Marwadi University
Marwadi Chandarana Group
NAAC A+

Faculty of Computer Application

Laboratory Manual

Stream Name: Bsc IT Cloud and Application Development

Subject Name: Server Admin. 1 Subject Code: 05CA0202

Student Name: Student Enrollment No:

S.No	Practical Description	Date	Faculty Sign
1.	Deploying Hyper-V Virtualization		
2.	Hyper-V Virtual Switch Configuration.		
3.	Creating a New Virtual Machine		
4.	Creating a Virtual Switch.		
5.	Creating and Managing Virtual Hard Disks.		
6.	Setting Up Hyper-V Replica.		
7.	iSCSI Implementation & Network Addressing Optimization.		
8.	Strategic IP Address Allocation and Subnetting.		
9.	Implementing DHCP for IPv6 (DHCPv6).		
10.	Deploying Multiple Web Servers Using IPv4 Addressing.		
11.	Establishing a Primary DNS Zone.		
12.	Implementing an FTP Server for Efficient File Transfer.		

PRACTICAL 1: Deploying Hyper-V Virtualization

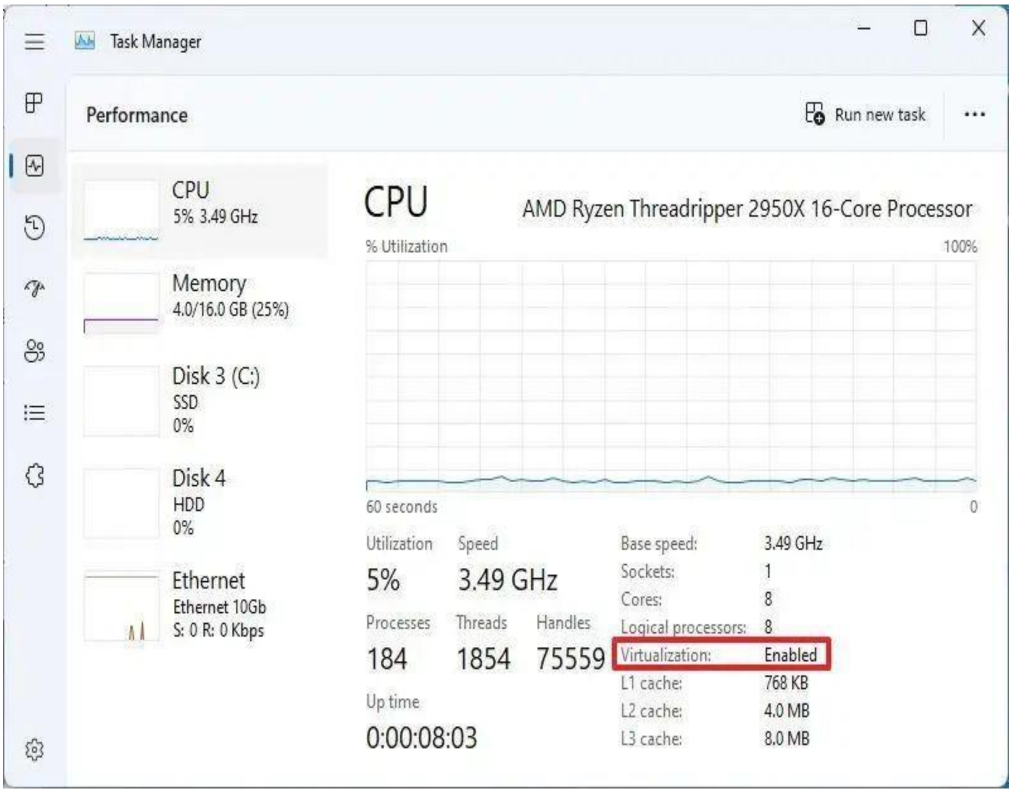
Aim: To practice virtualization using Hyper-V, Microsoft’s virtualization platform.

Steps:

Installation of Hyper V

Check virtualization before installing Hyper-V

1. Open Start on Windows 11.
2. Search for Task Manager and click the top result to open the app.
3. Click on Performance.
4. Confirm that “Virtualization” reads “Enabled” next to the system stats.
5. If virtualization is disabled, then continue with the steps below.



CPU
5% 3.49 GHz

Memory
4.0/16.0 GB (25%)

Disk 3 (C:)
SSD
0%

Disk 4
HDD
0%

Ethernet
Ethernet 10Gb
S: 0 R: 0 Kbps

CPU AMD Ryzen Threadripper 2950X 16-Core Processor

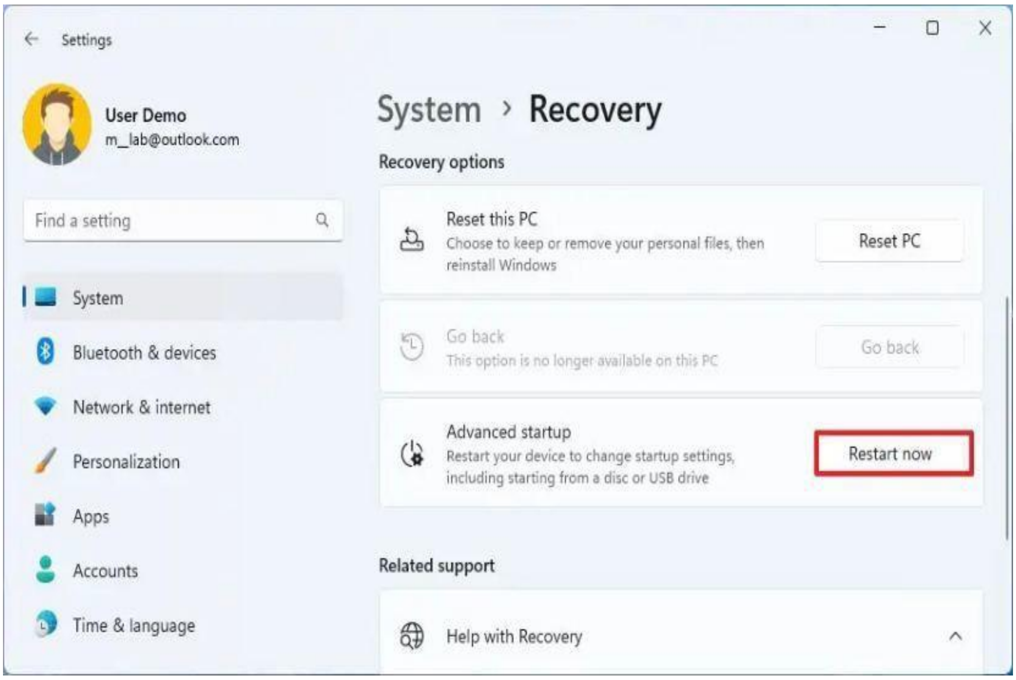
% Utilization 100%

Utilization 5%
Speed 3.49 GHz
Processes 184
Threads 1854
Handles 75559
Up time 0:00:08:03

Base speed: 3.49 GHz
Sockets: 1
Cores: 8
Logical processors: 8
Virtualization: Enabled
L1 cache: 768 KB
L2 cache: 4.0 MB
L3 cache: 8.0 MB

Configure virtualization on Windows 11 Home

1. To turn on virtualization on Windows 11 Home, use these steps:
2. Open Settings.
3. Click on System.
4. Click on Recovery.
5. Under the “Recovery options” section, click the Restart now button for the “Advanced start up” setting.



System › Recovery

Recovery options

Reset this PC
Choose to keep or remove your personal files, then reinstall Windows

Go back
This option is no longer available on this PC

Advanced startup
Restart your device to change startup settings, including starting from a disc or USB drive

Related support

Help with Recovery

Configure virtualization on Windows 11 Home

1. Click on Troubleshoot.

2. Click on Advanced options.

3. Click the “UEFI Firmware Settings” option.

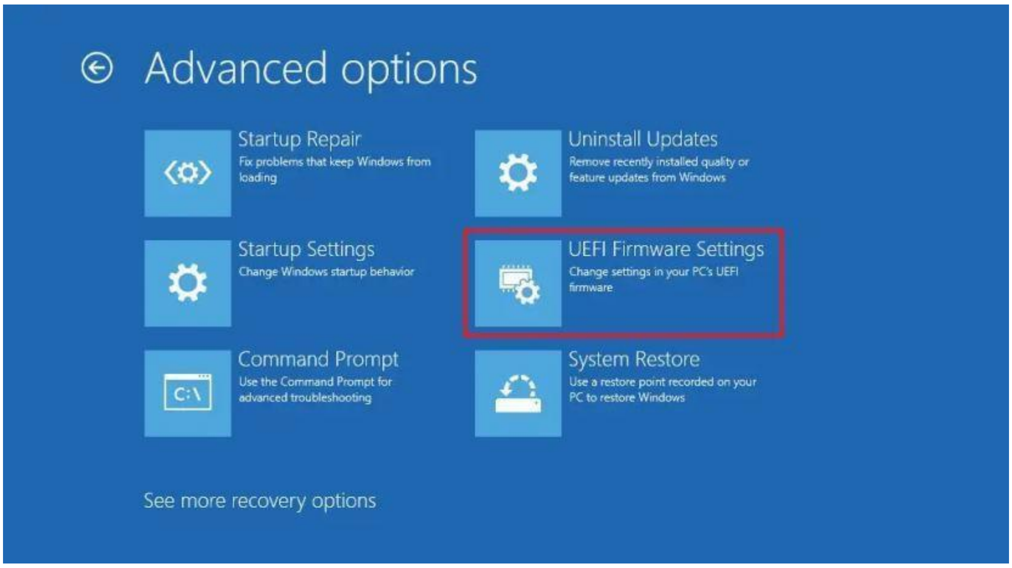
4. Click the Restart button.

5. Open the Configuration, Security, or Advanced page (the page’s name will depend on your manufacturer).

6. Select the Virtualization Technology, Intel Virtual Technology, or SVM Mode option (the feature name will depend on your manufacturer).

