question: After you integrate Virtual Machine Manager with Operations Manager, what reports are available?

Answer: After integrating Virtual Machine Manager with Operations Manager, the following reports are available:

1. Capacity Utilization
2. Host Group Forecasting
3. Host Utilization
4. Host Utilization Growth
5. Power Savings
6. SAN Usage Forecasting
7. Virtual Machine Allocation
8. Virtual Machine Utilization
9. Virtualization Candidates

Question: What do you have to install on the Virtual Machine Manager server before configuring the integration with Operations Manager?

Answer: The **Operations Manager** console

Module 11

Implementing and managing Hyper-V Replica and Azure Site Recovery

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Lesson 1

Implementing and managing Hyper-V Replica

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Question and Answers

Overview of Hyper-V Replica

Question: Can you use Hyper-V Replica to replicate only virtual machines that have integration services installed?

Answer: No, you can use Hyper-V Replica to replicate any virtual machine, regardless of whether it has integration services installed or not. However, some features such as Failover TCP/IP settings are applied to a replicated virtual machine only if it has integration services installed.

Hyper-V Replica architecture

Question: You want to replicate virtual machines to a hosting provider. Which type of authentication should you configure so that Hyper-V Replica can replicate a virtual machine to the hosting provider?

Answer: If you assume that the hosting provider is not part of the same Active Directory forest, then the replica Hyper-V host can authenticate the primary Hyper-V host by using a digital certificate.

Question: How can you limit the primary Hyper-V hosts to access only virtual machines that originate from the same company?

Answer: When you configure a Hyper-V host as a replica, you can specify the trust group. If you do so, the Hyper-V host will be able to access only virtual machines that originate from the same trust group.

Enabling a virtual machine for replication

Question: Are failover TCP/IP settings useful if a virtual machine is using Dynamic Host Configuration Protocol (DHCP) for obtaining an IP address?

Answer: No. Failover TCP/IP settings are useful if a virtual machine has a static IP address, and if the addresses used in the recovery site differ from the addresses used in primary site. If the virtual machine is using Dynamic Host Configuration Protocol (DHCP) for obtaining TCP/IP configuration, or if the virtual machine does not have integration services installed, failover TCP/IP settings are not useful.

Question: Can you modify the replication settings on a replicated virtual machine at a disaster site?

Answer: No. Replication settings on a replicated virtual machine at disaster site are read-only and you cannot modify them; you can modify them only on a primary virtual machine. However, you can modify Failover TCP/IP settings on a replicated virtual machine at a disaster site.

Hyper-V replication health

Question: How can you monitor virtual machine replication health from Windows PowerShell?

Answer: From a Windows PowerShell command prompt, you can run the **Get-VMReplication** and **Measure-VMReplication** cmdlets.

Question: What is the reason that the initial Hyper-V Replica health is in the warning state even when you configure virtual machine replication between Hyper-V hosts on the same network?

Answer: When you configure virtual machine replication, the initial state of the virtual machine must be replicated, and this takes some time even when both the Hyper-V hosts are on the same network. During that time, the Hyper-V Replica health state is in the Warning state. After the initial synchronization finishes, the replication health state changes to Normal.

Test failover, planned failover, and failover

Question: Which of the three failover actions can you perform while the primary virtual machine is running: test failover, planned failover, or failover?

Answer: While the primary virtual machine is running, you can perform only test failover. If there is no network connectivity between the primary and replica sites, you also can perform failover. However, you should not perform unplanned failover unless it is extremely necessary, such as when a disaster has occurred at the primary site.

Question: What is the difference between planned failover and failover?

Answer: You can perform planned failover when both the Hyper-V hosts—at the primary site and at the recovery site—are available, and planned failover is performed without any data loss. When this is not possible, for example if the primary site is no longer available because of a disaster, you can perform failover, which means unplanned failover. After failover, you will be able to use a replicated virtual machine, but changes that were performed at the primary site and were not yet replicated will be lost.

Hyper-V Replica resynchronization

Question: Is resynchronization between the primary and replica virtual machines always required?

Answer: No, resynchronization is a special event, which is not necessary if Replication Health is normal. However, resynchronization becomes necessary if replication is interrupted for an extended period, if the replica is modified (for example, restored from a backup), or if replication is reversed. While resynchronization can be memory-intensive and processor-intensive, it is more effective than performing the entire initial replication again.

Question: Where can you configure when resynchronization will occur if it is needed?

Answer: You can configure resynchronization settings on the primary virtual machine that is being replicated by Hyper-V Replica. You cannot configure or view configured resynchronization settings on the replicated virtual machine. In a production environment, resynchronization should be scheduled for off-peak usage times.

Extending Hyper-V replication

Question: Can you extend the Hyper-V replication on the primary Hyper-V host from which virtual machine is replicating to secondary Hyper-V host?

Answer: No. Hyper-V can replicate a virtual machine to a single target. If you want to extend Hyper-V replication, you can do that only on a virtual machine that is already replicating on a target Hyper-V host.

Question: Can you use a replication frequency of 30 seconds when you are extending Hyper-V replication?

Answer: No. When you are extending Hyper-V replication, you can select only a replication frequency of 5 minutes or 15 minutes. The replication interval cannot be shorter than the replication interval used when replicating a virtual machine from the primary to a secondary Hyper-V host.

Resources

Hyper-V Replica architecture



Additional Reading: For more information, refer to Set up Hyper-V Replica at: <https://aka.ms/j13kh9>.

Hyper-V replication health

 **Additional Reading:** For more information, refer to Interpreting Replication Health – Part 1 at: <https://aka.ms/fferdg>.

Hyper-V Replica resynchronization

 **Additional Reading:** For more information, refer to Resynchronization of virtual machines in Hyper-V Replica at: <https://aka.ms/th75kb>.

