Lesson 8: Creating and Configuring Virtual Machine Storage

MOAC 70-410: Installing and Configuring Windows Server 2012



WILEY

Overview

- Exam Objective 3.2: Create and configure virtual machine storage.
- Working with Virtual Disks
- Connecting to a SAN

Working with Virtual Disks

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Working with Virtual Disks

- Hyper-V uses a virtual hard disk (VHD) format to package part of the space on a physical disk to appear to the VM as though it is a physical hard drive.
- You can construct virtual storage subsystems to emulate almost any physical storage solution.
- The New Virtual Machine Wizard creates the following virtual storage subsystem:
 - 2 IDE (Integrated Drive Electronics) controllers (system drive + DVD drive)
 - 1 SCSI (Small Computer Systems Interface) controller (unpopulated)

Working with Virtual Disks

| 1 | Settings | for ServerC on CZ2 | | _ □ | x |
|--|--|--------------------|-------------------------------|---|---|
| ServerC | Image: Image: Ima | | | | |
| ServerC | You can incr and attaching the guest op disks must be | dware | rtual machine. Add button. | Add SI controller services in ller. System | |
| Snapsnot File Location D: Hyper-V\Config Smart Paging File Location D: \Hyper-V\Config Automatic Start Action Restart if previously running | | | | | |
| | | ОК | Cancel | Apply | |

The default VM drive controller configuration

Virtual Disk Formats

Three types of VHD formats:

- **Fixed hard disk image**: An image file of a specified size in which all the disk space required to create the image is allocated during its creation.
- **Dynamic hard disk image**: An image file with a specified maximum size, which starts out small and expands as needed to accommodate the data the system writes to it.
- **Differencing hard disk image**: A child image file associated with a specific parent image. The system writes all changes made to the data on the parent image file to the child image, to facilitate a rollback at a later time.

Virtual Hard Disk Formats

• VHD

o Limited to 2 TB

 Compatible with all versions of Hyper-V, Virtual Server, and Virtual PC

• VHDX

o Up to 64 TB

- Support 4 KB logical sector sizes
- Larger block sizes (up to 256 MB)
- Not backwards compatible

Creating Virtual Disks

- Hyper-V allows you to create virtual hard disks as a part of a virtual machine, or create them later and add them to a VM.
- Hyper-V Manager provides access to most of the VHD parameters.
- Windows PowerShell provides the most granular control.

Creating a Virtual Disk with a VM

- The New Virtual Machine Wizard includes a Connect Virtual Hard Disk page, with which you can add a single disk to your new VM with these options:
- **Create a virtual hard disk:** Enables you to specify the name, location, and size of a new virtual hard disk, but you can only create a dynamically expanding disk using the VHDX format.
- Use an existing virtual hard disk: Enables you to specify the location of an existing VHD or VHDX disk, which the VM will presumably use as its system disk.
- Attach a virtual hard disk later: Prevents the wizard from adding any virtual disks to the VM configuration. The assumption is that you will manually add a disk later, before you start the virtual machine.

| ۵. | New Virtual Hard Disk Wizard | x |
|--|---|-----|
| Choose Disk | Format | |
| Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary | What format do you want to use for the virtual hard disk? VHD Supports virtual hard disks up to 2,040 GB in size. VHDX This format supports virtual disks up to 64 TB and is resilient to consistency issues that might oc from power failures. This format is not supported in operating systems earlier than Windows Server 2012. | cur |
| | < Previous Next > Finish Cancel | |

The Choose Disk Format page of the New Virtual Hard Disk Wizard

| 2 | New Virtual Hard Disk Wizard | x |
|--|---|----------------------|
| Choose Disk | Туре | |
| Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary | What type of virtual hard disk do you want to create? Fixed size This type of disk provides better performance and is recommended for servers running application with high levels of disk activity. The virtual hard disk file that is created initially uses the size of the virtual hard disk and does not change when data is deleted or added. Dynamically expanding This type of disk provides better use of physical storage space and is recommended for servers running applications that are not disk intensive. The virtual hard disk file that is created is small initially and changes as data is added. Differencing This type of disk is associated in a parent-child relationship with another disk that you want to leave intact. You can make changes to the data or operating system without affecting the paree disk, so that you can revert the changes easily. All children must have the same virtual hard disk format as the parent (VHD or VHDX). | ons he nt k |
| | < <u>P</u> revious <u>N</u> ext > <u>F</u> inish Cancel | |