7. Enable the virtualization feature.

8. Save the UEFI (BIOS) settings (usually press F10).



Advanced options

Startup Repair
Fix problems that keep Windows from loading

Uninstall Updates
Remove recently installed quality or feature updates from Windows

Startup Settings
Change Windows startup behavior

UEFI Firmware Settings
Change settings in your PC's UEFI firmware

Command Prompt
Use the Command Prompt for advanced troubleshooting

System Restore
Use a restore point recorded on your PC to restore Windows

See more recovery options

Install Hyper-V on Windows 11 Home

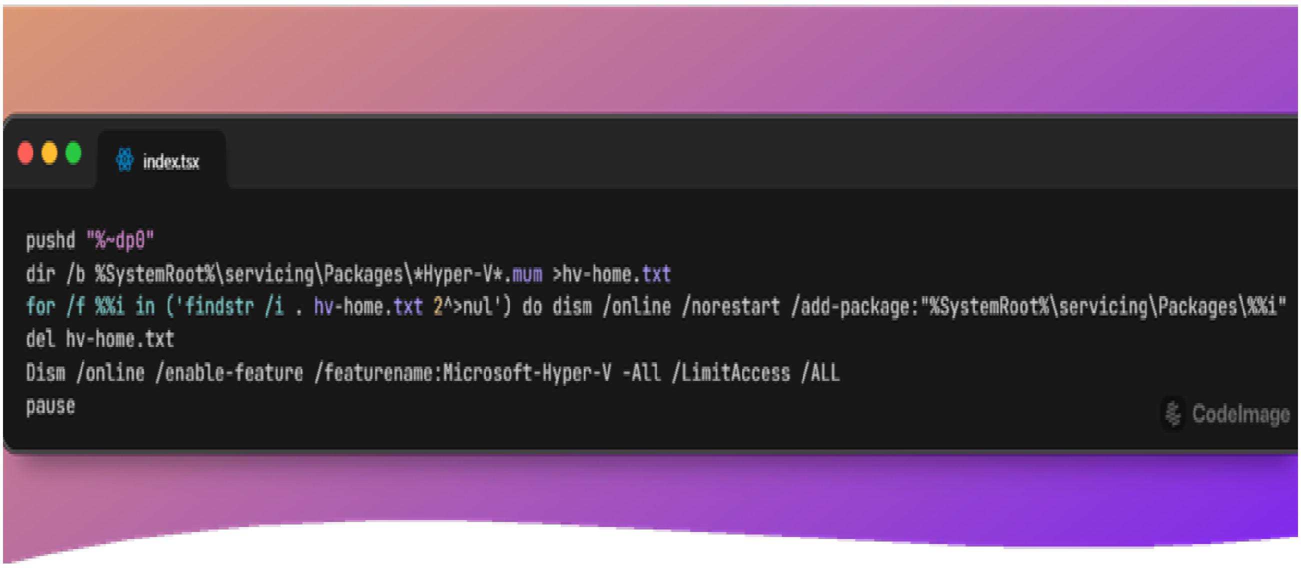
- Since the Home edition doesn't have the virtualization feature, you must install the

Components manually through a simple script.

- Although the script works as intended, you should always create a temporary full

Backup of your computer since you will modify the system files, which Microsoft doesn't

Support.



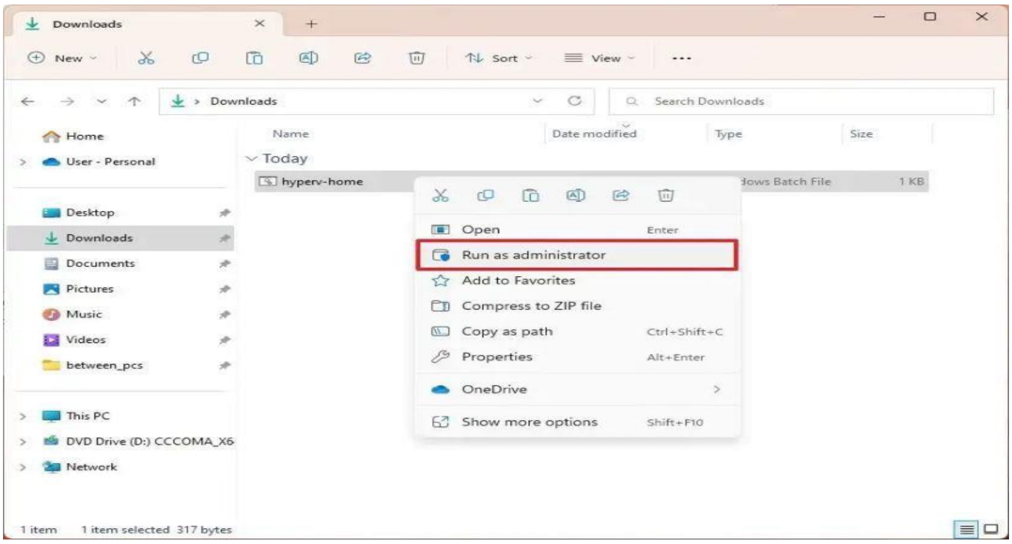
```
pushd "%~dp0"
dir /b %SystemRoot%\servicing\Packages\*Hyper-V*.mum >hv-home.txt
for /f %%i in ('findstr /i . hv-home.txt 2^>nul') do dism /online /norestart /add-package:"%SystemRoot%\servicing\Packages\%%i"
del hv-home.txt
Dism /online /enable-feature /featurename:Microsoft-Hyper-V -All /LimitAccess /ALL
pause
```

To install Hyper- V on Windows 11 Home, use these steps:

- Open Start.
- Search for Notepad and click the top result to open the app.
- Copy and paste the following script with the instructions to install Hyper-V on Windows 11 Home into the text file:

Install Hyper-V on Windows 11 Home

1. Click on File and choose the "Save as" option.
2. Confirm a name and use the ".bat" extension. For example, hyperv- home.bat.
3. Click the Save button.
4. Right-click the hyperv-home.bat file and select the "Run as administrator"option.



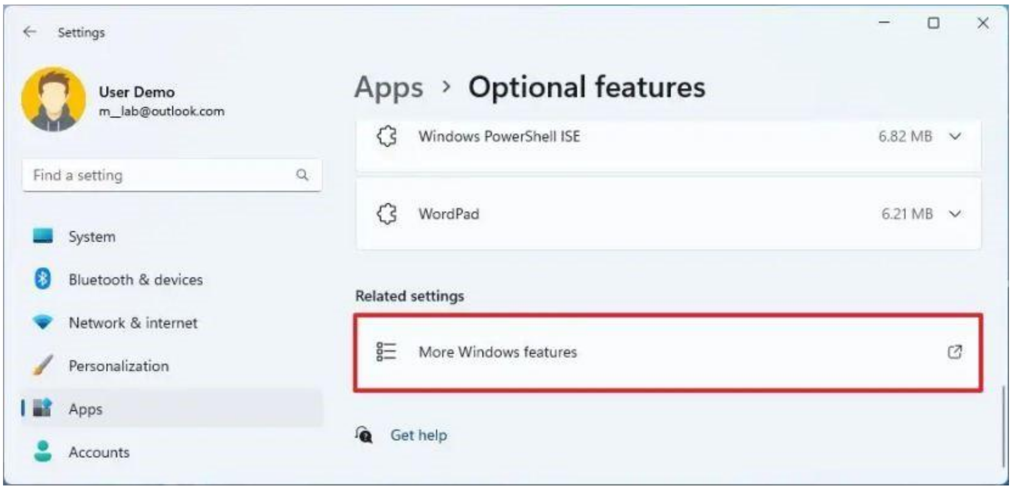
Disable Hyper-V on Windows 11 Home

1. Open Settings.

2. Click on Apps.

3. Click the Optional features tab.

4. Under the “Related settings” section, click the “More Windows features” setting.



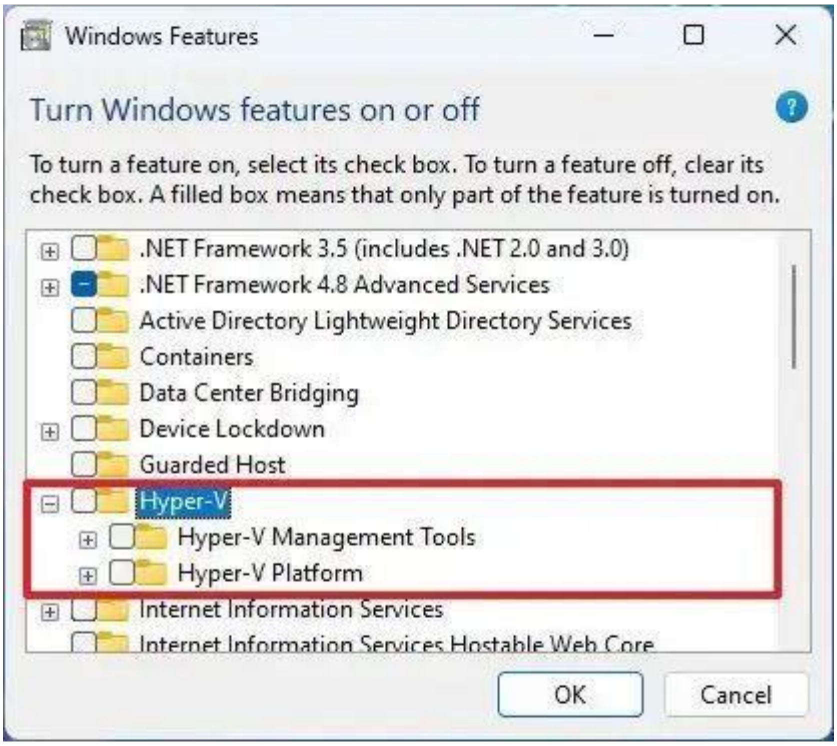
Disable Hyper-V on Windows 11 Home

1. Clear the Hyper-V feature.

2. Click the OK button.

3. Click the Restart now button.

4. Once you complete the steps, Microsoft Hyper-V will be disabled on Windows 11 Home.



Turn Windows features on or off

To turn a feature on, select its check box. To turn a feature off, clear its check box. A filled box means that only part of the feature is turned on.

