5.2.4 VHD Facts

A Virtual Hard Disk (VHD) is a file stored in the file system that emulates a physical storage device on which an operating system, data, and other files can be stored. You can install workstation and server editions of Windows in a VHD file instead of a standard disk partition on a physical storage device.

Keep the following facts about VHD files in mind:

- A VHD file allows the encapsulation of an operating system, applications, and data files into a single file that emulates standard disk operation.
- The VHD file resides on the hard drive with all the content and data contained within the VHD.
- The VHD file format is used by other Microsoft products. For example, the Backup and Restore console uses a VHD file when creating a system image backup.

Benefits of using a VHD file are described in the following table:

Benefit	Description
Ease of Use	Windows treats a VHD file the same way it treats a physical hard disk; whatever operations you can perform on a physical disk, you can perform on a virtual disk. For example: ▪ You can encrypt a VHD file using BitLocker. ▪ You can mount a VHD file directly in File Explorer by double-clicking on it. ▪ You can view the contents and copy and paste files into and out of a VHD file while it is mounted. ▪ VHD files are portable, allowing you to easily move them from one computer to another.
Installation	You can install Windows directly into a VHD file. The Windows bootloader can then be reconfigured to boot either the Windows installation on the physical storage device or the Windows installation within the VHD file. A Windows installation stored within a VHD file can be serviced either online or offline.
Bootable	VHD files are bootable. Using VHDs allows you to create a multiboot system without repartitioning the physical storage device. For example, you can install one Windows system natively on a physical storage device and another Windows system in a VHD file stored on that same device. The Windows bootloader can boot either Windows installation. VHD files created during a system image backup by the Backup and Restore console are also bootable. In the event of a system failure, the system image VHD file can be copied to a working system and then booted on that system. This feature allows you to bring a failed system back online in a very short amount of time.
Compatibility with Hypervisor Systems	You can use a VHD file to deploy an operating system without a hypervisor. However, only one operating system can run at a time. The operating system installed within the VHD file can't run concurrently with the host operating system. However, VHD files are also compatible with virtualization solutions, such as Hyper-V, VirtualBox, and Virtual PC. You can configure a virtual machine to use an existing VHD file as its storage device. You can then boot the virtual machine using the operating system already installed inside of the VHD file. When used in this manner, the operating system within the VHD can run concurrently with the host system's operating system, and the two can run on the same hardware.

You can perform the following general actions with a VHD file:

Action	Description

Create	VHD files have a .vhd or .vhdx file extension. When you first create a VHD file, it is similar to an uninitialized hard disk drive. As such, you can partition the VHD file and format the partitions using either the NTFS or ReFS file system.
	When you create a virtual disk, you can specify one of the following disk types:
	▪ A *fixed* disk occupies a set amount of hard disk space on the physical hard disk. The size of the virtual hard disk file matches the total storage capacity of the virtual disk.
	  ▪ This disk type takes longer to create than other disk types.
	  ▪ The entire disk size, including empty space within the virtual hard disk, is pre-allocated on the physical disk.
	  ▪ Performance is improved because the entire virtual disk is a contiguous block.
	▪ A *dynamically expanding* disk allocates additional physical disk space to the VHD file as virtual disk storage is consumed within the VHD.
	  ▪ The size of the VHD file grows as more virtual disk space within it is used.
	  ▪ This disk type makes the most efficient use of physical hard disk space because only the space needed is actually used.
	  ▪ The size will continue to grow until it reaches the maximum size you configured when it was created.
	  ▪ It is possible for the physical disk to run out of space as the .vhd file size grows.

Attach	

	Attaching a VHD file mounts it in the file system of the host Windows system. This allows you to access its contents using file system management utilities such as File Explorer. If the VHD has been partitioned and formatted with a file system, the volume inside the VHD is assigned a drive letter. To attach a VHD file, it must be located on an NTFS volume. You cannot attach a VHD that has been encrypted using Encrypting File System (EFS) on the host volume.
Detach	Detaching a VHD file dismounts it from the file system of the host Windows system. Detaching a VHD removes its drive letter assignment and makes it inaccessible to file system management utilities such as File Explorer. A VHD file must be detached before it can be copied to a new location. It must also be detached before it can be deleted.
Compact	You can compact a dynamically expanding VHD. Compacting a dynamically expanding VHD attempts to reduce the size of the file as much as possible. Situations where you may want to compact a VHD include the following: ▪ After installing Windows within the VHD. The installation process creates and then deletes many large temporary files, which can bloat the size of a dynamically expanding VHD file. ▪ After deleting large amounts of data from within the VHD. ▪ When you are preparing to archive the VHD file. ▪ Before you copy the VHD file to another computer. You cannot directly compact a fixed VHD file. However, you can convert a fixed-size VHD to a dynamically expanding VHD and then compact it.
Expand	Expanding the size of a VHD file increases the amount of storage space available within it.

Use the following tools to create and manage VHD files:

Tool	Description
Disk Management	The Disk Management MMC snap-in performs disk-related tasks, such as creating and formatting partitions and volumes, assigning drive letters, and shrinking and resizing volumes. Disk Management supports the following VHD operations: ▪ Create ▪ Attach ▪ Detach
DiskPart	*DiskPart* is a text-mode command prompt tool used to manage disks, partitions, or volumes. DiskPart provides the following commands for managing VHD files: ▪ **create vdisk file="*file_name*" type=*type* maximum=*size*** creates a new VHD of the specified size (in MB) and type (**fixed** or **expandable**). ▪ **select vdisk file="*file_name*"** specifies which VHD file to manage. ▪ **attach vdisk** attaches a VHD and assigns it a drive letter. ▪ **detach vdisk** detaches a VHD. ▪ **compact vdisk** compacts or reduces the size of a VHD. ▪ **expand vdisk maximum=*size*** expands the maximum size available in a VHD. ▪ **detail vdisk** displays information about a VHD, including the path and file name, state, virtual size, and physical size.
PowerShell	You can use a variety of PowerShell cmdlets to create and manage VHD files. However, most of these cmdlets are not included in the default PowerShell modules. Instead, to use these cmdlets, you must first install the Hyper-V Module for Windows PowerShell feature using Server Manager. Once that is complete, the following cmdlets are available: ▪ **Get-Disk** displays a listing of all storage devices available on the system, including currently-mounted VHD files. ▪ **New-VHD** creates a new VHD file. ▪ **Mount-VHD** mounts an existing VHD file, allowing it to be managed. ▪ **Initialize-Disk** initializes a newly created VHD file. The VHD file must be mounted before it can be initialized. ▪ **New-Partition** creates a new partition within a VHD file. The VHD file must be mounted before it can be partitioned. ▪ **Format-Volume** formats a partition within a VHD file. The VHD file must be mounted before the partition can be formatted. ▪ **Dismount-VHD** dismounts a mounted VHD file. You can use the **Get-Help** cmdlet to view the specific syntax required for each of the cmdlets shown here.
BCDEdit	*BCDEdit* is a command line tool used to manage BCD stores, including: ▪ Creating new BCD stores

- Modifying existing BCD stores
- Adding boot menu parameters

When you configure a computer to boot from a new VHD, use BCDEdit to create a new BCD boot entry.