

# MCA: Windows Server Hybrid Administrator Study Guide: AZ-800 & AZ-801

## Chapter 2: Understanding Hyper-V

# Introduction to Virtualization

Method for abstracting physical resources from the way that they interact with other resources.

- Server Virtualization
- Presentation Virtualization
- Desktop Virtualization
- Application Virtualization

# Microsoft Windows Hypervisor

- A thin layer of software that sits between the hardware and the Windows Server 2022 operating system.
- Allows one physical machine to run multiple operating systems in different virtual machines at the same time.
- The mechanism responsible for maintaining isolation between the different Hyper-V partitions.

# Hyper-V Features <sup>(1/2)</sup>

- Architecture
- Automatic Virtual Machine Activation (AVMA)
- Discrete Device Assignment (DDA)
- Dynamic Memory
- Enhanced Session Mode
- Fibre Channel
- Hardware Architecture
- Hyper-V Nesting
- Network Isolation
- Network Load Balancing
- Non-Uniform Memory Access

# Hyper-V Features (2/2)

- Operating System Support
- Quick Migration
- Resource Metering
- RemoteFX
- Scripting
- Shared Virtual Hard Disk
- Shielded Virtual Machines
- Support for Symmetric Multiprocessors
- Virtual Machines
- Virtual Machine Snapshot
- Virtual Machine Queue

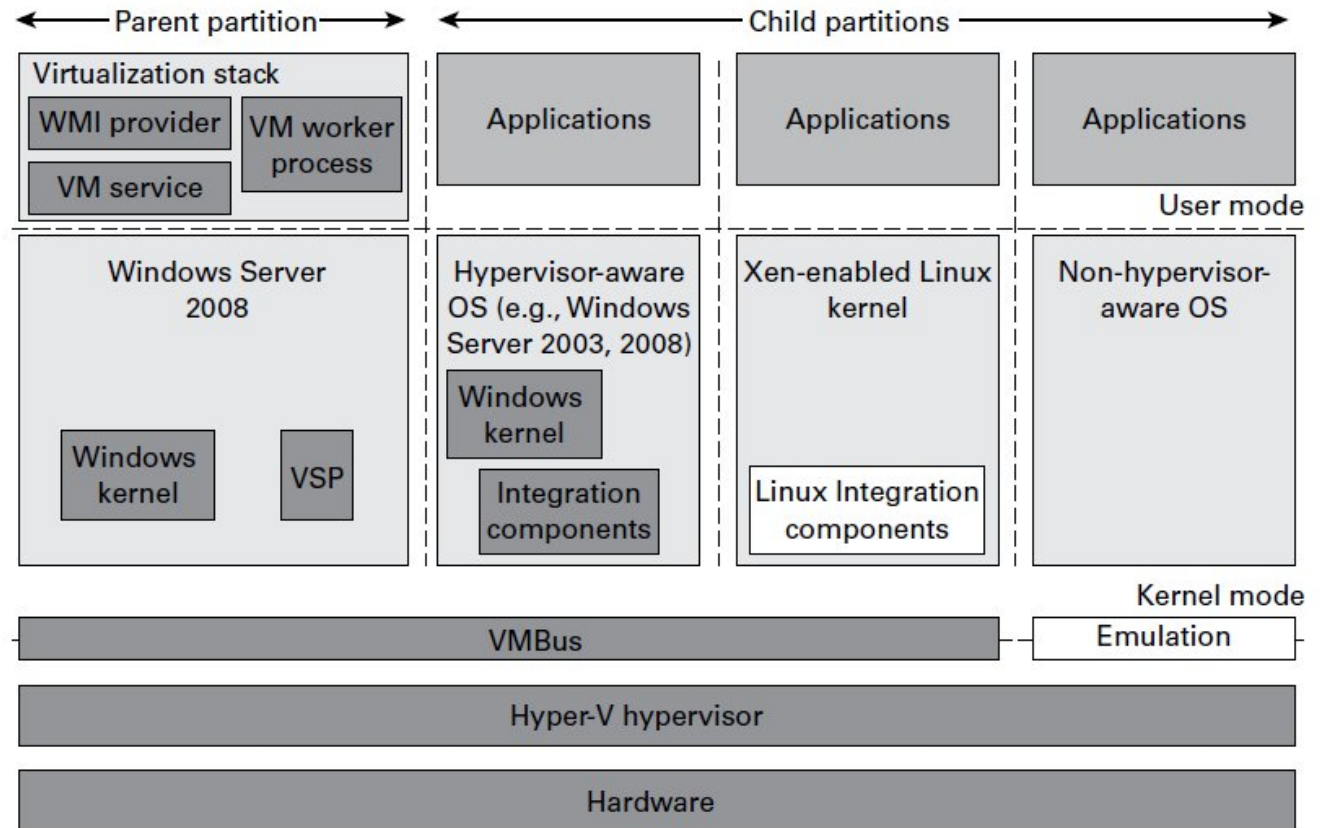
# Hyper-V Guest Server Operating Systems

<b>Guest Operating System (Server)</b>	<b>Maximum Number of Virtual Processors</b>
Windows Server 2022	64 for Generation 1 VMs and 240 for Generation 2 VMs.
Windows Server 2019	64 for Generation 1 VMs and 240 for Generation 2 VMs.
Windows Server 2016	64 for Generation 1 VMs and 240 for Generation 2 VMs.
Windows Server 2012 and Server 2012 R2	64
Windows Server 2008 R2 with Service Pack 1 (SP1)	64
Windows Server 2008 R2	64
Windows Server 2008 with Service Pack 2 (SP2)	8
Red Hat Enterprise Linux 5.7 and 5.8	64
Red Hat Enterprise Linux 6.0–6.3	64
SUSE Linux Enterprise Server 11 SP2	64
Open SUSE 12.1	64

# Hyper-V Guest Client Operating Systems

Guest Operating System (Client)	Maximum Number of Virtual Processors
Windows 11	32
Windows 10	32
Windows 8.1	32
CentOS 5.7 and 5.8	64
CentOS 6.0–6.3	64
Red Hat Enterprise Linux 5.7 and 5.8	64
Red Hat Enterprise Linux 6.0–6.3	64
SUSE Linux Enterprise Server 11 SP2	64
Open SUSE 12.1	64