- ⊞ □ .NET Framework 3.5 (includes .NET 2.0 and 3.0)
- ⊞ ■ .NET Framework 4.8 Advanced Services
- □ Active Directory Lightweight Directory Services
- □ Containers
- □ Data Center Bridging
- ⊞ □ Device Lockdown
- □ Guarded Host
- ⊟ □ Hyper-V
  - ⊞ □ Hyper-V Management Tools
  - ⊞ □ Hyper-V Platform
- ⊞ □ Internet Information Services
- □ Internet Information Services Hostable Web Core

Result: Hyper-V was successfully installed and used to deploy a virtual machine.

Conclusion: Hyper-V allows efficient resource utilization by creating multiple isolated VMs on a single physical machine.

PRACTICAL: Hyper-V Virtual Switch Configuration

Aim:
To navigate and configure the network connectivity within a virtualized environment by creating and managing Hyper-V virtual switches, ensuring optimized network performance and seamless communication between virtual machines.

Procedure:

1. **Open Hyper-V Manager**:
   - Launch **Hyper-V Manager** from the Start Menu or Server Manager.
2. **Access Virtual Switch Manager**:
   - Select your local Hyper-V host.
   - In the right pane, click **“Virtual Switch Manager”**.
3. **Create Virtual Switches**:
   - Click **“New Virtual Network Switch”**.
   - Choose a switch type:
     - **External**: For communication with the physical network.
     - **Internal**: For communication between VMs and the host only.
     - **Private**: For communication between VMs only.
   - Click **Create Virtual Switch**.
4. **Configure Switch Properties**:
   - Give the switch a name (e.g., “ExternalSwitch1”).
   - For **External switch**, select the physical network adapter from the dropdown.
   - Enable or disable options like VLAN ID, bandwidth management, etc.
   - Click **Apply** and then **OK**.
5. **Assign Virtual Machines to Switches**:
   - Right-click any VM > Settings > Network Adapter.
   - Select the desired virtual switch from the dropdown list.
6. **Test Network Connectivity**:
   - Start the VMs connected to different switches.
   - Use the `ping` command or `ipconfig` to verify network settings and connectivity.
   - Check if VMs communicate with each other and external networks (based on switch type).

Result:
Hyper-V virtual switches (External, Internal, and Private) were successfully created and configured. Virtual machines were assigned to appropriate switches, enabling controlled and optimized network communication.

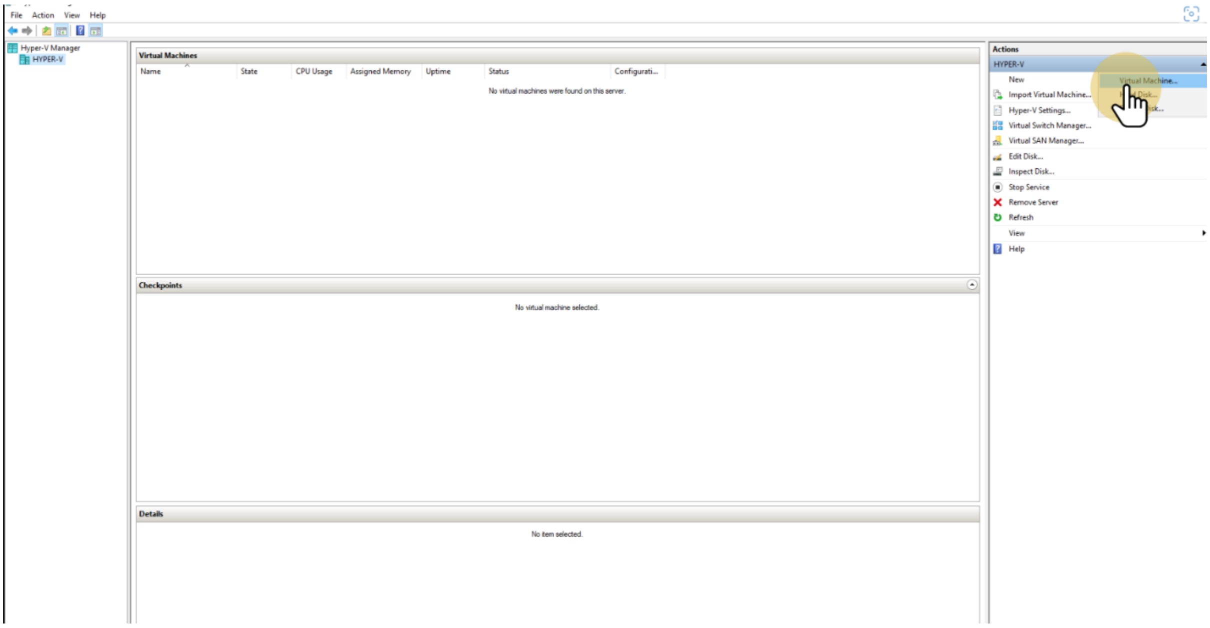
Conclusion:
Virtual switch configuration in Hyper-V allows fine-grained control over VM networking. By correctly implementing External, Internal, and Private switches, administrators can tailor network setups for performance, security, and flexibility within a virtualized infrastructure.

PRACTICAL: Creating a New Virtual Machine

Now that you have a plan, let’s walk through the steps to create your first virtual machine in Hyper-V.

Step-by-Step Guide to Create a VM in Hyper-V:

1. **Open Hyper-V Manager:**
   - Launch **Hyper-V Manager** from the Start menu or through **Server Manager**.
2. **Connect to the Server:**
   - In Hyper-V Manager, ensure you are connected to the correct host machine (the server or local machine running Hyper-V).
3. **Start the New Virtual Machine Wizard:**
   - In the right-hand pane, click on **New**, then select **Virtual Machine** from the dropdown.

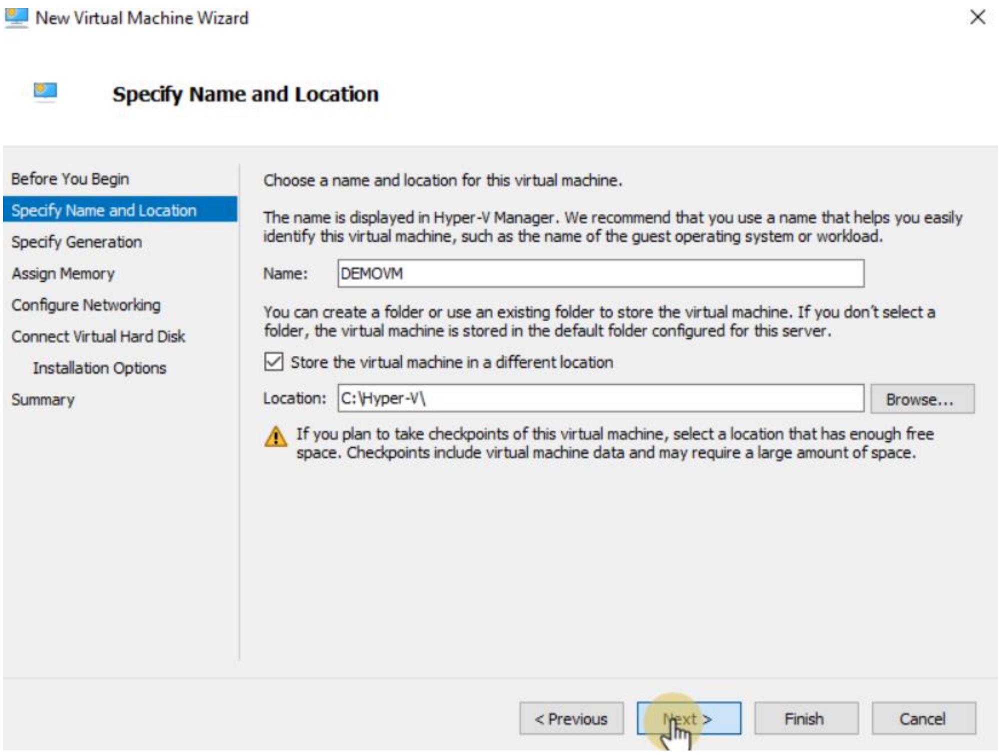


No virtual machines were found on this server.

No virtual machine selected.

No item selected.

4. **Specify Name and Location:**
   - Give your virtual machine a descriptive name, especially if you plan to manage multiple VMs.
   - You can choose a custom location to store the VM files, or leave it as default if storage location is not a concern.



New Virtual Machine Wizard

Specify Name and Location

Choose a name and location for this virtual machine.

The name is displayed in Hyper-V Manager. We recommend that you use a name that helps you easily identify this virtual machine, such as the name of the guest operating system or workload.

Name: DEMOVM

You can create a folder or use an existing folder to store the virtual machine. If you don't select a folder, the virtual machine is stored in the default folder configured for this server.