Demonstration: Enabling virtual machine replication

Demonstration Steps

1. On **LON-SVR1**, in Hyper-V Manager, right-click **LON-REPL**, and then click **Settings**.
2. In **Settings for LON-REPL on LON-SVR1**, in the navigation pane, on the left, expand **Network Adapter**, and point out that it has two nodes: **Hardware Acceleration**, and **Advanced Features**.
3. In **Settings for LON-REPL on LON-SVR1**, in the navigation pane, point out that the **Management** section has six settings, that **Replication** is not one of them, and then click **OK**.
4. In Hyper-V Manager, right-click **LON-REPL**, and then click **Enable Replication**.
5. In **Enable Replication for LON-REPL** wizard, on the **Before You Begin** page, click **Next**.
6. On the **Specify Replica Server** page, in the **Replica server** text box, type **LON-SVR2**, and then click **Next**.
7. On the **Specify Connection Parameters** page, point out that **Use Kerberos authentication (HTTP)** is selected, that **Compress the data that is transmitted over the network** is enabled, and then click **Next**.
8. On the **Choose Replication VHDs** page, point out that the **LON-REPL.vhd** virtual hard disk is selected, and then click **Next**.
9. On the **Configure Replication Frequency** page, in the drop-down list box, select **30 seconds**, and then click **Next**.
10. On the **Configure Additional Recovery Points** page, explain the available options, and then click **Next**.
11. On the **Choose initial Replication Method** page, point out that both the **Send initial copy over the network** and the **Start replication immediately** options are selected, and then click **Next**.
12. In **Enable Replication for LON-REPL**, on the **Completing the Enable Replication Wizard** page, click **Finish**.
13. Switch to LON-SVR2.
14. On **LON-SVR2**, in Hyper-V Manager, point out that **LON-REPL** is one of the virtual machines on **LON-SVR2**, and that it is in the **Off** state.
15. In Hyper-V Manager, right-click **LON-REPL**, click **Replication**, and then click **View Replication Health**.
16. In **Replication Health for "LON-REPL"**, review Replication Health. Point out that initial replication might not yet have completed, and Replication Health is in the **Warning** state.
17. In **Replication Health for "LON-REPL"**, click **Close**.

18. In Hyper-V Manager, right-click **LON-REPL**, and then click **Settings**.
19. In **LON-REPL Settings**, in the navigation pane on the left, expand **Network Adapter**. Point out that two new nodes, **Failover TCP/IP** and **Test Failover** now display. Explain when and why those options are used.
20. In **Settings for LON-REPL on LON-SVR2**, in the navigation pane, point out that there are seven settings in the Management section, including **Replication**, which was not present before, and then click **OK**.
21. In Hyper-V Manager, right-click **LON-REPL**, click **Replication**, and then click **View Replication Health**.
22. In **Replication Health for "LON-REPL"**, review Replication Health. Explain that after initial replication finishes, Replication Health will be set to **Normal**.
23. In **Replication Health for "LON-REPL"**, click **Close**.

Demonstration: Performing a planned failover with Hyper-V Replica

Demonstration Steps

1. On **LON-SVR1**, in Hyper-V Manager, double-click **LON-REPL**.
2. Sign in to **LON-REPL** as **Administrator** and use **Pa55w.rd** as the password.
3. On **LON-REPL**, right-click the desktop, click **New**, click **Folder**, type **Current State**, and then press Enter.
4. On **LON-SVR1**, in Hyper-V Manager, right-click **LON-REPL**, click **Replication**, and then click **Planned Failover**.
5. In **Planned Failover**, point out that **Start the Replica virtual machine after failover** is selected, and then click **Fail Over**.
6. When the **Planned Failover** error displays, explain that this is because the virtual machine is not prepared for a planned failover.
7. Click **Close**, and then click **Cancel**.
8. In Hyper-V Manager, right-click **LON-REPL**, click **Shut Down**, and then click **Shut Down** again.
9. In Hyper-V Manager, right-click **LON-REPL**, click **Replication**, and then click **Planned Failover**.
10. In the **Planned Failover** window, point out that the **Start the replica virtual machine after failover** check box is selected, and then click **Fail Over**.
11. Switch to **LON-SVR2**.
12. On **LON-SVR2**, in Hyper-V Manager, point out that **LON-REPL** is in the **Running** state, and then double-click **LON-REPL**.
13. Sign in to **LON-REPL** as **Administrator** with the password **Pa55w.rd**.
14. On **LON-REPL**, point out that a folder named **Current State** displays on the desktop. Explain that with planned failover, all changes from the primary virtual machine are replicated.
15. Right-click the desktop, click **New**, click **Folder**, type **Planned Failover**, and then press Enter.
16. On **LON-SVR2**, in Hyper-V Manager, right-click **LON-REPL**, click **Replication**, and then click **Reverse Replication**.
17. In the **Reverse Replication Wizard for LON-REPL**, click **Next** five times, and then click **Finish**.
18. In Hyper-V Manager, right-click **LON-REPL**, click **Shut Down**, and then click **Shut Down** again.

19. In Hyper-V Manager, point out that **LON-REPL** is in the **Off** state.
20. Right-click **LON-REPL**, click **Replication**, and then click **Planned Failover**.
21. In the **Planned Failover** dialog box, confirm that **Start the replica virtual machine after failover** is selected, and then click **Fail Over**.
22. On **LON-SVR1**, in Hyper-V Manager, point out that the **LON-REPL** state is **Running**.
23. In Hyper-V Manager, double-click **LON-REPL**. Point out that the Virtual Machine Connection to **LON-REPL** opens.
24. On **LON-REPL**, sign in as **Administrator** with **Pa55w.rd** as the password.
25. On **LON-REPL**, point out that a folder named **Current State** and a folder named **Planned Failover** both display on the desktop.

Lesson 2

Implementing and managing Azure Site Recovery

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Question and Answers

What is Azure Site Recovery?

Question: Can you use Azure Site Recovery to manage virtual machine replication between two Hyper-V hosts?

Answer: No, you cannot use Azure Site Recovery to manage replication between two Hyper-V hosts. You can use Azure Site Recovery to manage virtual machine replication from a Hyper-V host to Azure, or between two clouds that are managed by VMM. If you want to manage virtual machine replication between two Hyper-V hosts, you should use Hyper-V Manager.

Question: Is Azure Site Recovery used only as a disaster recovery solution?

Answer: No. Although administrators often use Azure Site Recovery as a disaster recovery solution, you also can use it in several other scenarios, such as migrating workloads to Azure, cloud bursting, DevTest, and analytics and reporting.