The Choose Disk Type page of the New Virtual Hard Disk Wizard

| å | New Virtual Hard Disk Wizard | x |
|--|---|---|
| Specify Name | e and Location | |
| Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary | Specify the name and location of the virtual hard disk file. Name: New Virtual Hard Disk.vhdx Location: D:\Hyper-V\Virtual Hard Disks\ | |
| | < Previous Next > Finish Cance | 2 |

The Name and Location page of the New Virtual Hard Disk Wizard

| å | New Virtual Hard Disk Wizard | × |
|--|--|---|
| Configure Dis | k | |
| Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary | You can create a blank virtual hard disk or copy the contents of an existin Create a new blank virtual hard disk Size: 40 GB (Maximum: 64 TB) Copy the contents of the specified physical disk: Physical Hard Disk \\PHYSICALDRIVE0 \\PHYSICALDRIVE1 Copy the contents of the specified virtual hard disk Path: | ng physical disk. Size 465 GB 931 GB Browse |
| | < <u>P</u> revious <u>N</u> ext > | <u>Fi</u> nish Cancel |

The Configure Disk page of the New Virtual Hard Disk Wizard

| | New Virtual Hard Disk Wizard | x |
|--|--|---|
| Completing | the New Virtual Hard Disk Wizard | |
| Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary | You have successfully completed the New Virtual Hard Disk Wizard. You are about to create the following virtual hard disk. Description: Format: VHDX Type: dynamically expanding Name: New Virtual Hard Disk.vhdx Location: D:\Hyper-V\Virtual Hard Disks Size: 40 GB To create the virtual hard disk and close this wizard, click Finish. | |
| | < Previous Next > Finish Cancel | |

The Completing the New Virtual Hard Disk Wizard page of the New Virtual Hard Disk Wizard

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Adding Virtual Disks to Virtual Machines

- If you chose the **Attach a virtual hard disk later** option when creating your virtual machine, you will need to attach a virtual hard drive to one of your controllers.
- In the VM's settings you will see 2 IDE controllers (IDE 0 and IDE 1) and 1 SCSI controller.

Add a Virtual Disk to a Virtual Machine

| Set Set | tings for New Virtual Machine on CZ2 |
|--|---|
| New Virtual Machine 🗸 🗸 | 4 ▶ Q. |
| New Virtual Machine V Hardware Add Hardware BIOS Boot from CD Boot from CD Iter State Processor 1 Virtual processor IDE Controller 0 Dt De Controller 1 Dt Do Drive None SCSI Controller None SCSI Controller One COM 1 None Diskette Drive None Memory Anangement Name New Virtual Machine Starvices offered Sapahot File Location D: Hyper-V(Config Smart Paging File Location D: Hyper-V(Config | IDE Controller You can add hard drives and CD/DVD drives to your IDE controller. Select the type of drive you want to attach to the controller and then click Add. Hard Drive DVD Drive Agd You can configure a hard drive to use a virtual hard disk or a physical hard disk after you attach the drive to the controller. |
| Automatic Start Action Restart if previously running | |
| Automatic Stop Action Save | |
| | <u>O</u> K <u>Cancel</u> Apply |