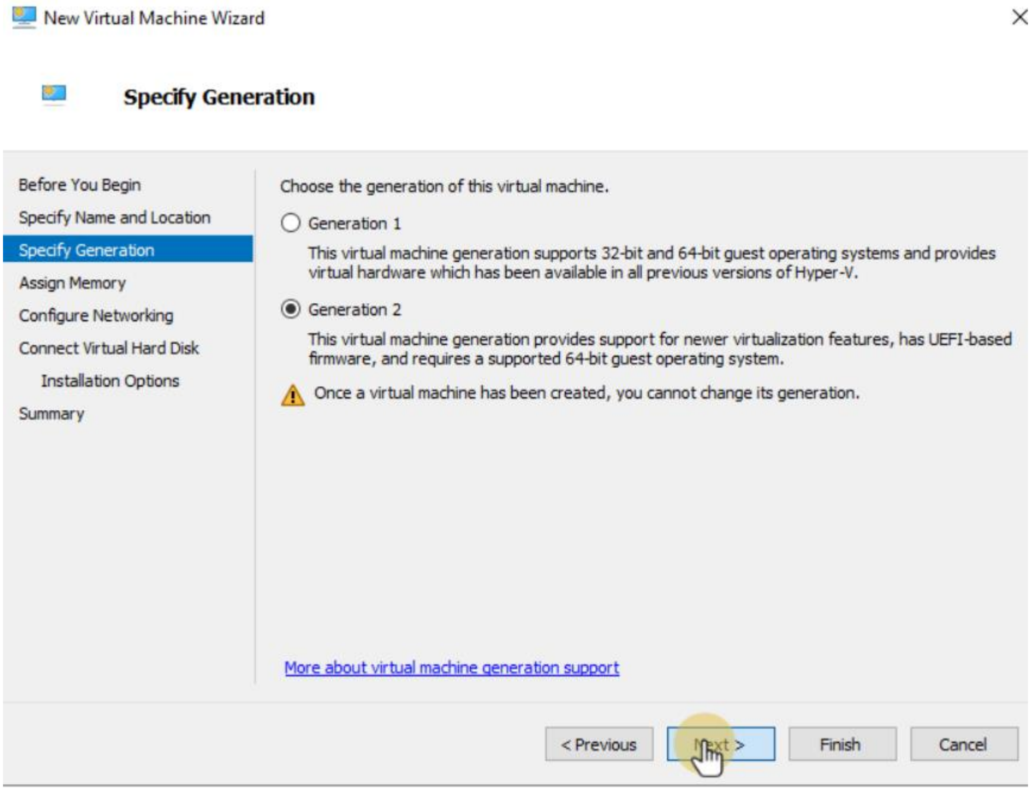
☑ Store the virtual machine in a different location

Location: C:\Hyper-V\

If you plan to take checkpoints of this virtual machine, select a location that has enough free space. Checkpoints include virtual machine data and may require a large amount of space.

5. **Specify Generation:**

   - Choose the **Generation 1** option if you need broader compatibility with older operating systems or applications.
   - Choose **Generation 2** for newer VMs that support features like UEFI, Secure Boot, and more efficient resource utilization.



New Virtual Machine Wizard

Specify Generation

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.

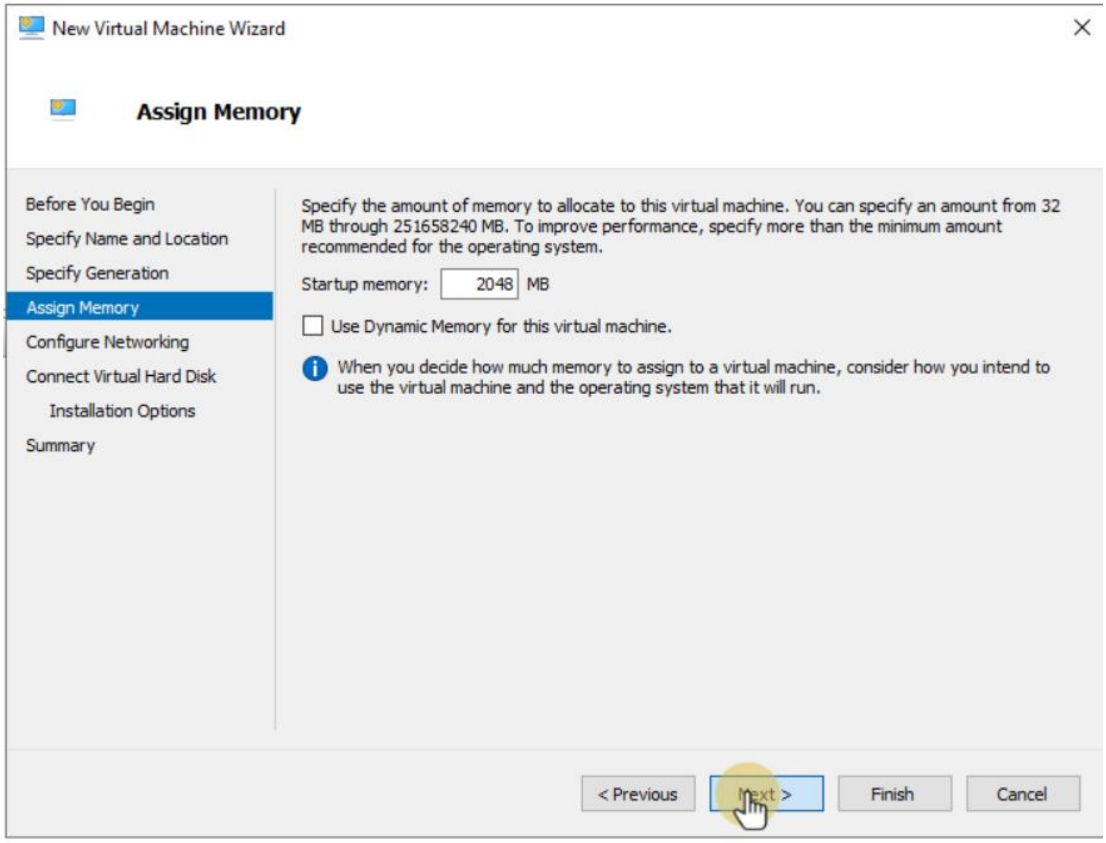
More about virtual machine generation support

Note: Generation 2 is recommended for most modern operating systems, but some older OS versions may not support it.

6. **Assign Memory:**

- Allocate memory for your VM. For example, a typical VM might start with **2048 MB** (2 GB) of RAM for basic tasks.

- Optionally, you can enable **Dynamic Memory**, which allows Hyper-V to adjust the amount of memory assigned to the VM based on its workload, optimizing resource usage.



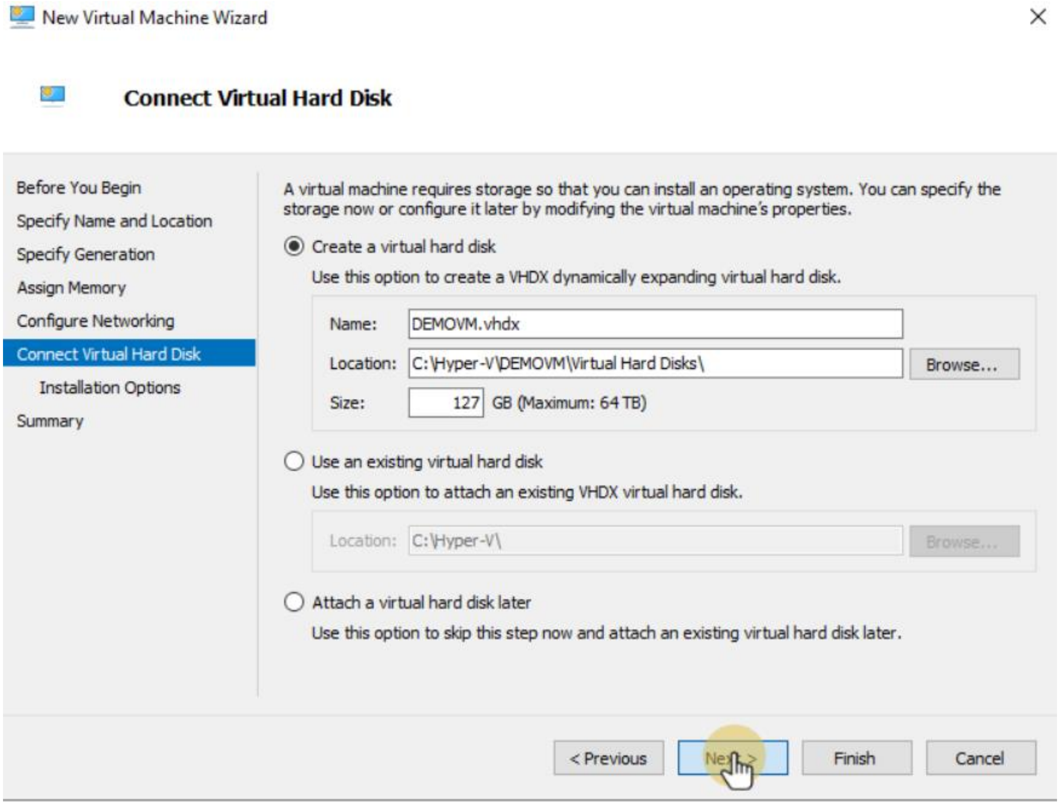
Specify the amount of memory to allocate to this virtual machine. You can specify an amount from 32 MB through 251658240 MB. To improve performance, specify more than the minimum amount recommended for the operating system.

Startup memory: 2048 MB

□ Use Dynamic Memory for this virtual machine.

When you decide how much memory to assign to a virtual machine, consider how you intend to use the virtual machine and the operating system that it will run.

7. **Configure Networking:**
   - Connect the VM to an existing virtual switch. If no switch is available, you will need to create one in Hyper-V Manager to enable network connectivity for the VM.
8. **Connect Virtual Hard Disk:**
   - Create a new virtual hard disk (VHD) for the VM or use an existing one if applicable.
   - Specify the size of the disk based on your needs. For instance, a basic installation might require at least **50 GB** of storage.


New Virtual Machine Wizard

Connect Virtual Hard Disk

A virtual machine requires storage so that you can install an operating system. You can specify the storage now or configure it later by modifying the virtual machine's properties.

● Create a virtual hard disk

Use this option to create a VHDX dynamically expanding virtual hard disk.

Name: DEMOVM.vhdx

Location: C:\Hyper-V\DEMOVM\Virtual Hard Disks\

Size: 127 GB (Maximum: 64 TB)

○ Use an existing virtual hard disk

Use this option to attach an existing VHDX virtual hard disk.