Implementing Azure Site Recovery

Question: Can you manage Azure Site Recovery in the VMM console?

Answer: You can view in the VMM console when the VMM is registered with Azure Site Recovery. However, you cannot manage Azure Site Recovery by using the VMM console. Instead, you can manage Azure Site Recovery by using either the Azure portal or by using Windows PowerShell.

When VMM is registered with Azure Site Recovery and the Azure Site Recovery replication policy is associated with the cloud, you can use the VMM console to configure Azure Site Recovery protection for virtual machines that are deployed to a VMM cloud.

Question: Which VMM object can you use as a source and as a target when configuring the Azure Site Recovery replication policy?

Answer: You can control which virtual machines will be replicated from a protected cloud when you register VMM with Azure Site Recovery. However, to configure Azure Site Recovery replication, virtual machines must be deployed to a VMM cloud. You then use the cloud as a source and target object when configuring Azure Site Recovery protection.

Azure Site Recovery replication and recovery plans

Question: Can you have multiple replication policies in the same Recovery services vault?

Answer: Yes, you can have multiple replication policies in the same Recovery services vault. However, only a single replication policy can be associated with each VMM cloud.

Question: How many virtual machine groups can you define in a single recovery plan?

Answer: In a single recovery plan, you can define up to seven virtual machine groups. Each virtual machine group can include multiple virtual machines that fail over between the source and target locations as a single unit.

Azure Site Recovery and failover

Question: What must you configure in Azure Site Recovery to control the order in which virtual machines will start during failover to a secondary location?

Answer: The Azure Site Recovery policy controls and orchestrates Azure Site Recovery, including the order in which virtual machines will start during failover, and additional tasks that should be performed during failover.

Question: Is there any downtime during a planned Azure Site Recovery failover?

Answer: Yes. During a planned Azure Site Recovery failover, virtual machines are shut down on the primary location, and become available again only after they start on the secondary location. You cannot connect to virtual machines from the time they are turned off on the primary location, until they are started on the secondary location. This represents downtime.

Resources

What is Azure Site Recovery?

 **Additional Reading:** For more information, refer to What workloads can you protect with Azure Site Recovery? at: <https://aka.ms/f73vqb>.

 **Additional Reading:** This course covers only how you can integrate Azure Site Recovery with VMM and use it for providing disaster recovery for VMM clouds in onsite datacenters. For more information on Azure Site Recovery, refer to What is Site Recovery? at: <https://aka.ms/lwzmbw>.

Implementing Azure Site Recovery

 **Additional Reading:** For additional information on the Azure Site Recovery prerequisites and how to prepare for them, refer to Prepare for Azure Site Recovery deployment at: <https://aka.ms/Odgkok>.

Azure Site Recovery replication and recovery plans

 **Additional Reading:** For additional information on creating recovery plans in Azure Site Recovery, refer to Create recovery plans, at: <https://aka.ms/c87d65>.

 **Additional Reading:** For additional information on using Azure automation runbooks with recovery plans, refer to Add Azure automation runbooks to recovery plans, at: <https://aka.ms/nbt9vy>.

Azure Site Recovery and failover

 **Additional Reading:** For additional information on performing failover by using Azure Site Recovery, refer to Failover in Site Recovery, at: <https://aka.ms/khd8ho>.

Demonstration: Registering VMM with Azure Site Recovery

Demonstration Steps

1. On **LON-HOST1**, on the taskbar, click **Virtual Machine Manager**, and then click **Connect**.
2. In the **Virtual Machine Manager** console, click the **Settings** workspace.
3. In the **Settings** pane, click **Microsoft Azure Site Recovery**, and then in the details pane, point out that the VMM server is not registered with the Azure Site Recovery service.
4. In **LON-VMM**, on the taskbar, click the **Internet Explorer** icon.
5. In the Internet Explorer address bar, type **http://portal.azure.com**, and then press Enter.

6. On the **Microsoft Azure** page, sign in with your Microsoft account that you created in the first module.



Note: Your account must be in the *<YourInitials>MMDDYY@outlook.com* format, with the complex password that you assigned and wrote down in the first module. The **Sign-in** page might not ask for a password if you still have a tab with your Microsoft account inbox open.

7. On the **Dashboard** page, in the **Hub** vertical menu on the left, click **All services**. In the **All services** text box, type **recovery**, and then click **Recovery Services vaults**.
8. On the **Recovery Services vaults** blade, click **Add**.
9. In the **Name** text box, type **RecoveryVault1**, and then in the **Subscription** drop-down list box, verify that **Azure Pass** is selected.
10. In the **Resource group** section, select the **Create new** option. In the **Create new** text box, type **RecoveryVault1**, and then in the **Location** drop-down list box, select the Azure region that is closest to your location.
11. Select the **Pin to dashboard** check box, and then click **Create**.
12. After the recovery services vault is created, on the **RecoveryVault1** blade, in the **GETTING STARTED** section, click **Site Recovery**.
13. On the **RecoveryVault1 - Site Recovery** blade, in the **FOR ON-PREMISES MACHINES** section, click **Prepare Infrastructure**.
14. On the **Protection goal** blade, select the following values, and then click **OK**:
 - o Where are your machines located: **On-premises**
 - o Where do you want to replicate your machines to: **To recovery site**
 - o Are your machines virtualized: **Yes, with Hyper-V**
 - o Are you using System Center VMM to manage your Hyper-V hosts: **Yes**
 - o Are you managing the recovery site with another System Center VMM: **No, same System Center VMM manages both sites**
15. On the **Deployment planning** blade, in the **Have you completed deployment planning** drop-down list, select **Yes, I have done it**, and then click **OK**.
16. On the **Prepare source** blade, click **+VMM**.
17. On the **Add Server** blade, click **Download** in the third bullet point-**Download the installer for the Microsoft Azure Site Recovery provider**.
18. In the **Do you want to run or save AzureSiteRecoveryProvider.exe** notification window, click the down arrow next to the **Save** button, and then click **Save as**. Browse to the **C:\VMs** folder, and then click **Save**.
19. On the **Add Server** blade, click **Download** in the fourth bullet point-**Download the vault registration key**.
20. In the notification area, click the down arrow near **Save**, and then click **Save as**. Verify that the location points to the **C:\VMs** folder, and then click **Save**.
21. In the notification area, click **Open folder**.
22. In File Explorer, double-click **AzureSiteRecoveryProvider.exe**.