The IDE Controller interface in the Settings dialog box

Add a Virtual Disk to a Virtual Machine

| 1 <u>2</u> | Settings for New Virtual Machine on CZ2 | – – X |
|---|--|---|
| New Virtual Machine | ✓ 4 ▶ Q. | |
| ★ Hardware ▲ Add Hardware ▲ BIOS Boot from CD ■ Memory \$12 M8 ■ Processor 1 Virtual processor ■ IDE Controller 0 ▲ Hard Drive <file></file> ■ IDE Controller 1 ● DVD Drive None SCSI Controller ■ IDE Controller 1 ● DVD Drive None SCSI Controller ■ None ○ COM 1 None ○ COM 1 None ○ COM 2 None ■ Diskette Drive None ▲ Management ▲ Management ③ Name New Virtual Machine ○ Integration Services All services offered ◎ Snaphot File Location D: \Hyper-V\Config ■ Smart Paging File Location D: \Hyper-V\Config ● Automatic Start Action Restart if previously running | Hard Drive You can change how this virtual hard disk is attached to the virtual machine from starting. Controller: Location: IDE Controller 0 0 (in use) Media You can compact or convert a virtual hard disk by editing the associat Specify the full path to the file. Virtual hard disk: Image: Image: I | ine. If an prevent the v led file. Browse Browse but does not Remove |
| | OK Cancel | Apply |

The Hard Drive interface in the Settings dialog box

Creating Differencing Disks

- Allows you to create a cloned version of a baseline installation
- The parent disk is the baseline installation
- The child is the differencing disk
- Make changes to the child differencing disk without changing the baseline
- You can revert back to the baseline installation anytime
- Excellent tool for testing or labs

Create a Cloned Installation with a Differencing Disk

| L | New Virtual Hard Disk Wizard | x |
|--|---|---|
| Configure Dis | sk | |
| Before You Begin Choose Disk Format Choose Disk Type Specify Name and Location Configure Disk Summary | Specify the virtual hard disk that you want to use as the parent for the new differencing virtual hard disk. Location: D:\Hyper-V\Virtual Hard Disks\ Browse. | d |
| | <previous next=""> Finish Cancel</previous> | |

The Configure Disk page in the New Virtual Hard Disk Wizard, when creating a differencing disk

Configuring Pass-Through Disks

- A **pass-through disk** is a type of virtual disk that points not to an area of space on a physical disk, but to a physical disk drive itself, installed on the host computer.
- The VM must have exclusive access to the physical disk.
- You must take the disk offline in the parent operating system.

Configuring Pass-Through Disks

| 4 | | Computer Man | agement | | | - | | x |
|--|--------------------|----------------------------------|------------------------|--|------|---------|---------|-----|
| File Action View Help | | | | | | | | |
| 🗢 🔿 🙋 📰 🔮 I | e 🗟 | | | | | | | |
| Computer Management (Local | Volume | Layout Type File Sy | /stem Status | | | Actions | | |
| ⊿ | C:) | Simple Basic NTFS | Healthy (Healthy (| (Boot, Page File, Crash Dum) (System, Active, Primary Par | p, P | Disk Ma | nage | . 🔺 |
| Fusic Scheduler | WMGUEST (D:) | Simple Basic CDFS | Healthy (| (Primary Partition) | | More | Actions | s 🕨 |
| ▷ | | | | | | | | |
| Performance Performance | | | | | | | | |
| ⊿ 🔄 Storage | | | | | | | | |
| Windows Server Backup | × | | | | | | | |
| Disk Management Services and Applications | Disk 0 | | | | Â | | | |
| | Basic 127.00 GB | System Reserved 350 MB NTFS 1 | (C:) 26.66 GB NTFS | | | | | |
| | Online | Healthy (System, Ac | Healthy (Boot, Pa | ige File, Crash Dump, Prim | = | | | |
| | | | | | | | | |
| | GDisk 1 | | | | | | | |
| | 40.00 GB | 40.00 GB | | | | | | |
| | Offline () Help | | | | | | | |
| | | 1 | | | v | | | |
| < III > | Unallocated | Primary partition | | | | | | |
| | | | | | | | | |

An offline disk in the Disk Management snap-in

Modifying Virtual Hard Disks

- You can edit a virtual hard disk, whether you have attached it to a VM or not.
- Use the Edit Virtual Hard Disk Wizard in the Hyper-V Manager.