# Hyper-V Architecture





# Hyper-V Operating Systems

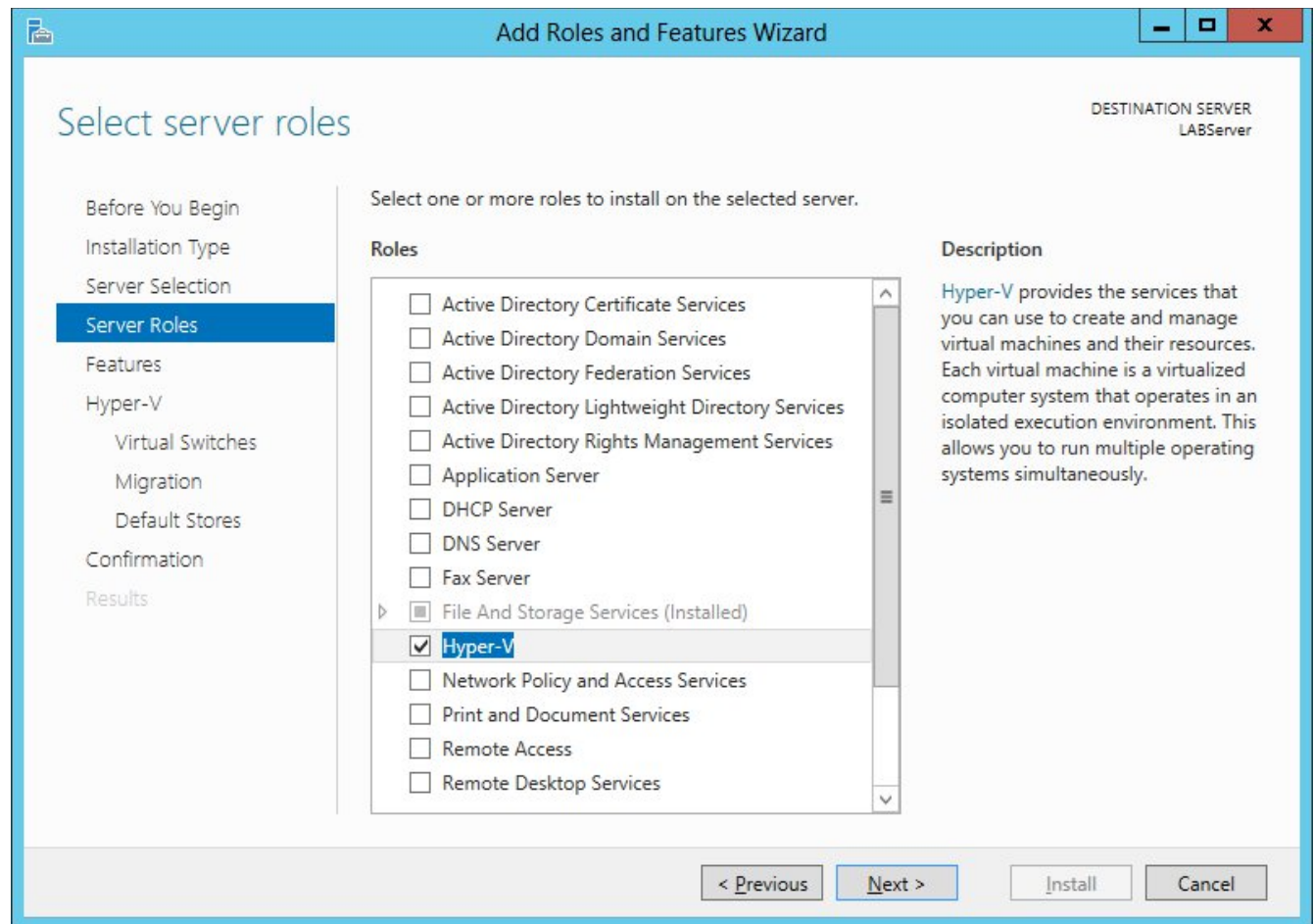
Hyper-V runs only on the following editions of the Windows Server 2022 operating system:

- Windows Server 2022 Standard edition
- Windows Server 2022 Datacenter edition
- Microsoft Hyper-V Server 2022 edition