Location: C:\Hyper-V\

○ Attach a virtual hard disk later

Use this option to skip this step now and attach an existing virtual hard disk later.

9. **Install Operating System:**
   - Select the option **Install an operating system from a bootable image file**.
   - Browse for and select the **ISO file** for your chosen OS.

Tip: Make sure to download a compatible ISO file beforehand from the official website or another trusted source.

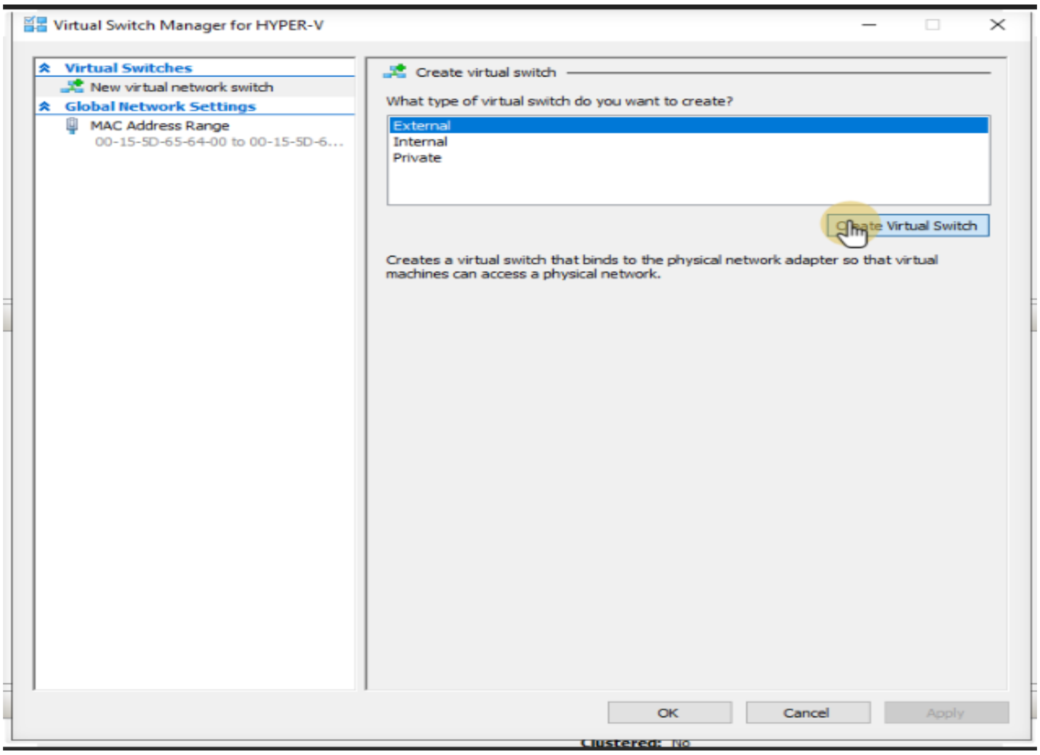
10. **Complete the Wizard:**
    - Review all the settings you've chosen in the summary page. If everything looks good, click **Finish** to complete the creation of your new VM.

PRACTICAL: Creating a Virtual Switch

Once you’ve decided which type of switch you need, the next step is to create it in Hyper-V Manager.

Step-by-Step Guide to Create a Virtual Switch:

1. **Open Hyper-V Manager:**
   - Launch **Hyper-V Manager** from the Start menu or Server Manager.
2. **Access Virtual Switch Manager:**
   - In Hyper-V Manager, find the right pane and click on **Virtual Switch Manager**.
3. **Select Switch Type:**
   - Choose between **External**, **Internal**, or **Private** based on your needs, then click **Create Virtual Switch**.

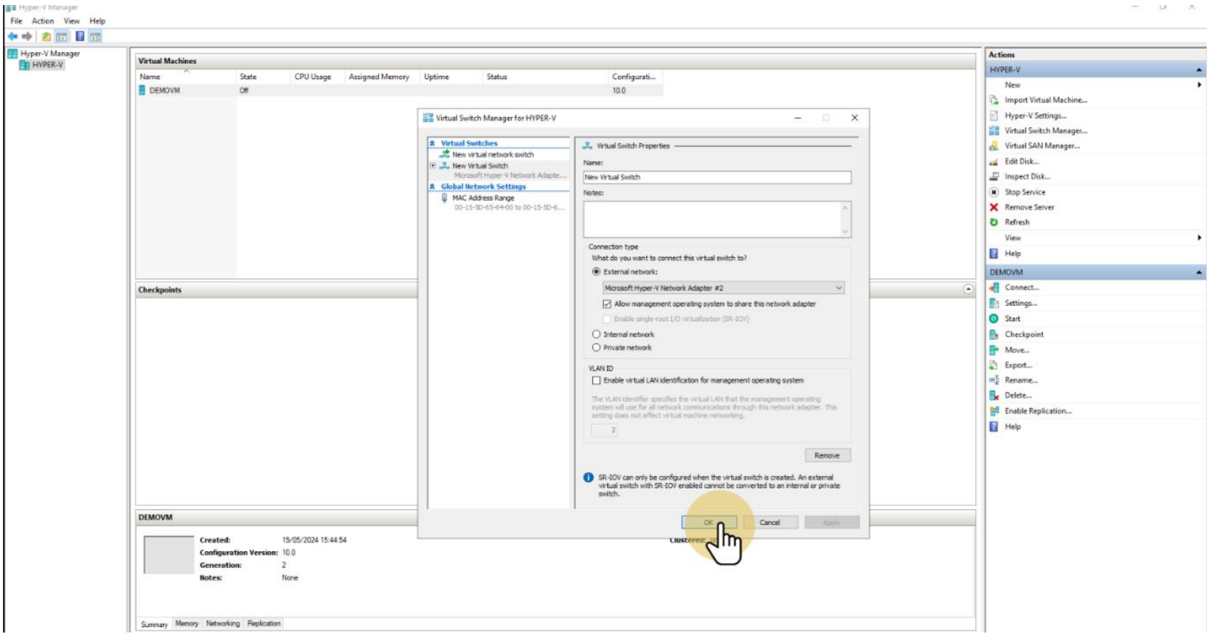


What type of virtual switch do you want to create?

Creates a virtual switch that binds to the physical network adapter so that virtual machines can access a physical network.

4. **Configure Switch Settings:**

   - **Name:** Enter a meaningful name for your virtual switch to easily identify it later.
   - **External Network:** If you selected an external switch, choose the network adapter to bind to.
   - **Internal/Private Network:** No additional network adapter settings are required for these switch types.



Name: New Virtual Switch

Notes:

Connection type

What do you want to connect this virtual switch to?

● External network: Microsoft Hyper-V Network Adapter #2

☑ Allow management operating system to share this network adapter

□ Enable single-root I/O virtualization (SR-IOV)

○ Internal network

○ Private network

VLAN ID

□ Enable virtual LAN identification for management operating system

The VLAN identifier specifies the virtual LAN that the management operating system will use for all network communications through this network adapter. This setting does not affect virtual machine networking.

2

SR-IOV can only be configured when the virtual switch is created. An external virtual switch with SR-IOV enabled cannot be converted to an internal or private switch.

4. **Apply Settings:**
   - Once all configurations are set, click **Apply** and then **OK**.

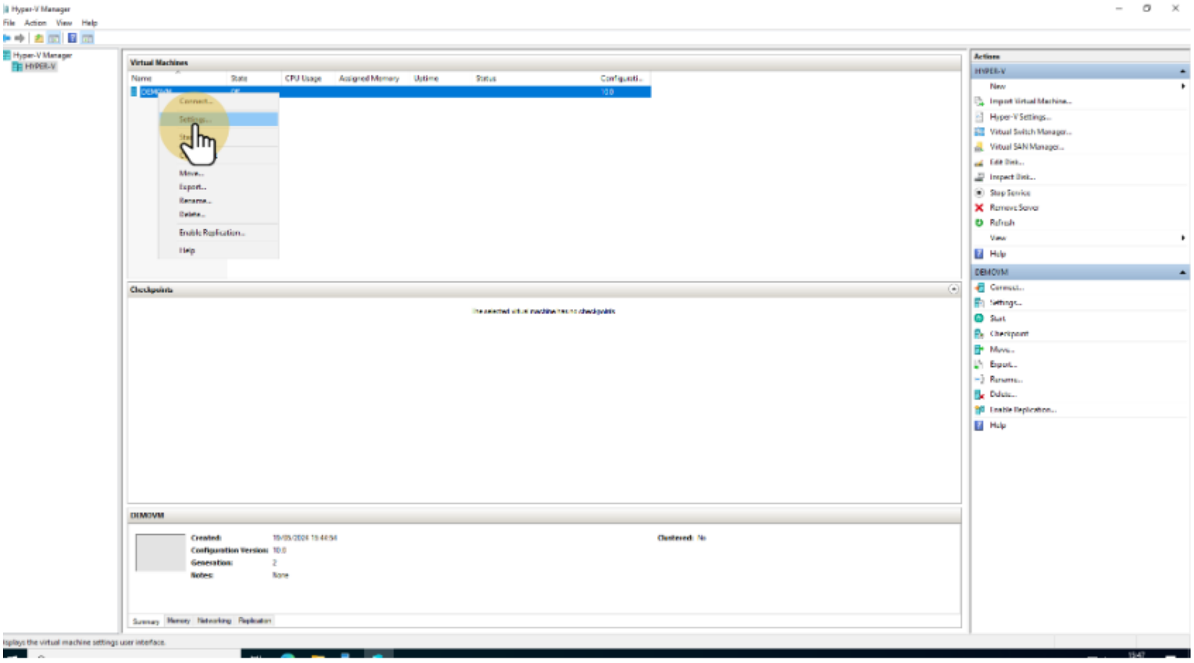
Note: Creating an external virtual switch may temporarily disrupt network connectivity on the host machine while the switch is being created.