Edit a Virtual Hard Disk

| ø. | Edit Virtual Hard Disk Wizard | x |
|---|---|---|
| Locate Virtu | al Hard Disk | |
| Before You Begin Locate Disk Choose Action Summary | Where is the virtual hard disk file located? Location: D:\Hyper-V\Virtual Hard Disks\ | a |
| | < Previous Next > Finish Cancel | |

The Locate Disk page in the Edit Virtual Hard Disk Wizard

Edit a Virtual Hard Disk

| ø. | Edit Virtual Hard Disk Wizard | x |
|---|---|---|
| Choose Actio | on | |
| Before You Begin Locate Disk Choose Action Summary | What do you want to do to the virtual hard disk? Compact This option compacts the file size of a virtual hard disk. The storage capacity of the virtual hard disk remains the same. Convert This option converts a virtual hard disk by copying the contents to a new virtual hard disk. The new virtual hard disk can use a different type and format than the original virtual hard disk. Expand This option expands the capacity of the virtual hard disk. Shrink This option reduces the storage capacity of the virtual hard disk. | |
| | < Previous Next > Finish Cancel | |

The Choose Action page in the Edit Virtual Hard Disk Wizard

Edit a Virtual Hard Disk

| ý la star star star star star star star sta | Edit Virtual Hard Disk Wizard | x |
|---|---|---|
| Completing | the Edit Virtual Hard Disk Wizard | |
| Before You Begin Locate Disk Choose Action Summary | You have successfully completed the Edit Virtual Hard Disk Wizard. You are about to make the following changes. Description: Virtual Hard Disk: ServerA.vhdx (VHDX, dynamically expanding) Action: Compact To complete the action and close the wizard, click Finish. | |
| | < Previous Next > Finish Cancel | |

The Completing the Edit Virtual Hard Disk Wizard page in the Edit Virtual Hard Disk Wizard

Mount a Virtual Hard Disk

| * | | Compute | r Management | | | | X |
|---|---------------------|---|--|---|-------------------------|--------|---|
| File Action View Help | | | | | | | |
| 🗢 🄿 🖄 📰 🛿 🖬 🖗 1 | e 🛱 | | | | | | |
| 🛓 Computer Management (Local | Volume | Layout Type File Syste | m Status | | Actions | | |
| | (C:) | Simple Basic NTFS | Healthy (Boot, Pag Healthy (Briman) | ge File, Crash Dump, Primary Pa Partition) | ^{ar} Disk Mana | gement | • |
| Frank Scheduler Frank Scheduler Frank Scheduler | System Reserve | d Simple Basic NTFS | Healthy (System, J | Active, Primary Partition) | More Ac | tions | • |
| Shared Folders | | | | | | | |
| Example 2 Series and Groups | | | | | | | |
| Device Manager | | | | | | | |
| ⊿ 📇 Storage | < | Ш | | | > | | |
| Windows Server Backup Disk Management | | | | | | | |
| Services and Applications | Basic | System Reserved (C |) | | | | |
| | 465.76 GB Online | 350 MB NTFS 465 Healthy (System Aci He | .42 GB NTFS http://Boot_Page File_(| Trash Dumn, Primany Pa | | | |
| | | | inny (boot, rugerine, e | crash barnp, r ninary r a | | | |
| | Dick 1 | | | | | | |
| | Basic | New Volume (D:) | | | | | |
| | 931.39 GB Online | 931.39 GB NTFS Healthy (Primary Partition) | | | | | |
| | | | | | | | |
| | CD-ROM 0 | | | | | | |
| | | Primany partition | | | - | | |
| | | | | | | | |
| | | | | | | | |

The Disk Management snap-in

Mount a Virtual Hard Disk

| Attach Virtual Hard Disk | x |
|---|--------|
| Specify the virtual hard disk location on the computer. | |
| Location: | |
| | Browse |
| Read-only. | |
| ОК | Cancel |

The Attach Virtual Hard Disk dialog box

Creating Snapshots

- A **snapshot** is a captured image of the state, data, and hardware configuration of a virtual machine at a particular moment in time.
- Offers a convenient way for administrators to revert a virtual machine to a previous state at will.
- Select Snapshot from the Actions pane.
- The system creates a snapshot file, with an AVHD or AVHDX extension in the same folder as the virtual hard disk file.