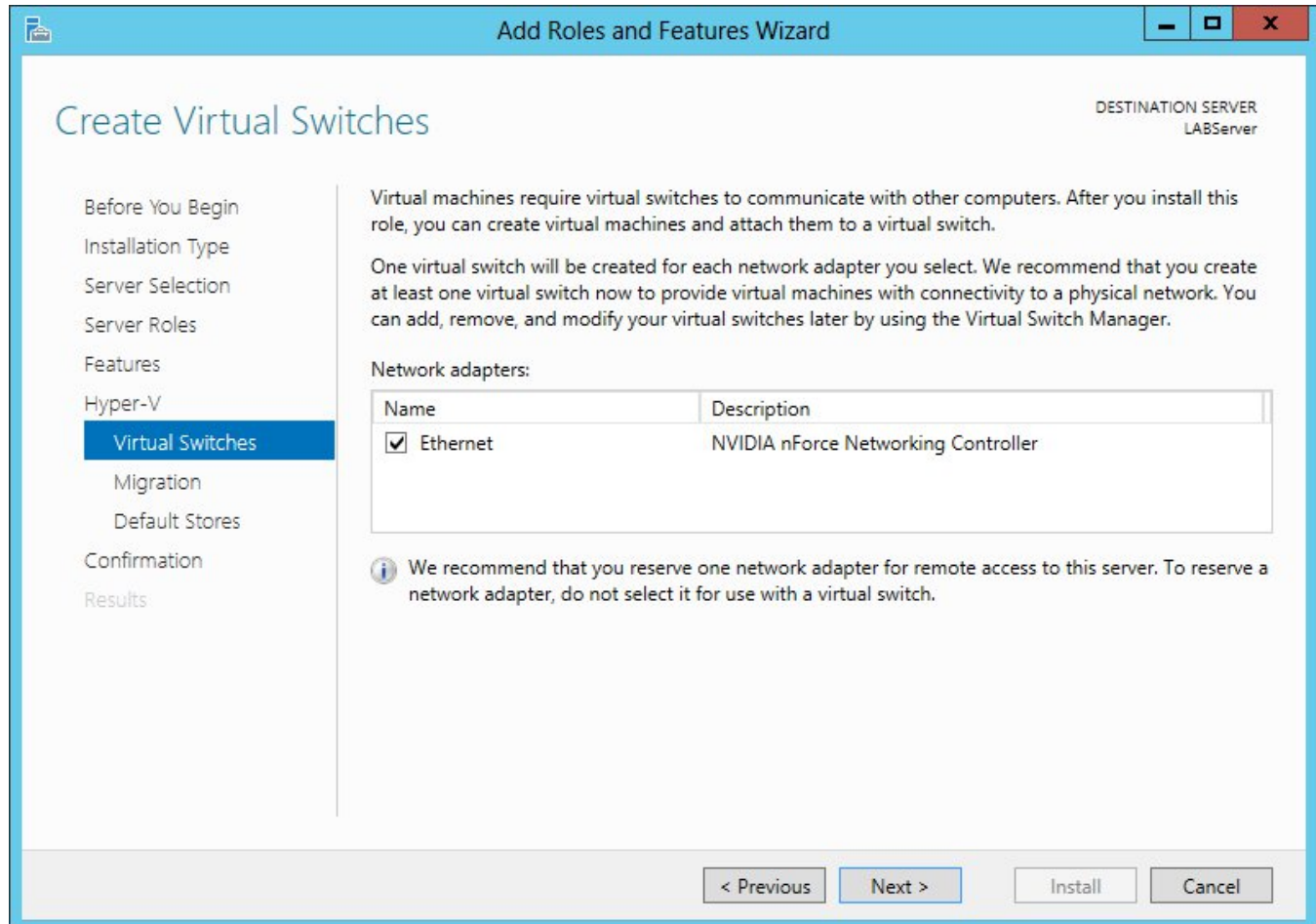
# Hyper-V Hardware Requirements

Requirement Area	Definition
CPU	x64-compatible processor with Intel VT or AMD-V technology enabled. Hardware Data Execution Prevention (DEP), specifically Intel XD bit (execute disable bit) or AMD NX bit (no execute bit), must be available and enabled. Minimum: 1.4GHz. Recommended: 2GHz or faster.
Memory	Minimum: 1GB RAM. Recommended: 4GB RAM or greater. (Additional RAM is required for each running guest operating system.) Maximum: 1TB.
Hard disk	Minimum: 8GB. Recommended: 20GB or greater. (Additional disk space needed for each guest operating system.)

# Installing Hyper-V in Full Installation Mode – Server Manager Add Features



# Installing Hyper-V in Full Installation Mode – Create Virtual Switch Screen



**Add Roles and Features Wizard**

DESTINATION SERVER  
LABServer

## Create Virtual Switches


Before You Begin  
Installation Type  
Server Selection  
Server Roles  
Features  
Hyper-V  
**Virtual Switches**  
Migration  
Default Stores  
Confirmation  
Results

Virtual machines require virtual switches to communicate with other computers. After you install this role, you can create virtual machines and attach them to a virtual switch.

One virtual switch will be created for each network adapter you select. We recommend that you create at least one virtual switch now to provide virtual machines with connectivity to a physical network. You can add, remove, and modify your virtual switches later by using the Virtual Switch Manager.

Network adapters:

Name	Description
<input checked="" type="checkbox"/> Ethernet	NVIDIA nForce Networking Controller

 We recommend that you reserve one network adapter for remote access to this server. To reserve a network adapter, do not select it for use with a virtual switch.

< Previous   Next >   Install   Cancel

# Installing Hyper-V in Server Core

Provides the following benefits:

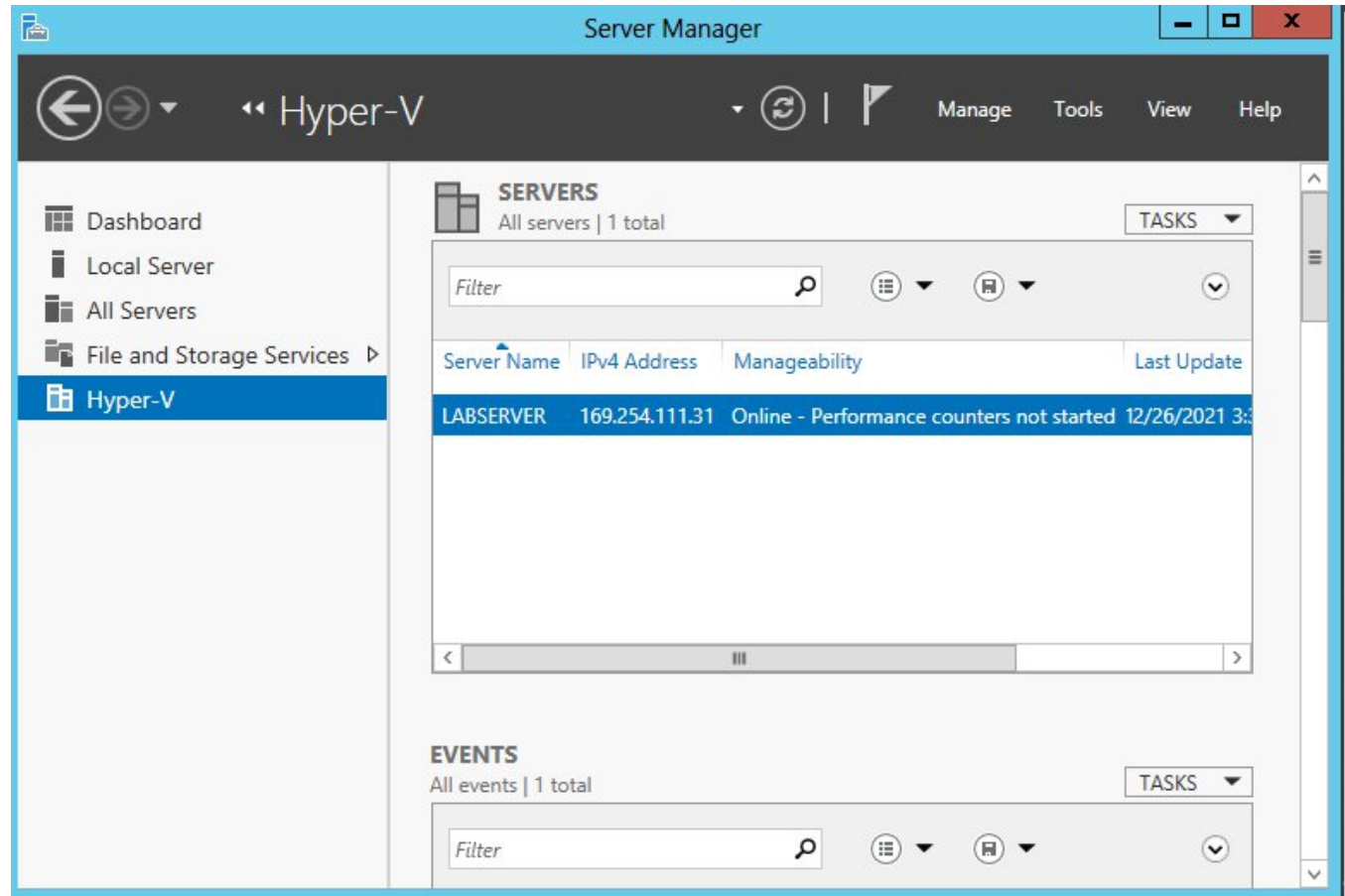
- Reduces attack surface (because fewer applications are running on the server)
- Reduces maintenance and management (because only the required options are installed)
- Requires less disk space and produces less processor utilization
- Provides a minimal parent partition
- Reduces system resources required by the operating system as well as the attack surface