Connecting VMs to a Virtual Switch

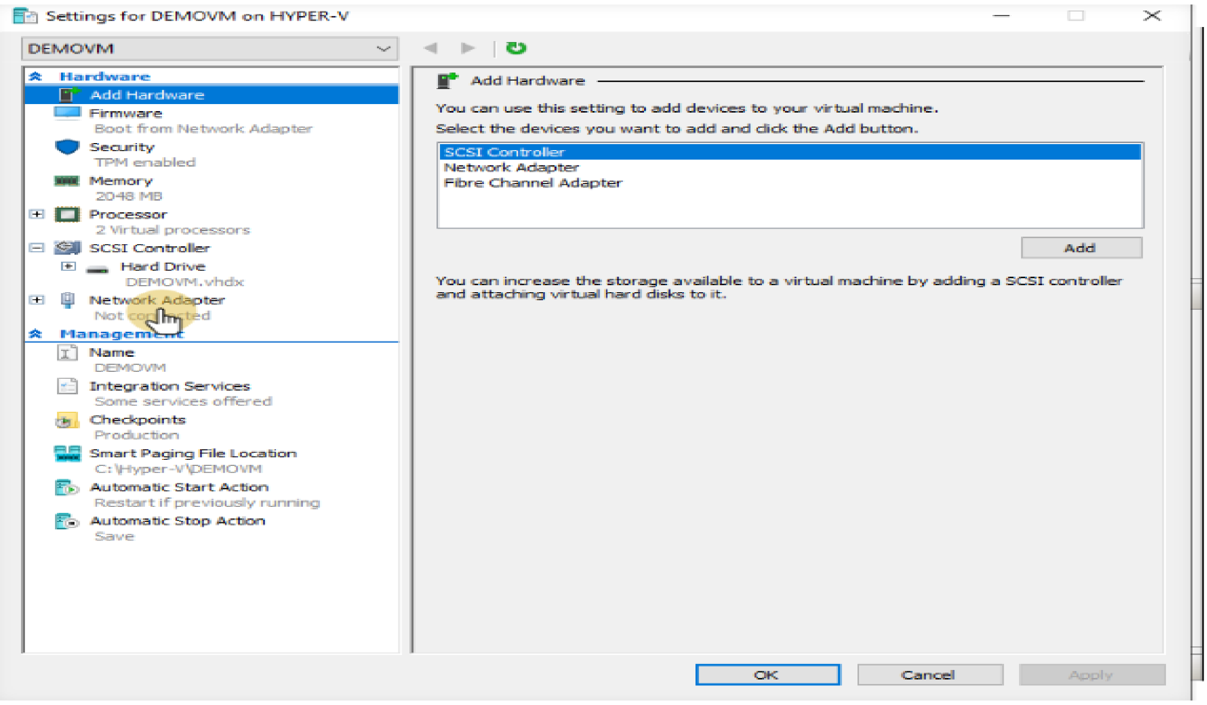
Once your virtual switch is set up, you'll need to connect your VMs to it. This allows them to communicate with the network based on the type of switch you've created.

Assigning a Network Adapter to a VM:

1. **Open VM Settings:**
   - In Hyper-V Manager, right-click the VM you want to connect, and select **Settings**.



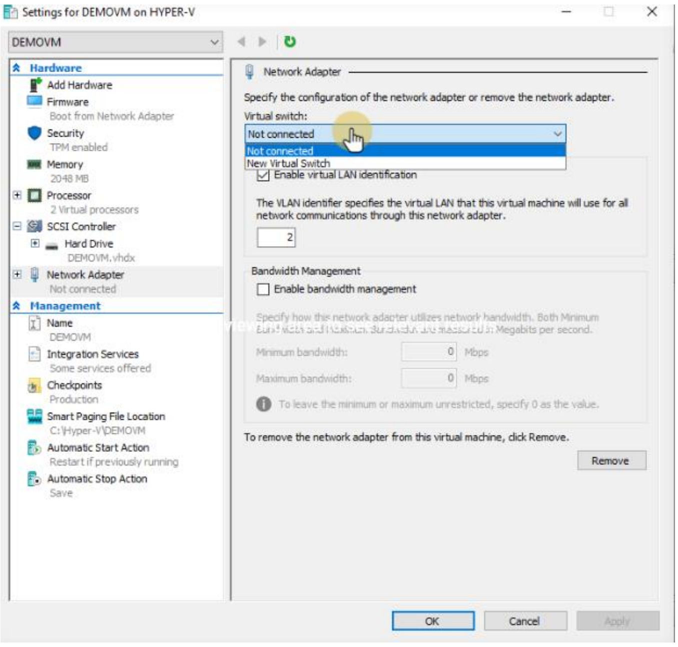
2. **Select Network Adapter:**
   - In the left pane, click on **Network Adapter**.



You can use this setting to add devices to your virtual machine.
Select the devices you want to add and click the Add button.

You can increase the storage available to a virtual machine by adding a SCSI controller and attaching virtual hard disks to it.

3. **Select Virtual Switch:**
   - In the right pane, choose the desired virtual switch from the dropdown list, then click **Apply** and **OK** to save the changes.



Specify the configuration of the network adapter or remove the network adapter.

Virtual switch: Not connected

☑ Enable virtual LAN identification

The VLAN identifier specifies the virtual LAN that this virtual machine will use for all network communications through this network adapter.

2

Bandwidth Management

□ Enable bandwidth management

Specify how this network adapter utilizes network bandwidth. Both Minimum Bandwidth and Maximum Bandwidth are measured in Megabits per second.

Minimum bandwidth: 0 Mbps

Maximum bandwidth: 0 Mbps

To leave the minimum or maximum unrestricted, specify 0 as the value.

To remove the network adapter from this virtual machine, click Remove.

Tip: If your VM requires internet access or external communication, make sure to assign it to an external virtual switch.

Configuring Network Settings Inside the VM

Once your VM is connected to a virtual switch, you may need to configure network settings inside the VM itself. Depending on your network setup, this could involve either static or dynamic IP addressing.

Setting Up IP Addresses:

1. **Static IP Configuration:**
   - Inside the VM, open **Network and Sharing Center**.
   - Click on the network connection and select **Properties**.
   - Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.
   - Enter the IP address, subnet mask, gateway, and DNS servers manually.
2. **Dynamic IP Configuration:**
   - To automatically assign an IP address via DHCP, ensure **Obtain an IP address automatically** is selected.
   - The VM will receive an IP address from a DHCP server, assuming one is available on the network.

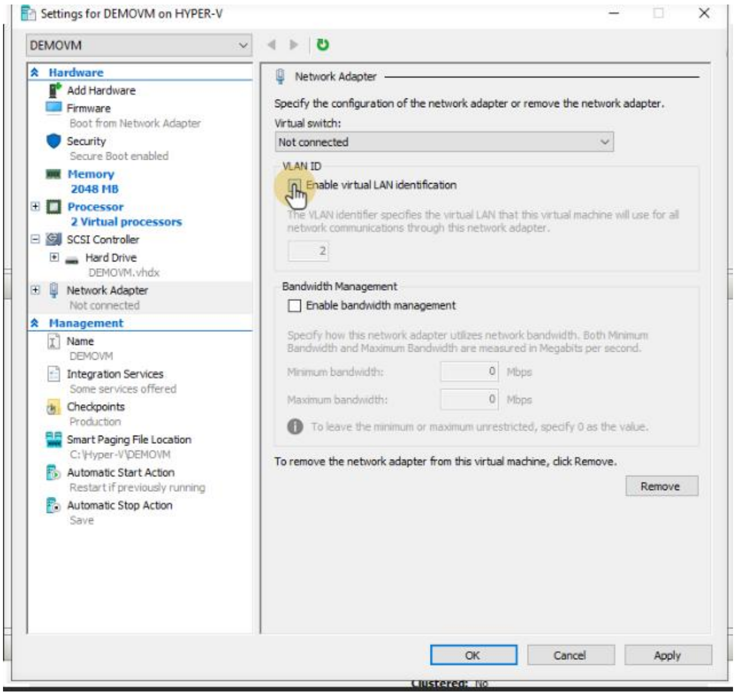
Note: If your VM doesn't receive an IP address, verify that the virtual switch is connected to a network with a DHCP server, or consider manually assigning a static IP.

3.6 Advanced Networking Features

Hyper-V includes several advanced networking features that can help optimize performance, enhance security, and manage network traffic.

VLAN Configuration:

- **Virtual LANs (VLANs)** allow you to segment network traffic for security or organizational purposes. This is particularly useful in multi-tenant environments.
- To configure VLAN settings, go to the **Network Adapter** settings of the VM and assign a VLAN ID.



Settings for DEMOVM on HYPER-V

DEMOVM

Hardware
- Add Hardware
- Firmware
Boot from Network Adapter
- Security
Secure Boot enabled
- Memory
2048 MB
- Processor
2 Virtual processors
- SCSI Controller
  - Hard Drive
DEMOVM.vhdx
- Network Adapter
Not connected

Management
- Name
DEMOVM
- Integration Services
Some services offered
- Checkpoints
Production
- Smart Paging File Location
C:\Hyper-V\DEMOVM
- Automatic Start Action
Restart if previously running
- Automatic Stop Action
Save

Network Adapter

Specify the configuration of the network adapter or remove the network adapter.

Virtual switch: Not connected

VLAN ID

□ Enable virtual LAN identification

The VLAN identifier specifies the virtual LAN that this virtual machine will use for all network communications through this network adapter.

2

Bandwidth Management

□ Enable bandwidth management

Specify how this network adapter utilizes network bandwidth. Both Minimum Bandwidth and Maximum Bandwidth are measured in Megabits per second.