Creating Snapshots

| N N N N N N N N N N N N N N N N N N N | | | Hyper-V Ma | nager | | | _ D X | | |
|---------------------------------------|---------------------------|----------------------|------------|-----------------|------------------------------|--------|--------------------------|--|--|
| File Action View Help | | | | | | | | | |
| 🗢 🔿 🙎 🖬 🚺 🖬 | | | | | | | | | |
| 🔡 Hyper-V Manager | | | | | | | Actions | | |
| CZ2 | Virtual Machines | | | | | | CZ2 | | |
| | Name 📩 | State | CPU Usage | Assigned Memory | Uptime | ^ | New | | |
| | New Virtual Machine | Off | | | | = | | | |
| | New Virtual Machine | Off | | | | - | | | |
| | ServerA | Running | 0 % | 576 MB | 1.01:12:22 | | 🖆 Hyper-V Settings | | |
| | ServerB | Off | | | | | 👯 Virtual Switch Manager | | |
| | ServerC | Off | | | | > | | | |
| | | | | | | | j Edit Disk | | |
| | Snapshots | | | | | | Inspect Disk | | |
| | 🖃 📲 😹 ServerA - (9/30/201 | 2 - 11:13:54 PM) | | | | | | | |
| | Now | | | | | | Stop Service | | |
| | | | | | | | X Remove Server | | |
| | ServerA - (9/30/20 | 12 - 11:13:54 | 4 PM) | | | | 🔉 Refresh | | |
| | | | | | | | View 🕨 | | |
| Created: 9/30/2012 11:13:57 PM | | | | | | 🛛 Help | | | |
| | Notes: None | | | | | | | | |
| Manage Networking Destination | | | | | ServerA - (9/30/2012 - 11: 🔺 | | | | |
| | | | | | Settings | | | | |
| | | | | | Apply | | | | |
| | Summary Memory Netwo | orking Replication | | | | | 🗐 Rename 🗸 | | |
| , | - | | | | | | | | |
| | | | | | | | | | |

A snapshot in Hyper-V Manager

Connecting to a SAN

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Connecting to a SAN

- A storage area network (SAN) is simply a network dedicated to high-speed connections between servers and storage devices.
- A SAN consists of one or more drive arrays equipped with network interface adapters, which you connect to your servers using standard twisted pair or fiber optic network cables.
- A SAN-connected server has a minimum of two network adapters—one for the standard LAN connection, and one for the SAN.

Connecting to a SAN



A server connected to a SAN

Advantages of SANs

- Avoid the limitations imposed by the maximum number of devices you can connect directly to a computer.
- Provide added flexibility in their communications capabilities.
- Can also greatly extend the distances between servers and storage devices.

Clustering in a SAN

Because any device on a SAN can communicate with any other device on the same SAN, high-speed data transfers can occur in the following ways:

- Server to storage: Servers access storage devices over the SAN just as if they were connected directly to the computer.
- Server to server: Servers use the SAN to communicate directly with each other at high speeds to avoid flooding the LAN with traffic.
- Storage to storage: Storage devices communicate among themselves without server intervention (e.g., performing backups from one medium to another or to mirror drives on different arrays).

By connecting redundant servers to the same network, enabling them to access the same data storage devices, you create fault tolerance—clustering.

Clustering in a SAN



SAN Technologies

- Hard drive arrays directly connected to a server consist of multiple drives and a SCSI interface.
- Some include RAID controllers, while some are JBOD (Just a Bunch of Disks).
- Drive arrays for SANs are more complex because they also include support for networking and intelligent agents that provide advanced functions, like serverless backups.