# Hyper-V for a Windows Server 2022 Installation

To install Hyper-V for a Windows Server 2022 installation, you must execute the following command in the command-line interface:

```
Dism /online /enable-feature  
/featurename:Microsoft-Hyper-V
```

# Hyper-V in Server Manager

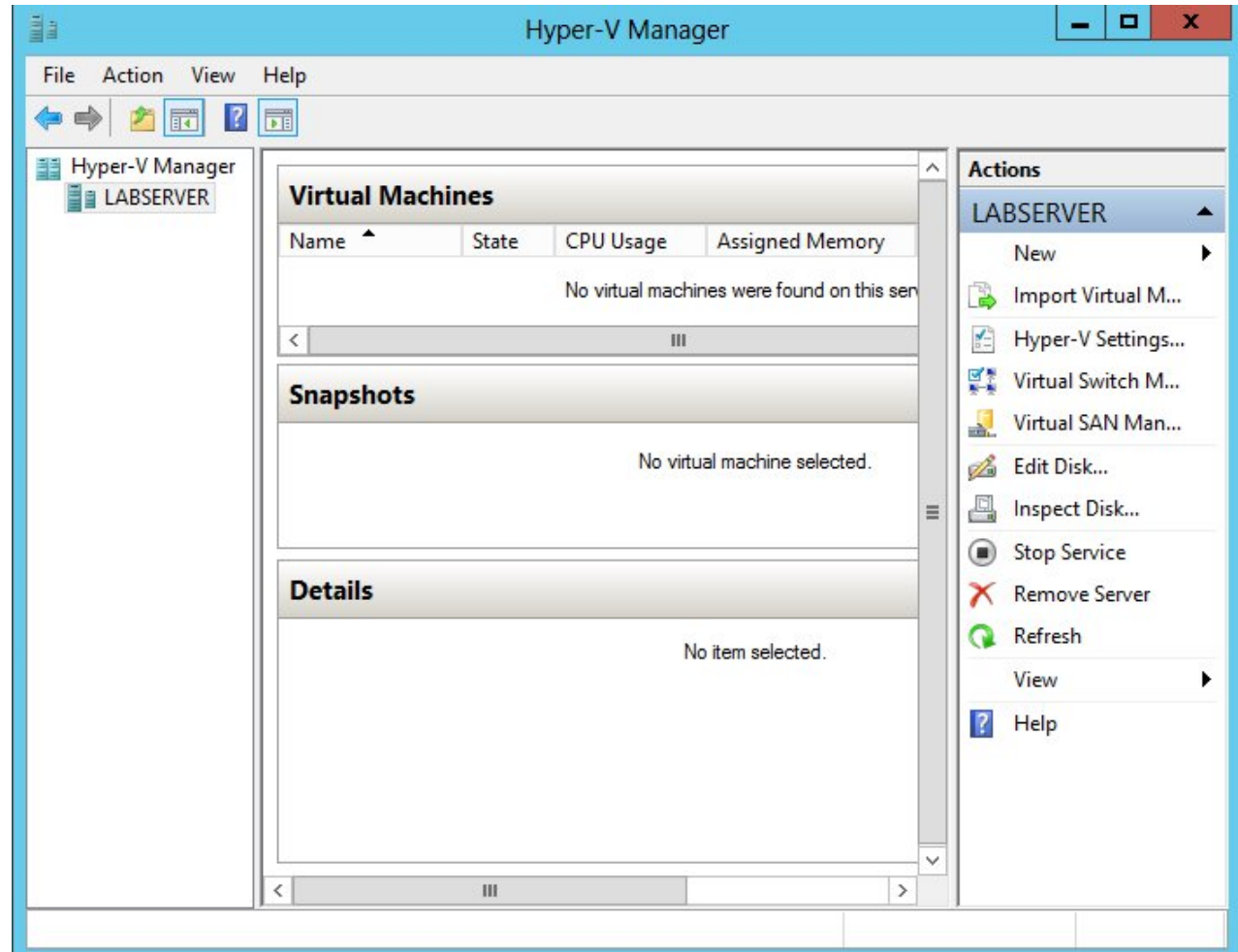


# Using Hyper-V Manager

- Hyper-V Manager is the central management console to configure your server and create and manage your virtual machines, virtual networks, and virtual hard disks.
- Can access it either in Server Manager or by using Administrative Tools ➤ Hyper-V Manager.