23. In the **Open File – Security Warning** dialog box, click **Run**, and then click **OK**.



Note: Be aware that if the time on **LON-VMM** is not accurate, you will not be able to continue. In that case, you should set the accurate time on **LON-HOST1** (including time zone) and then run **AzureSiteRecoveryProvider.exe** again. This is because all virtual machines automatically synchronize their time with **LON-HOST1**.

24. In the **Azure Site Recovery Provider Setup (VMM server)** wizard, on the **Microsoft Update** page, click the **Off** option, and then click **Next**.
25. On the **Provider Installation** page, click **Install**, click **Register**, and then click **OK**.
26. In the **Microsoft Azure Site Recovery Registration Wizard**, on the **Vault Settings** page, click **Browse**, and then browse to the **C:\VMs** folder. Click the file whose name starts with **RecoveryVault1**, click **Open**, and then click **Next**.
27. On the **Proxy Settings** page, verify that the **Connect directly to Azure Site Recovery without a proxy server** option is selected, and then click **Next**.
28. On the **Registration** page, click **Browse**, and then browse to the **C:\VMs** folder. Click **OK**, click **Next**, click **Register**, and then click **Finish**.
29. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **Settings** workspace, point out that the VMM server is registered with the Azure Site Recovery service.



Note: The Virtual Machine Manager service on **LON-VMM** was restarted during the Azure Site Recovery provider installation. You will need to wait until the **Virtual Machine Manager** console on **LON-HOST1** reconnects to **LON-VMM**.

Demonstration: Configuring Azure Site Recovery replication

Demonstration Steps

1. On **LON-HOST1**, in the **Virtual Machine Manager** console, click the **VMs and Services** workspace.
 2. In the **VMs and Services** pane, expand **All Hosts**, expand the **London Hosts 2** host group, and then click **lon-svr2**. In the details pane, point out that **LON-INF1**, **LON-INF2**, and **LON-INF3** are listed.
-
- Note:** If virtual machines are not listed in the details pane, make sure that **VMs** button is selected on the ribbon.
3. Right-click **LON-INF3**. Point out that the **Manage Protection** option is visible, but you cannot select it. Explain that this is because the Azure Site Recovery replication policy is not associated with the cloud.
 4. In the **VMs and Services** pane, expand the **London Hosts 1** host group, and then click **lon-svr1**.
 5. In the details pane, point out that **LON-INF1**, **LON-INF2** and **LON-INF3** virtual machines are not present on **lon-svr1**.
 6. In the **VMs and Services** pane, click **Cloud1**, and point out that it does not include any virtual machine.
 7. In the **VMs and Services** pane, click **Cloud2**, and point out that it includes three virtual machines.
 8. On **LON-VMM**, in Internet Explorer, in the Azure portal, verify that the **Site Recovery**, **Prepare infrastructure**, and **Prepare source** blades are open.
 9. On the **Prepare source** blade, select the following values, and then click **OK**:
 - o System Center VMM: **LON-VMM.Adatum.com**

- Cloud: **Cloud2**
10. On the **Target** blade, in the **Cloud** drop-down list box, select **Cloud1**, and then click **OK**.
 11. On the **Replication Policy** blade, click **+Create and Associate**.
 12. On the **Create and associate policy** blade, specify the following settings (leave all other settings with the default values), and then click **OK**:
 - Name: **ReplicationPolicy1**
 - Copy frequency: **30 seconds**
 - Data transfer compression: **Enable**
 - Delete replica VM: **Yes**
 13. Wait until the replication policy is created and associated, and then on the **Replication policy** blade, click **OK**.
 14. On the **Prepare infrastructure** blade, click **OK**.
 15. On the **RecoveryVault1 - Site Recovery** blade, in the **FOR ON-PREMISES MACHINES AND AZURE VMS** section, click **Step 1: Replicate Application**.
 16. On the **Source** blade, verify that the following options are selected, and then click **OK**:
 - Source: **On-premises**
 - Source location: **LON-VMM.Adatum.com**
 - Cloud: **Cloud2**
 17. On the **Select virtual machines** blade, click **LON-INF1**, click **LON-INF2**, and then click **OK**.
 18. On the **Enable replication** blade, click **Enable replication**.
 19. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **VMs and Services** pane, click **lon-svr1**.
 20. In the details pane, point out that **LON-INF1** and **LON-INF2** display, but that **LON-INF3** does not. Explain that the two visible virtual machines were replicated from **LON-SVR2** by Azure Site Recovery.
 21. In the **VMs and Services** pane, click **lon-svr2**.
 22. In the details pane, point out that **LON-TEST2** is not deployed to the cloud. Right-click **LON-TEST2** and point out that the **Manage Protection** option is visible but that you cannot select it. Explain that this is because **LON-TEST2** is not deployed to the cloud.
 23. In the **VMs and Services** pane, click **Cloud2**.
 24. In the details pane, right click **LON-INF3**, and then click **Manage Protection**.
 25. In the **LON-INF3 Properties** dialog box, select **Enable Microsoft Azure Site Recovery protection for this virtual machine**. Point out that the **Replication frequency** drop-down list box includes only the **30 seconds** option. Explain that this is because this setting was configured in the Azure Site Recovery replication policy, and then click **OK**.
 26. In the **VMs and Services** pane, click **lon-svr1**.
 27. In the details pane, verify that **LON-INF3** now displays, and explain that this is because it is replicated by Azure Site Recovery.



Note: Be aware that it takes some time before **LON-INF3** is listed on the **LON-SVR1** virtualization host.