Using Fibre Channel

- Fibre Channel is a high-speed serial networking technology that was originally designed for use with supercomputers, but which is now associated primarily with storage area networking.
- Supports various network media, transmission speeds, topologies, and upperlevel protocols
- Its primary disadvantage is that it requires specialized hardware that can be extremely expensive.

Connecting Virtual Machines to a SAN

- Windows Server 2012 Hyper-V now supports the creation of virtual Fibre channel adapters.
- This is essentially a pass-through device that enables a virtual machine to access a physical Fibre Channel adapter installed in the computer, and through that, the external resources connected to the SAN.

Connecting Virtual Machines to a SAN

| V | irtual SAN Manager for | CZ2 | × |
|---|-------------------------|------------------|--------------------|
| Virtual Fibre Channel SANs New Fibre Channel SAN Emulex-LP11002 | Q New Fibre Channel SAN | | |
| ★ Global Fibre Channel Settings | Emulex-LP11002 | | |
| World Wide Names C003FF6378E20000 to C003FF63 | Notes: | | <u>^</u> |
| | | | ~ |
| | WWNN | WWPN | Status |
| | 20000000C9EA2BCE | 10000000C9EA2BCE | 'Emulex-LP11002' |
| | | | |
| | | | Remove virtual SAN |
| | | | |
| | | QK | Cancel Apply |

WWNNs and WWPNs in a virtual SAN

Connecting Virtual Machines to a SAN

| 2 | Settings for LG1 on ServerA |
|---|--|
| LG1 | |
| Add Hardware Add Hardware BtOS Boot from CD Memory S12 MB Processor 1 Virtual processor IDE Controller 0 Hard Drive LG1.vhdx IDE Controller 1 DVD Drive 7600.16385.090713-1255 SCSI Controller Fibre Channel Adapter Emulex-LP11002 IM | Fibre Channel Adapter You can review and edit the World Wide Names (WWNs) assigned to the Fibre Channel adapter, and connect the adapter to a virtual storage area network (SAN). Virtual <u>S</u> AN: Emulex-LP11002 Click Edit Addresses to edit the port addresses. Edit Addresses Port addresses Address set A: <u>World Wide Node Name (WWNN): C003FF0000FFFF00</u> World Wide Port Name (WWNN): C003FF6378E20002 Address set B: World Wide Name (WWNN): C003FF6378E20002 |
| Vetwork Adapter RWVDEV DOT INTRA COM 1 None OM 2 None Diskette Drive None | World Wide Note Name (WWNN): C003FF0000FFF00 World Wide Port Name (WWPN): C003FF6378E20003 Create Addresses Click Copy to copy the addresses to the clipboard. Copy |
| Praildyellett Name LG1 Integration Services All services offered Snapshot File Location C:\ProgramData\Microsoft\Win Snart Paging File Location C:\ProgramData\Microsoft\Win | To remove the adapter from this virtual machine, click Remove. |
| | <u>Q</u> K <u>C</u> ancel <u>Apply</u> |

A Fibre Channel adapter in a VM

Lesson Summary

- Hyper-V uses a specialized virtual hard disk (VHD) format to package part of the space on a physical disk and make it appear to the virtual machine as though it is physical hard disk drive.
- A dynamic hard disk image is an image file with a specified maximum size, which starts out small and expands as needed to accommodate the data the system writes to it.
- A differencing hard disk image is a child image file associated with a specific parent image. The system writes all changes made to the data on the parent image file to the child image, to facilitate a rollback at a later time.

Lesson Summary

- VHDX image files in Windows Server 2012 can be as large as 64 TB, and they also support 4 KB logical sector sizes, to provide compatibility with new 4 KB native drives.
- A pass-through disk is a type of virtual disk that points not to an area of space on a physical disk, but to a physical disk drive itself, installed on the host computer.
- In Hyper-V, a snapshot is a captured image of the state, data, and hardware configuration of a virtual machine at a particular moment in time.
- The specialized networking technologies used to build Fibre Channel SANs have, in the past, made it difficult to use them with virtualized servers. However, Windows Server 2012 Hyper-V now supports the creation of virtual Fibre channel adapters.

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