# Hyper-V Manager



# Configure Hyper-V Settings

The Hyper-V Settings page includes the following settings:

- Virtual Hard Disks
- Virtual Machines
- Physical GPUs
- NUMA Spanning
- Live Migrations
- Storage Migrations
- Replication Configuration
- Keyboard
- Mouse Release Key
- Reset Check Boxes

# Manage Virtual Switches

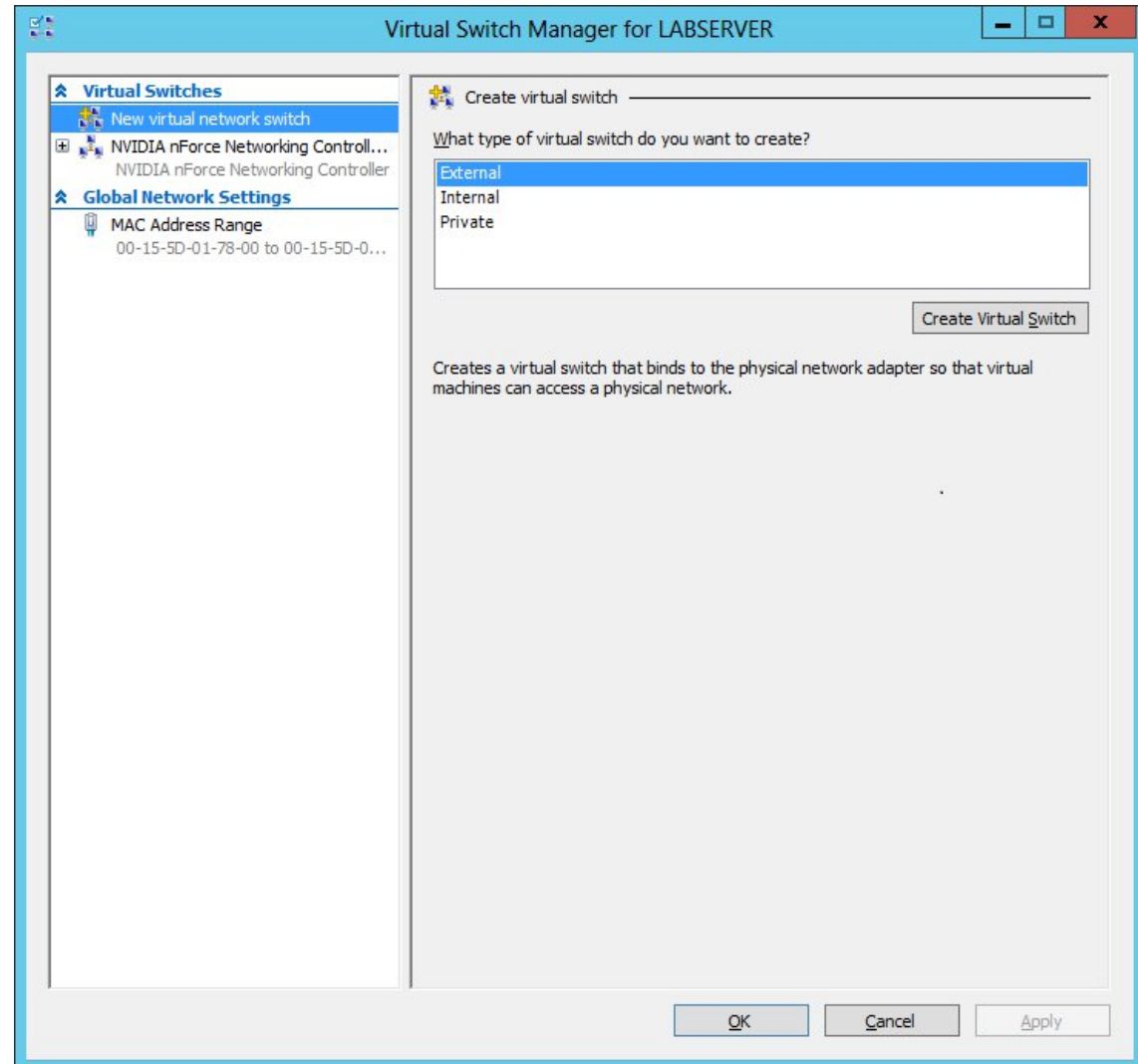
Using Virtual Switch Manager, you can:

- Create virtual switches
- Manage virtual switches
- Delete virtual switches

You can define the network type as:

- External
- Internal only
- Private

# Virtual Network Manager



# Virtual Hard Disks in Hyper-V

Type of disk	Description	When to use it
Dynamically expanding	This disk starts with a small VHD file and expands it on demand once an installation takes place. It can grow to the maximum size you defined during creation. You can use this type of disk to clone a local hard drive during creation.	This option is effective when you don't know the exact space needed on the disk and when you want to preserve hard disk space on the host machine. Unfortunately, it is the slowest disk type.
Fixed size	The size of the VHD file is fixed to the size specified when the disk is created. This option is faster than a dynamically expanding disk. However, a fixed-size disk uses up the maximum defined space immediately. This type is ideal for cloning a local hard drive.	A fixed-size disk provides faster access than dynamically expanding or differencing disks, but it is slower than a physical disk.
Differencing	This type of disk is associated in a parent-child relationship with another disk. The differencing disk is the child, and the associated virtual disk is the parent. Differencing disks include only the differences to the parent disk. By using this type, you can save a lot of disk space in similar virtual machines. This option is suitable if you have multiple virtual machines with similar operating systems.	Differencing disks are most commonly found in test environments and should not be used in production environments.
Physical (or pass-through disk)	The virtual machine receives direct pass-through access to the physical disk for exclusive use. This type provides the highest performance of all disk types and thus should be used for production servers where performance is the top priority. The drive is not available for other guest systems.	This type is used in high-end datacenters to provide optimum performance for VMs. It's also used in failover cluster environments.