Minimum bandwidth: 0 Mbps

Maximum bandwidth: 0 Mbps

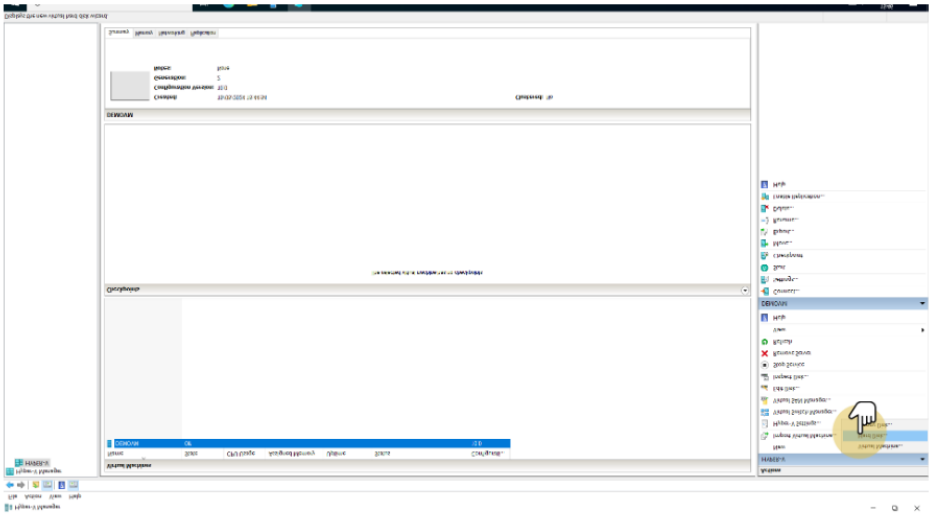
To leave the minimum or maximum unrestricted, specify 0 as the value.

To remove the network adapter from this virtual machine, click Remove.

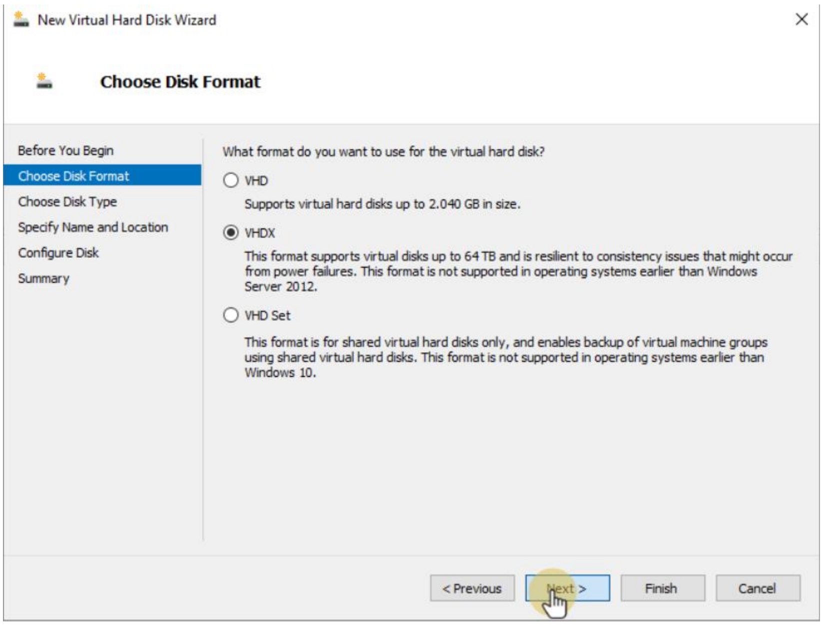
PRACTICAL: Creating and Managing Virtual Hard Disks

Creating a New VHD:

1. **Open Hyper-V Manager:**
   - Open **Hyper-V Manager** from the Start menu or Server Manager.
2. **Access New Virtual Hard Disk Wizard:**
   - In the right pane, click on **New**, then **Hard Disk**.



3. **Choose Disk Format:**
   - Select either **VHD** or **VHDX** format.



New Virtual Hard Disk Wizard

Choose Disk Format

What format do you want to use for the virtual hard disk?

○ VHD

Supports virtual hard disks up to 2,040 GB in size.

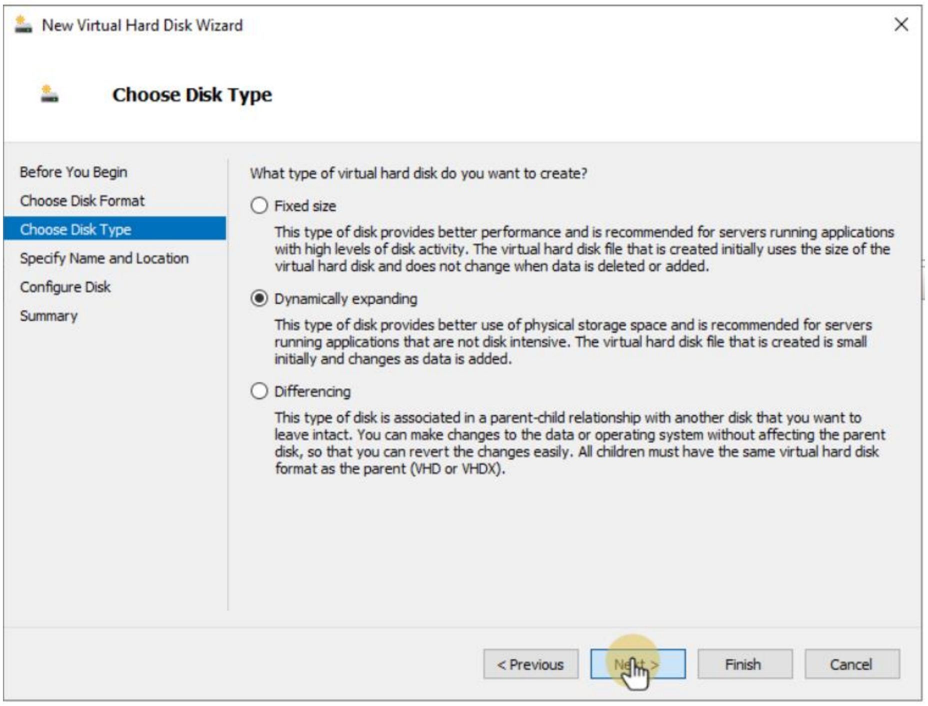
● VHDX

This format supports virtual disks up to 64 TB and is resilient to consistency issues that might occur from power failures. This format is not supported in operating systems earlier than Windows Server 2012.

○ VHD Set

This format is for shared virtual hard disks only, and enables backup of virtual machine groups using shared virtual hard disks. This format is not supported in operating systems earlier than Windows 10.

4. **Choose Disk Type:**
   - **Fixed Size:** Allocates the entire disk size immediately.
   - **Dynamically Expanding:** Expands as data is added, up to the maximum size.
   - **Differencing:** Tracks changes from a parent disk, useful for test environments.



New Virtual Hard Disk Wizard

Choose Disk Type

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 applications 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.

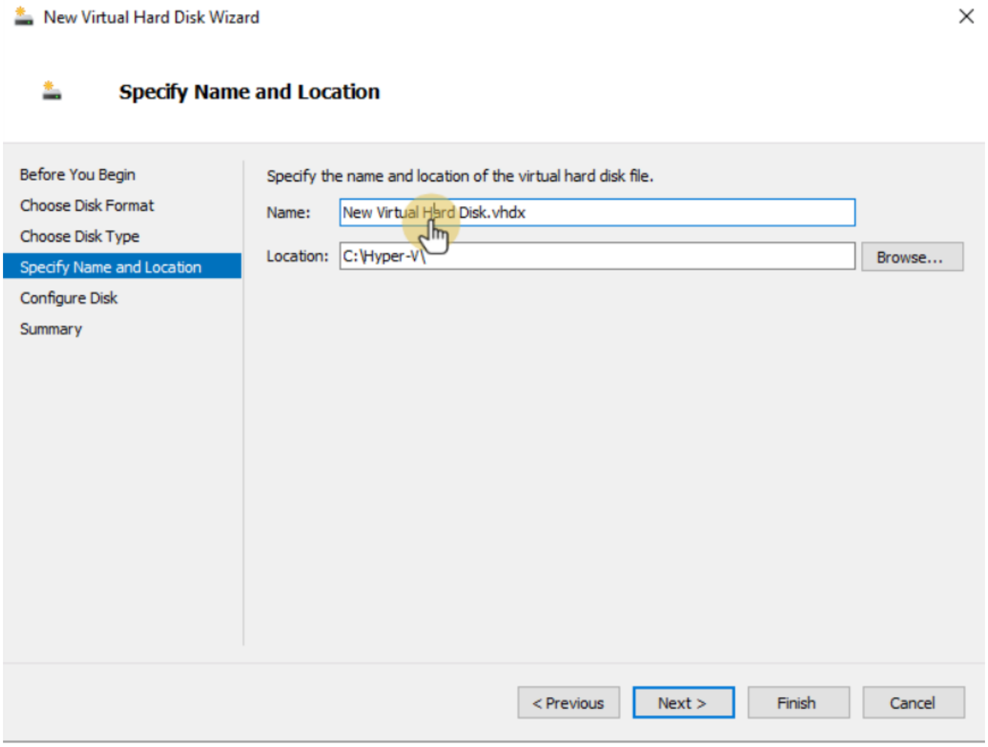
● Dynamically expanding

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 parent 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).

5. **Specify Name and Location:**
   - Enter a name for the VHD and choose a location to store the file.