28. On **LON-SVR1**, in Hyper-V Manager, in the details pane, right-click **LON-INF1**, and point out that the **Replication** option is available. Explain that this shows that **LON-INF1** is replicating by using Hyper-V Replica.
29. On **LON-HOST1**, in the **Virtual Machine Manager** console, in the **VMs and Services** pane, click **Cloud2**.
30. In the details pane, right-click **LON-INF3**, and point out that you now can select the **Manage Protection** option. Explain that this is because **LON-INF3** is deployed to the cloud, and the Azure Site Recovery replication policy is associated with the cloud.

Module Review and Takeaways

Best Practice

For large environments, the ability to test your recovery plans in Azure Site Recovery is critical to ensuring that you are fully prepared and you have confidence in your disaster recovery solution.

Review Questions

Question: What would be the most probable reason that Replication Health is not in the Normal state after you enable replication for a virtual machine?

Answer: After you enable replication for a virtual machine, replica is not yet synchronized with the primary virtual machine. Therefore, Replication Health will be in the Warning state, and not in the Normal state. However, there also could be other reasons for the Warning state, for example, if you pause replication.

Question: What is the difference between Hyper-V Replica failover and Azure Site Recovery failover?

Answer: Hyper-V Replica failover is a manual process, which is performed on each virtual machine. Azure Site Recovery failover is an automated and orchestrated process, which can fail over multiple virtual machines simultaneously. Only with Azure Site Recovery failover can you control the order in which virtual machines will be started at a secondary location and trigger additional tasks during failover.

Question: Can you replicate Linux virtual machines by using Hyper-V Replica?

Answer: Hyper-V Replica is hardware and operating system–agnostic feature. You can use it with any operating system that can be installed on a Hyper-V virtual machine. Because you can install Linux in Hyper-V virtual machines, you also can use Hyper-V Replica with Linux virtual machines.

Common Issues and Troubleshooting Tips

Common Issue	Troubleshooting Tip
Ensure sufficient funds are available for running Azure Site Recovery.	As Azure is subscription based, ensure that you have sufficient funds to perform the recovery actions needed. Some billing models assign credits, which can be backed by an Enterprise Agreement or a credit card to ensure funds do not run out.

Lab Review Questions and Answers

Lab: Implementing and managing Hyper-V Replica and Azure Site Recovery

Question and Answers

Question: When using Hyper-V Replica, what is the difference between test failover and planned failover?

Answer: Test failover does not affect virtual machine availability, and you can perform it regardless of the state of the primary virtual machine. You can perform planned failover only if the primary virtual machine is turned off, which causes some virtual machine downtime. In both cases, Failover TCP/IP configuration is used for replica virtual machines.

Question: Can you use Azure Site Recovery to protect a virtual machine that is running on a VMM-managed Hyper-V host?

Answer: You can protect a virtual machine by using Azure Site Recovery only if it is deployed to a VMM cloud. If the virtual machine is not deployed to a VMM cloud, you cannot protect it by using Azure Site Recovery.

Module 12

Protecting a virtualization infrastructure by using Data Protection Manager

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Lesson 1

Overview of backup and restore options for VMs

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Question and Answers

The Windows Server 2016 backup infrastructure

Question: Can you create a consistent backup by copying the content of data volume?

Answer: It depends, but generally the answer is no. Copying a large amount of data takes a long time and during that time files might change. If that happens, copied data will not be identical to the data at the moment when the copy operation started. Some files might also be open exclusively, which means that they will not be copied.

Question: Which VSS component initiates creation of the snapshot and creates a backup based on that snapshot? Which Windows Server feature acts as the VSS requestor?

Answer: The VSS component that initiates creation of the snapshot and creates backup based on the snapshot is called the VSS requestor. The Windows Server Backup feature acts as VSS requestor.

Backup options for VMs

Question: Do you need to install a backup application in a VM to backup data in the VM? The VM uses a virtual hard disk that is stored locally on the Hyper-V host.

Answer: Because VM data is stored on a virtual hard disk, which is stored locally, you can perform its backup either by using a host level backup or a guest level backup. A guest level backup requires that a backup application or a backup agent is installed in the VM, while for a host level backup you need a backup application only on the Hyper-V host and not in the VM.

Question: Can you perform a guest level backup of the VM that is turned off?

Answer: No. For a host level backup, a backup application must be running in the VM, which is not possible if the VM is turned off. You can include such a VM only in a host level backup.

Backup and restore options for a VMM managed environment

Question: What is included in the backup if you use the backup option in the VMM console?

Answer: If you use the backup option in the VMM console, only the VMM database is included in the backup. If you want to create a complete backup of the VMM environment, you must back up additional virtualization components, for example, by using DPM.

Question: Where are stored VMM encryption keys? Can the VMM management server access information in the VMM database without the encryption keys?

Answer: Information in the VMM database is encrypted and the VMM management server cannot decrypt and access that information without VMM encryption keys. Encryption keys are stored either locally on the VMM management server or in the AD DS if you select the Distributed Key Management option during VMM installation.

Benefits of using System Center DPM

Question: Is DPM required if you want to back up a VMM managed virtualization infrastructure?

Answer: No, DPM is not required if you want to back up a VMM managed virtualization infrastructure. In a small environment with only a few servers, you can use Windows Server Backup to back up the environment. In larger environments, you can use a third-party backup solution, but DPM is part of System Center and you likely have a license to use it. DPM is an enterprise backup solution and you can use it in the most complex environments.

Question: Do you need to install a DPM agent in a VM if you need to create a backup of the VM by using DPM?

Answer: It depends on the backup type that you want to perform. If you want to perform a guest level backup, then you must install the DPM agent in the VM. If you want to perform a host level backup, then you must install the DPM agent on the Hyper-V host, but you do not need to install it in the VM.

What is Azure Backup Server?

Question: What is the main difference in functionality between DPM and Azure Backup Server?

Answer: DPM and Azure Backup Server work similar and have very similar features. The main difference between them is that DPM supports tape libraries and can use them for storing long-term backups, while Azure Backup Server does not support tape libraries. The second difference is that DPM does not require an Azure subscription, while Azure Backup Server does not work without an active Azure subscription.

Question: Do you need to purchase Azure Backup Server if you want to use it?

Answer: No, you do not need to purchase Azure Backup Server. You can download Azure Backup Server from the Azure portal and use it for storing your backups in Azure. Azure Backup Server is free, but you need to pay for an Azure subscription and for the storage space that you use in Azure.