# Managing Virtual Hard Disks

Hyper-V also provides two tools to manage virtual hard disks:

- Inspect Disk
- Edit Disk



# Edit Virtual Hard Disk Wizard Overview

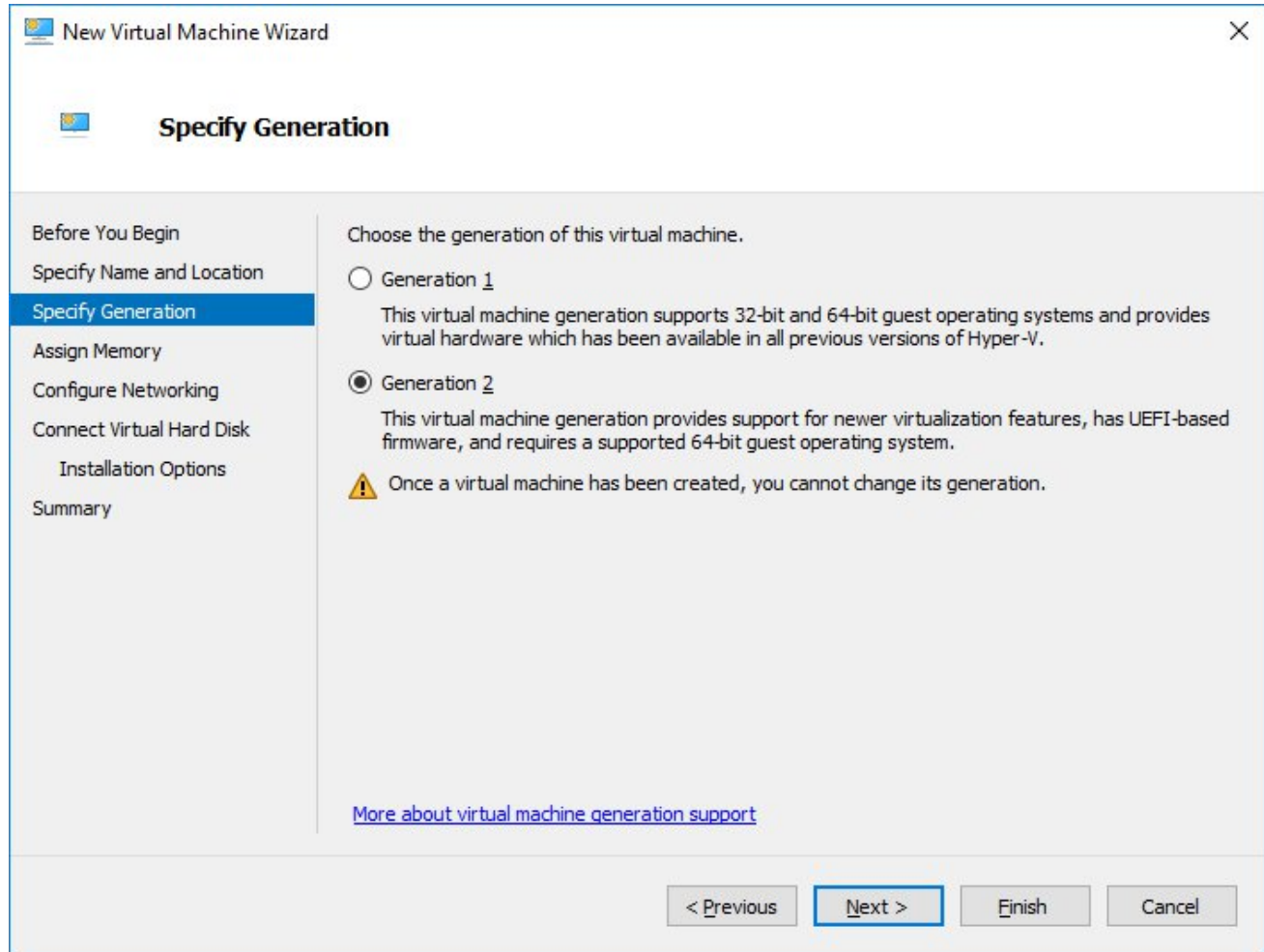
Action	Description
Compact	Reduces the size of a dynamically expanding or differencing disk by removing blank space from deleted files.
Convert	Converts a dynamically expanding disk to a fixed disk or vice versa.
Expand	Increases the storage capacity of a dynamically expanding disk or a fixed virtual hard disk.
Merge	Merges the changes from a differencing disk into either the parent disk or another disk (applies to differencing disks only!).
Reconnect	If a differencing disk no longer finds its referring parent disk, this option can reconnect the parent to the disk.

# Creating a New Virtual Machine

1. Open Hyper-V Manager.
2. In Hyper-V Manager, on the Actions pane, choose New  
➤ Virtual Machine.
3. In the New Virtual Machine Wizard, click Next on the Before You Begin page.
4. Specify a Name And Location. Click Next.
5. Next, select the desired Generation and click Next.
6. On the Assign Memory page, define how much memory to assign to the virtual machine.
7. On the Configure Networking page, select the virtual network and click Next to continue.
8. Configure your virtual hard disk.
9. Next, select how you want to install your operating system.
10. Then on the summary page, verify that all settings are correct. Click Next to create the virtual machine.




# Specify Generation Screen



The screenshot shows the 'Specify Generation' step of the 'New Virtual Machine Wizard'. The wizard has a sidebar on the left with the following steps: 'Before You Begin', 'Specify Name and Location', 'Specify Generation' (highlighted), 'Assign Memory', 'Configure Networking', 'Connect Virtual Hard Disk', 'Installation Options', and 'Summary'. The main area is titled 'Specify Generation' and contains the following text:

Choose the generation of this virtual machine.

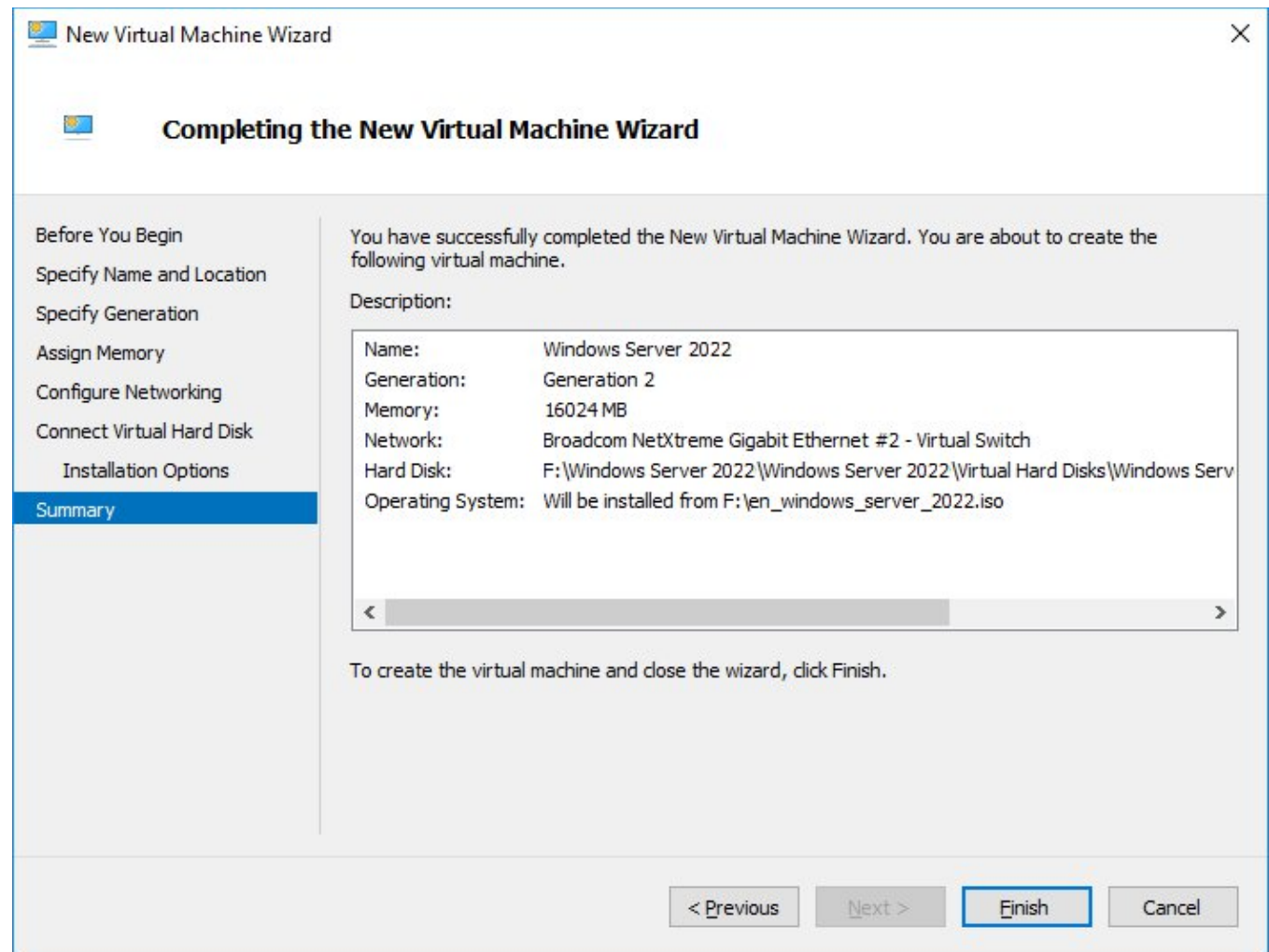
- ☐ Generation 1  
This virtual machine generation supports 32-bit and 64-bit guest operating systems and provides virtual hardware which has been available in all previous versions of Hyper-V.
- ☒ Generation 2  
This virtual machine generation provides support for newer virtualization features, has UEFI-based firmware, and requires a supported 64-bit guest operating system.

 Once a virtual machine has been created, you cannot change its generation.

[More about virtual machine generation support](#)

At the bottom, there are four buttons: '< Previous', 'Next >' (highlighted with a blue border), 'Finish', and 'Cancel'.

# Completing the New Virtual Machine Wizard Screen



# Virtual Machine Options

Virtual Machines					
Name ^	State	CPU Usage	Assigned Memory	Uptime	Status
Test VM	Running	0 %	512 MB	00:00:07	
<div>Connect...</div> <div>Settings...</div> <div>Turn Off...</div> <div>Shut Down...</div> <div>Save</div> <div>Pause</div> <div>Reset</div> <div>Snapshot</div> <div>Move...</div> <div>Rename...</div> <div>Enable Replication...</div> <div>Help</div>					

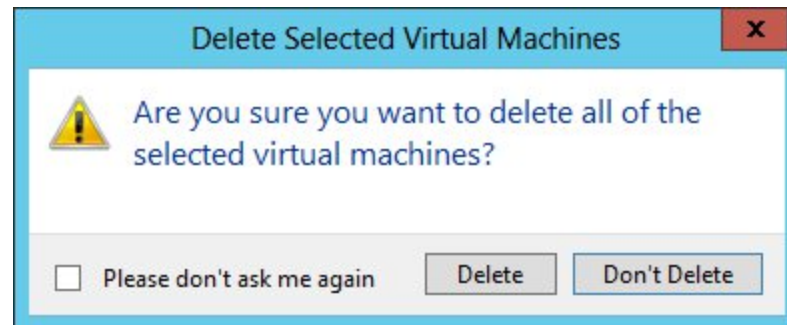
# Changing Configuration on an Existing Virtual Machine

Right-click the virtual machine's name in the Virtual Machines pane in Hyper-V Manager and choose Settings. Some of the things you can configure:

- Add hardware
- BIOS
- Memory
- Processor
- IDE Controller
- Hard Drive
- DVD Drive
- SCSI Controller
- Network Adapter

# Deleting Virtual Machines

- Can also delete virtual machines using Hyper-V Manager. This deletes all of the configuration files.
- Make sure to manually delete any virtual disks that were part of the virtual machines to free up disk space. Virtual disks are not deleted when you delete a virtual machine.