Resources

The Windows Server 2016 backup infrastructure

 **Additional Reading:** For more information, refer to Volume Shadow Copy Service: <https://aka.ms/gtn832>.

Backup and restore options for a VMM managed environment

 **Additional Reading:** For more information, refer to Back Up and Restore Virtual Machine Manager: <https://aka.ms/tpgw05>.

Benefits of using System Center DPM

 **Additional Reading:** System Center DPM provides dramatically faster backups and storage savings when it is installed on Windows Server 2016. In such a configuration, DPM uses Modern Backup Storage, which benefits from ReFS block cloning and RCT. For more information, refer to What's new in DPM: <https://aka.ms/c10cs6>.

 **Additional Reading:** For more information, refer to Data Protection Manager: <https://aka.ms/n8m7n3>.

 **Additional Reading:** For information, refer to What can DPM back up?: <https://aka.ms/h5dzi8>.

What is Azure Backup Server?



Additional Reading: For more information, refer to Preparing to back up workloads using Azure Backup Server: <https://aka.ms/vobw84>.

Lesson 2

Configuring and managing DPM for virtualization infrastructure protection

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Question and Answers

DPM components

Question: How can you manage multiple DPM servers at the same time from the central location?

Answer: DPM includes a management console that you can use for managing a single DPM server. If you need to manage multiple DPM servers from the central location, you should install Central console. Central console must be installed on Operations Manager server; it cannot be installed on DPM server.

Question: How can you protect the DPM server?

Answer: If you need to protect the DPM server, you should implement a secondary DPM server in your environment. A secondary DPM server is the same as the primary DPM server, with the exception that you use it to provide protection for the primary DPM servers.

Question: What is the purpose of protection groups in DPM?

Answer: Protection groups define storage pools, retention settings, and data sources that need protecting. All data sources in the same protection group share storage allocation, replication creation methods, and settings for on-the-wire compression.

DPM protection process

Question: Which two data source types does DPM support?

Answer: DPM supports file-based and application-based data sources.

Question: What is the maximum number of recovery points that you can have for file-based data sources? What can you do if you want to keep your backup copies for more time?

Answer: For file-based data sources, you can have up to 64 recovery points. If you want to keep your backups for more time, then you should configure long-time protection by using tapes or online protection.

Managing storage pools

Question: Can you add an iSCSI disk to a DPM storage pool?

Answer: A storage pool can use block storage on DAS and SAN. iSCSI disk is block storage that is available on SAN, so you can add an iSCSI disk to a storage pool.

Question: Can you add volume on a dynamic disk to the DPM storage pool?

Answer: No, you can only add volumes from basic disks to a DPM storage pool. If a volume is on a dynamic disk, it cannot be added to the storage pool.

DPM protection methods

Question: Can the same DPM server use the D2D protection method for protecting VMs and the D2D2T protection method for protecting the VMM library?

Answer: Yes. The same DPM server can use different protection methods for protecting different types of data, as protection methods are configured per protection group. This means that you can use D2D for protecting data in one protection group and D2D2T for protecting data in another protection group.

Question: What must you do in DPM before you can use the D2D protection method?

Answer: To use the D2D protection method in DPM, the DPM server must have sufficient storage, which means that you must add disks to the storage pool. You must also deploy DPM protection agents and configure a protection group before servers will be protected.

Deploying DPM protection agents

Question: When would you install the DPM protection agent manually?

Answer: You would probably install the DPM protection agent automatically by using the System Center DPM Administrator Console whenever possible. However, if this is not possible—for example if you need to install the DPM protection agent on a server that is behind a firewall that blocks traffic or if you encounter a network- or permission-related issues—you would install the DPM protection agent manually and then connect it to the DPM server.

Question: Do you need to install different DPM protection agents for protecting the Hyper-V host and for protecting SQL Server?

Answer: No, you need to install the same DPM protection agent regardless on the workload that it should protect. A single DPM protection agent can protect any workload that can be backed up by DPM.

Managing protection groups

Question: Can you protect the system state of a server by one protection group and volume C of the same server by another protection group on the same DPM server? Can you protect these two data sources by using two DPM servers?

Answer: Yes, you can protect two data sources from the same protected server by using two protection groups on the same DPM server. However, the same DPM server must protect all data sources from the same protected server. This means that you cannot protect the system state of a computer by one DPM server, while the other DPM server protects the volume C of the same computer.

Question: Can you configure data sources in a protection group with online protection, while other data sources in the same protection group do not have online protection?

Answer: Data protection settings are set per protection group and it is the same for all data sources in the same protection group.

Protecting a virtualization infrastructure

Question: You have a highly available VMM management server that runs on a failover cluster. Which server should you include in your backup plan to protect the encryption key that is used to protect the configuration data in the VMM database?

Answer: If the VMM management server runs on a failover cluster, it must be configured with the Distributed Key Management option. This means that the encryption key is stored in AD DS and you must include one of the domain controllers in your backup plan to protect the encryption key.

Question: The Linux VM runs on your virtualization infrastructure. Where must you install a DPM protection agent to protect the VM?

Answer: You cannot install a DPM protection agent in a Linux VM, as the DPM protection agent can be installed only on a Windows operating system. However, you can install a DPM protection agent on the Hyper-V host on which a Linux VM runs and then include the VM in the host level backup.

Recovering VMs

Question: Which three VM recovery options are available in DPM?

Answer: When you are recovering a VM in DPM, you have the following three options available: recover data to the original instance, recover as a VM to any host, and copy to a network folder. If you have type library in DPM, then you can also select a copy to tape option.

Question: You use a DPM server to create a host based backup of the VM named VM1. VM1 includes the folder named Data, which contains several documents. Do you need to recover a whole VM1 before you can access documents in folder Data1?

Answer: No. You can use DPM to perform item level recovery, which enables you to recover files and folders from VM1, without recovering the whole VM first.

Question: Can you use item level recovery to recover files from a shielded VM?

Answer: Content of a shielded VM is encrypted. Because of this, you cannot use item level recovery to recover individual files; you can only recover the entire shielded VM.