# NIC Teaming

- Also known as load balancing and failover (LBFO), gives the ability to allow multiple network adapters on a system to be placed into a team.
- To use NIC Teaming, the computer system must have at least one Ethernet adapter. To provide fault protection, must have a minimum of two Ethernet adapters.
- One advantage of Windows Server 2022 is that an administrator can set up 32 network adapters in a NIC team.

# Switch Embedded Teaming (SET)

- SET can be an alternative to using NIC Teaming in environments that include Hyper-V and the Software Defined Networking (SDN) stack in Windows Server 2022.
- SET is available in all versions of Windows Server 2022 that include Hyper-V and SDN stack.
- SET allows an administrator to combine a group of physical adapters (minimum of 1 adapter and a maximum of 8 adapters) into software based virtual adapters.

# Storage Quality of Service

- Storage QoS allows a Hyper-V administrator to manage how virtual machines access storage throughput for virtual hard disks.
- Storage QoS gives an administrator the ability to guarantee that the storage throughput of a single VHD cannot adversely affect the performance of another VHD on the same host.
- To configure Storage QoS, you would set the maximum IOPS values (or limits) and set the minimum values (or reserves) on virtual hard disks for virtual machines.



# Linux and FreeBSD Image Deployments

- Windows 2022 has the ability for Hyper-V to support Linux and FreeBSD virtual machines.
- Hyper-V has the ability to emulate these two devices, no additional software needs to be installed on Hyper-V.

# Hyper-V PowerShell Commands <sup>(1/5)</sup>

Command	Explanation
Add-VMdvdDrive	Adds a DVD drive to a virtual machine.
Add-VMHardDiskDrive	Adds a hard disk drive to a virtual machine.
Add-VMMigrationNetwork	Adds a network for virtual machine migration on one or more virtual machine hosts.
Add-VMNetworkAdapter	Adds a virtual network adapter to a virtual machine.
Add-VMSwitch	Adds a virtual switch to an Ethernet resource pool.
Checkpoint-VM	Creates a checkpoint of a virtual machine.
Convert-VHD	Converts the format, version type, and block size of a virtual hard disk file.
Copy-VMFile	Copies a file to a virtual machine.
Debug-VM	Debugs a virtual machine.
Disable-VMConsoleSupport	Disables keyboard, video, and mouse for virtual machines.
Disable-VMMigration	Disables migration on one or more virtual machine hosts.
Dismount-VHD	Dismounts a virtual hard disk.

# Hyper-V PowerShell Commands (2/5)

Command	Explanation
Enable-VMConsoleSupport	Enables keyboard, video, and mouse for virtual machines.
Enable-VMMigration	Enables migration on one or more virtual machine hosts.
Enable-VMReplication	Enables replication of a virtual machine.
Enable-VMResourceMetering	Collects resource utilization data for a virtual machine or resource pool.
Export-VM	Exports a virtual machine to disk.
Export-VMSnapshot	Exports a virtual machine checkpoint to disk.
Get-VHD	Gets the virtual hard disk object associated with a virtual hard disk.
Get-VHDSet	Gets information about a VHD set.
Get-VHDSnapshot	Gets information about a checkpoint in a VHD set.
Get-VM	Gets the virtual machines from one or more Hyper-V hosts.
Get-VMDVDDrive	Gets the DVD drives attached to a virtual machine or snapshot.
Get-VMHardDiskDrive	Gets the virtual hard disk drives attached to one or more virtual machines.

# Hyper-V PowerShell Commands (3/5)

Command	Explanation
Get-VMMemory	Gets the memory of a virtual machine or snapshot.
Get-VMNetworkAdapter	Gets the virtual network adapters of a virtual machine, snapshot, management operating system, or of a virtual machine and management operating system
Get-VMProcessor	Gets the processor of a virtual machine or snapshot.
Get-VMReplication	Gets the replication settings for a virtual machine.
Get-VMSwitch	Gets virtual switches from one or more virtual Hyper-V hosts.
Merge-VHD	Merges virtual hard disks.
Mount-VHD	Mounts one or more virtual hard disks.
Move-VM	Moves a virtual machine to a new Hyper-V host.
New-VHD	Creates one or more new virtual hard disks.
New-VM	Creates a new virtual machine.
New-VMGroup	Creates a virtual machine group.
New-VMSwitch	Creates a new virtual switch on one or more virtual machine hosts.
Remove-VHDSnapshot	Removes a snapshot from a VHD set file.
Remove-VM	Deletes a virtual machine.

# Hyper-V PowerShell Commands (4/5)

Command	Explanation
Remove-VMHardDiskDrive	Deletes one or more virtual hard disks (VHDs) from a virtual machine (VM).
Remove-VMNetworkAdapter	Removes one or more virtual network adapters from a virtual machine.
Remove-VMReplication	Removes the replication relationship of a virtual machine.
Remove-VMSan	Removes a virtual storage area network (SAN) from a Hyper-V host.
Remove-VMSwitch	Deletes a virtual switch.
Rename-VM	Renames a virtual machine.
Rename-VMGroup	Renames virtual machine groups.
Resize-VHD	Resizes a virtual hard disk.
Restart-VM	Restarts a virtual machine.
Save-VM	Saves a virtual machine.
Set-VHD	Sets properties associated with a virtual hard disk.
Set-VM	Configures a virtual machine.
Set-VM Bios	Configures the BIOS of a Generation 1 virtual machine.
Set-VM Memory	Configures the memory of a virtual machine.

# Hyper-V PowerShell Commands (5/5)

Command	Explanation
Set-VMNetworkAdapter	Configures features of the virtual network adapter in a virtual machine or the management operating system.
Set-VMProcessor	Configures one or more processors of a virtual machine.
Set-VMReplicationServer	Configures a host as a Replica server.
Set-VMSan	Configures a virtual storage area network (SAN) on one or more Hyper-V hosts.
Set-VMSwitch	Configures a virtual switch.
Stop-VM	Shuts down, turns off, or saves a virtual machine.
Suspend-VM	Suspends, or pauses, a virtual machine.