Online protection in DPM

Question: What must you do on the DPM server to configure online protection?

Answer: Before you can configure online protection in DPM, you must install the Azure Backup Agent on the DPM server and register the DPM server with the Azure Recovery Services vault.

Question: What must you create in Azure and what must you do on the DPM server before you can register the DPM server with Azure?

Answer: The first step is to create the Recovery Services vault in Azure. From the vault, you can download backup credentials and the Azure Backup Agent, which must be installed on the DPM server. During installation, you should point to the backup credentials, and after the installation the DPM server will be registered with the vault.

Resources

DPM protection process

 **Additional Reading:** For more information, refer to How does DPM work: <https://aka.ms/bsdtkw>.

Managing storage pools

 **Additional Reading:** For more information, refer to New DPM2010 Storage Calculator links (Sep-2010): <https://aka.ms/p4bml5>.

 **Additional Reading:** For more information, refer to Add Storage to DPM: <https://aka.ms/tns1dm>.

Deploying DPM protection agents

 **Additional Reading:** For more information, refer to Get ready to deploy DPM servers: <https://aka.ms/qeroyz>.



Additional Reading: For more information, refer to Data Protection Manager Agent Network Troubleshooting: <https://aka.ms/vp4r9n>.

Managing protection groups



Additional Reading: For more information, refer to Deploy protection groups: <https://aka.ms/lsdg4v>.

Online protection in DPM



Additional Reading: For more information, refer to Backup Pricing: <https://aka.ms/iv73oz>.



Additional Reading: For more information, refer to Preparing to back up workloads to Azure with DPM: <https://aka.ms/kgpz2n>.



Additional Reading: For more information, refer to Azure Backup service-FAQ: <https://aka.ms/pejyyh>.

Demonstration: Creating a storage pool and deploying DPM protection agents

Demonstration Steps

1. On **LON-DPM**, on the taskbar, right-click **Start**, and then select **Disk Management**.
2. In **Disk Management**, point out that **LON-DPM** has three disks.
3. Right-click on unallocated space on **Disk 1**, click **New Simple Volume**, click **Next**, in the **Simple volume size in MB** text box type **100000**, click **Next** three times, and then click **Finish**. In **Microsoft Windows** dialog box, click **Cancel**.
4. On the taskbar, click **Start**, and then click **Server Manager**.
5. In **Server Manager**, in the navigation pane, click **File and Storage Services**, and then click **Storage Pools**.
6. In the **STORAGE POOLS** section, verify that **Primordial** is selected.
7. In the **STORAGE POOLS** section, click **TASKS**, and then click **New Storage Pool**.
8. In New Storage Pool Wizard, on the Before you begin page, click Next.
9. On Specify a storage pool name and subsystem page, in the Name text box, type Pool1, and then click Next.
10. On the Select physical disks for the storage pool page, select Msft Virtual Disk (LON-DPM) is selected, click Next, click Create, and then click Close.
11. In the **STORAGE POOLS** section, click **Pool1**.
12. In the **VIRTUAL DISKS** section, click **TASKS**, click **New Virtual Disk**, and then click **OK**.
13. In the New Virtual Disk Wizard, on the Before you begin page, click Next.
14. On the **Specify the virtual disk name** page, in **Name** text box, type **VDisk1**, and then click **Next** two times.
15. On the **Select the storage layout**, in **Layout** section, click **Simple**, and then click **Next**.

16. On the **Specify the provisioning type** page, select **Thin**, and then click **Next**.
17. On the **Specify the size of the virtual disk** page, in the **Specify size** text box, enter **1**, select **TB** from the drop-down list box, click **Next**, click **Create**, clear the **Create a volume when this wizard closes** option, and then click **Close**.
18. On the taskbar, click **Disk Management**.
19. In **Disk Management**, on **Disk 3**, right-click the **Unallocated** space, click **New Simple Volume**, click **Next** four times, and then click **Finish**.
20. In **Disk Management**, verify that **New Volume** on **Disk 1** and on **Disk 3** are formatted with **NTFS**.
21. On the desktop, double-click **Microsoft System Center Data Protection Manager**.
22. In the System Center DPM Administrator Console, click the **Management** workspace.
23. In the navigation pane, click **Disk Storage**, and then on the ribbon click **Add**.
24. In the **Add Disk Storage** window, in the **Available volumes** list, point out that volumes **D:** and **F:** are shown.
25. Press and hold the **Ctrl** key, in **Available volumes** section, click **D:**, click **F:**, release the **Ctrl** key, click **Add**, point out the note, click **Yes**, and then click **OK**.
26. Point out that **D:** and **F:** appear in the details pane under **DPM Storage Pool Volumes and Folders**.
27. On the taskbar, click **Disk Management**.
28. In **Disk Management**, point out that partitions on **Disk 1** and **Disk 3** have GUID as their name, they are formatted with **ReFS**, and that **Disk 1** still has unallocated space.
29. In the **System Center DPM Administrator Console**, in the navigation pane, click **Production Servers**, and then on the ribbon click **Add**.
30. In the Production Server Addition Wizard, on the **Select Production Server type** page, verify that **Windows Servers** is selected, and then click **Next**.
31. On the **Select agent deployment method** page, verify that **Install agents** is selected, and then click **Next**.
32. On the **Select computers** page, press and hold the **Ctrl** key, select **LON-SVR1** and **LON-SVR2**, release the **Ctrl** key, click **Add**, and then click **Next**.
33. On the **Enter credentials** page, enter the following information, and then click **Next**:
 - o User name: **Administrator**
 - o Password: **Pa55w.rd**
 - o Domain: **Adatum.com**
34. On the **Choose Restart Method** page, select the **Yes**. Restart the selected computers after installing the protection agent (if required) option, and then click **Next**.
35. On the **Summary** page, click **Install**. After installation is successful, click **Close**.
36. In **System Center Data Protection Manager**, in the details pane, point out that **LON-SVR1** and **LON-SVR2** are listed as unprotected computers with protection agents installed.

Demonstration: Creating and configuring a protection group

Demonstration Steps

1. On LON-DPM, in the System Center DPM Administrator Console, click Protection workspace.
2. On the ribbon, click **New**.
3. In the Create New Protection Group Wizard, on the Welcome to the New Protection Group Wizard page, click Next.
4. On the **Select protection group type** page, point out that the **Servers** option is selected, mention that DPM can also protect clients, and then click **Next**.
5. On the **Select Group Members** page, in the **Available members** pane, expand **LON-SVR2**, expand **HyperV**, and then select the **RCT\LON-PROD2** check box.
6. Expand **All Shares**, expand **All Volumes**, expand **System Protection**, and then explain that DPM can protect all data sources.
7. Expand **LON-SVR1**, expand **HyperV**, select the **RCT\LON-PROD1** check box, and then click **Next**.
8. On the Select data protection method page, in the Protection group name field, type Hyper-V VMs, and then click Next.



Note: Point out that you cannot select online protection and long-term tape protection and explain why you cannot select them.

9. On the **Specify Short-Term Goals** page, point out that **Retention range** is set to **5** days, and then click **Next**.
10. On the **Review Disk Storage Allocation** page, discuss the allocation information, and then click **Next**.
11. On the Choose Replica Creation Method page, click Next.



Note: Explain how changes are replicated from protected servers to DPM.

12. On the **Consistency check options** page, explain when and why DPM uses consistency checks, and then click **Next**.
13. On the **Summary** page, click **Create Group**. After the group has been created, click **Close**.
14. In the details pane, point out that the Hyper-V VMs protection group is shown and that it contains the **LON-PROD1** and **LON-PROD2** VMs.

Demonstration: Recovering a VM

Demonstration Steps

1. On **LON-SVR1**, on the taskbar, click **Start** and then click **Server Manager**. In Server Manager, click **Tools** and then click **Hyper-V Manager**.
2. In **Hyper-V Manager**, in the navigation pane, point out that **LON-SVR1** is selected. In the details pane, point out that the **LON-PROD2** VM is not present.
3. On LON-DPM, in the System Center DPM Administrator Console, click the Recovery workspace.

4. In the Browse pane, expand LON-SVR2, expand All Protected Hyper-V Data, and then click All Protected Hyper-V Data.
5. In the **Path** pane in the lower part of the console, right-click **LON-PROD2** and click **Recover**. The **Recovery Wizard** opens.
6. In the Recovery Wizard, on the Review Recovery Selection page, click Next.
7. On the Select Recovery Type page, select the Recover as virtual machine to any host option, and then click Next.
8. On the **Specify Destination** page, click **Browse**, expand **LON-SVR1**, expand **Volumes**, click **D:**, click **OK**, and then click **Next**.
9. On the **Specify Recovery Options** page, point out the **Network bandwidth usage throttling** option, explain why you would use it, and then click **Next**.
10. On **Summary** page, click **Recover**, and then click **Close**.
11. On **LON-SVR1**, in **Hyper-V Manager**, point out that the **LON-PROD2** VM is now present on the **LON-SVR1** Hyper-V host.
12. On LON-DPM, in the System Center DPM Administrator Console, in the Recovery workspace, in the Browse pane, expand LON-SVR1, and click All Protected Hyper-V Data.
13. In the **Path** pane in lower part of the console, double-click **LON-PROD1**.
14. In the **Path** pane, double-click **D:\LON-PROD1\Virtual Hard Disks\LON-PROD1.vhd**. Explain that this is VHD that LON-PROD1 uses.
15. In the **Path** pane, double-click **WINPE**.
16. In the **Path** pane, click the **EFI** folder, and then on the ribbon click **Recover**.
17. In the Recovery Wizard, on the Review Recovery Selection page, click Next.
18. On the **Select Recovery Type** page, point out that the only single option, **Copy to a network folder**, is available and selected, and then click **Next**.
19. On the **Specify Destination** page, click **Browse**, extend **LON-SVR1**, extend **Volumes**, click **D:**, click **OK**, and then click **Next**.
20. On Specify Recovery Options page, click Next.
21. On **Summary** page, click **Recover**, and then click **Close**.
22. On **LON-SVR1**, on the taskbar, click **File Explorer**.
23. In **File Explorer**, in the **navigation** pane, click **Allfiles (D:)**. In the details pane, point out most recently modified folder that has GUID in its name, and then double-click the folder.
24. In the details pane, verify that the **EFI** folder is shown. Explain that this folder was recovered from VM virtual hard disk by using item level recovery.

Module Review and Takeaways

Question: Are you required to create two separate protection groups to protect Hyper-V VMs and SQL Server databases?

Answer: No. You can create one protection group to protect both Hyper-V VMs and SQL Server databases. However, separating these types of applications into separate protection groups allows you to configure different schedules and protection settings for each type of protected data.

Question: Compliancy standards require that your organization backups are stored offsite. Which DPM protection methods can you use to achieve this goal?

Answer: You can use different DPM protection methods to achieve this goal. For example, you can use D2D2T to create a copy of the protected data first on the DPM disk and then an additional backup copy on tape, which can be stored offsite. You could also use D2D2D, where your primary DPM server would be protected by a secondary DPM server. One of the possible options is also to implement D2D2C protection, where data is stored on the DPM server, and in the cloud, for example in Azure.

Question: Can you use DPM to protect data on a computer running Windows 10? Can you use DPM to protect data on a Linux computer?

Answer: You can install the DPM protection agent on Windows 10, which means that the computer running Windows 10 can be protected by the DPM server. You cannot install the DPM protection agent on Linux, but if Linux is running in a VM on the Hyper-V host, you can use a host-based backup to protect Linux VM.

Lab Review Questions and Answers

Lab: Protecting virtualization infrastructure by using DPM

Question and Answers

Question: Can you install DPM protection agents manually on servers that you want to protect by DPM?

Answer: Yes, you can install DPM protection agents manually. Manual installation is initiated on the server and as part of the installation, the DPM protection agent configures Windows Firewall to allow communication with DPM server.

Question: Can you configure online protection for a protection group if the DPM server is not registered in the Azure Recovery Services vault?

Answer: No. To configure online protection, the Azure Backup Agent must be installed on the DPM server and after that, you must register the DPM server in the Azure Recovery Services vault.