New Virtual Hard Disk Wizard

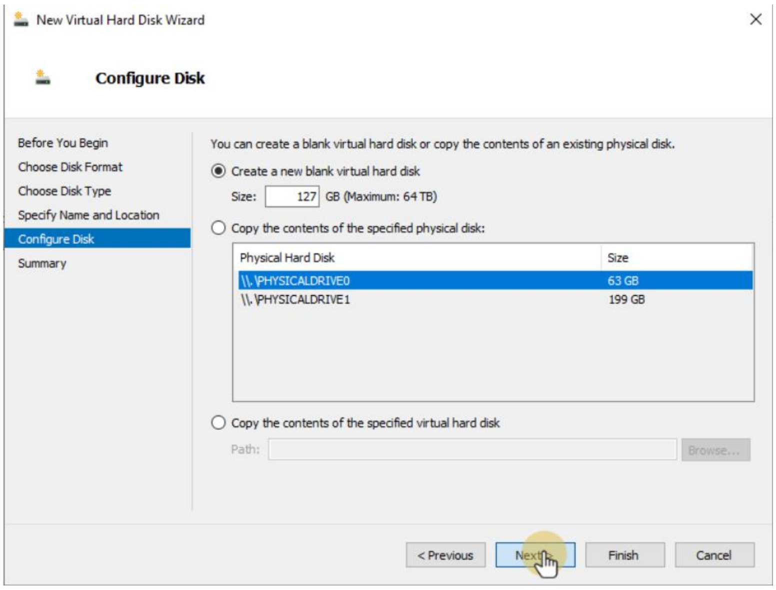
Specify Name and Location

Specify the name and location of the virtual hard disk file.

Name: New Virtual Hard Disk.vhdx

Location: C:\Hyper-V\

6. **Specify Disk Size:**
   - Enter the maximum size for the VHD.



New Virtual Hard Disk Wizard

Configure Disk

- 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 existing physical disk.

● Create a new blank virtual hard disk

Size: 127 GB (Maximum: 64 TB)

○ Copy the contents of the specified physical disk:

Physical Hard Disk	Size
\\.\PHYSICALDRIVE0	63 GB
\\.\PHYSICALDRIVE1	199 GB

○ Copy the contents of the specified virtual hard disk

Path:

7. **Complete the Wizard:**
   - Review your settings and click **Finish**.

Attaching a VHD to a VM:

1. **Open VM Settings:**
   - In Hyper-V Manager, right-click the VM and select **Settings**.
2. **Add Hard Drive:**
   - In the left pane, click **SCSI Controller** or **IDE Controller**, then **Hard Drive**.
   - Click **Add**.
3. **Select Virtual Hard Disk:**
   - Browse and select the VHD file to attach.
   - Click **Apply** and then **OK**.

Configuring Storage for VMs

Storage Options:

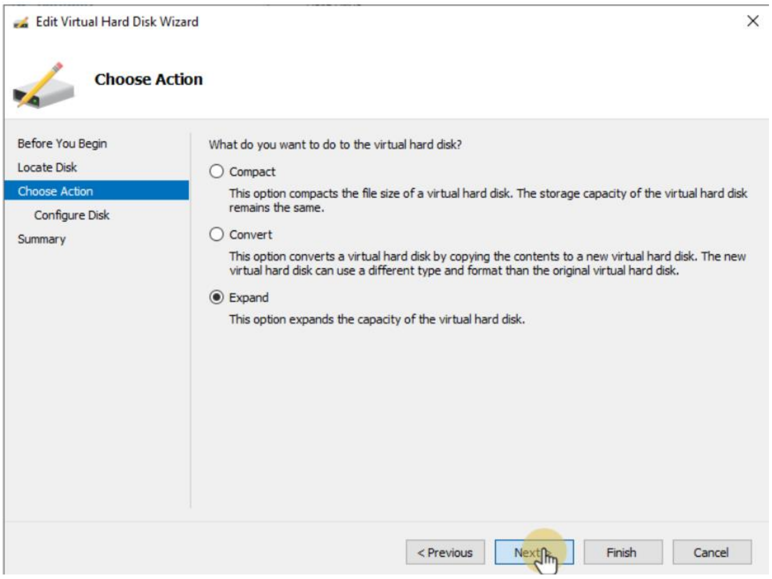
- **Pass-through Disks:**
  - Allows VMs to access physical disks directly.
  - Offers better performance but less flexibility.
- **Shared Storage:**
  - Use shared storage solutions (e.g., iSCSI, SMB) for high availability and live migration.
  - Suitable for clustered environments.

Expanding VHDs:

1. **Expand Virtual Hard Disk:**
   - In Hyper-V Manager, select **Edit Disk** from the Actions pane.

  - Browse to the VHD file and select **Expand**.
  - Specify the new size and complete the wizard.

2. **Extend Volume Inside VM:**
    - Inside the VM, use **Disk Management** to extend the volume.
    - Right-click the volume and select **Extend Volume**.



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.

4.4 Backing Up and Restoring VMs

Backup Strategies:

- **Regular Backups:**
    - Schedule regular backups of VMs and their VHDs.
    - Use Windows Server Backup or third-party solutions.
- **Snapshots:**
    - Take snapshots to capture the state of a VM at a specific point in time.
    - Useful for quick recovery during updates or changes.

Restoring VMs:

1. **Restore from Backup:**
    - Use your backup software to restore the VM files.
    - Import the restored VM in Hyper-V Manager.
2. **Apply Snapshots:**
    - In Hyper-V Manager, right-click the VM and select **Checkpoint**.
    - Choose the desired snapshot and click **Apply**.

4.5 Managing Storage Performance

Optimizing VHD Performance:

- **Use VHDX Format:**
  - Prefer VHDX for better performance and resilience.
- **Separate VHDs:**
  - Store OS and data on separate VHDs for improved performance.
- **Defragment VHDs:**
  - Periodically defragment VHDs to maintain performance.

PRACTICAL: Setting Up Hyper-V Replica:

1. **Enable Replication:**
   - On the primary host, open **Hyper-V Manager**, right-click the VM, and select **Enable Replication**.
2. **Specify Replica Server:**
   - Enter the name of the secondary Hyper-V host.
3. **Configure Connection Settings:**
   - Choose the authentication method (Kerberos or Certificate-based).
   - Specify the compression settings if needed.
4. **Select VHDs to Replicate:**
   - Choose which virtual hard disks to replicate.
5. **Configure Replication Frequency:**
   - Select the replication interval (30 seconds, 5 minutes, or 15 minutes).
6. **Choose Initial Replication Method:**
   - Select how the initial copy of the VM will be transferred (over the network, using external media, etc.).
7. **Complete the Wizard:**
   - Review the settings and click **Finish**.

5.3 Live Migration

What is Live Migration?

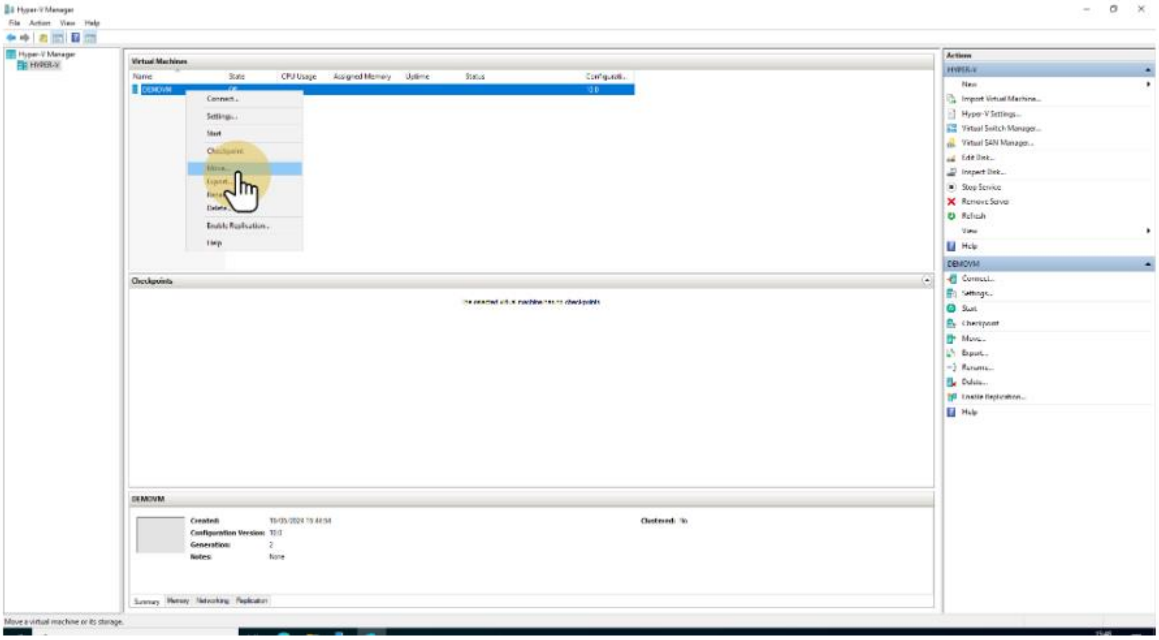
Live Migration allows you to move running VMs between Hyper-V hosts without downtime. This feature is useful for load balancing, maintenance, and minimizing downtime.

Requirements:

- **Windows Server Edition:** Live Migration is available in Windows Server editions (Standard and Datacenter).
- **Domain Membership:** Hosts must be part of the same Active Directory domain.
- **Network Configuration:** Dedicated network for live migration traffic to ensure performance.
- **Shared Storage:** Common storage accessible by all participating Hyper-V hosts, such as iSCSI or SMB-based storage.

Setting Up Live Migration:

1. **Configure Hosts:**
   - On each Hyper-V host, open **Hyper-V Manager**, click on the host name, and select **Hyper-V Settings**.
   - Go to **Live Migrations** and check **Enable incoming and outgoing live migrations**.
2. **Configure Authentication Protocol:**
   - Choose **CredSSP** or **Kerberos** for authentication.
3. **Configure Networks:**
   - Specify the networks to be used for live migration.
4. **Move VM:**
   - Right-click the running VM, select **Move**, and follow the wizard to transfer the VM to another host.



Name	State	CPU Usage	Assigned Memory	Uptime	Status	Configurati...
DEMOVM	Off					10.0

The selected virtual machine has no checkpoints.

DEMOVM

Created: 10/03/2024 10:44:54

Configuration Version: 10.0

Generation: 2

Notes: None

Clustered: No

Move a virtual machine or its storage.

Practical: iSCSI Implementation & Network Addressing Optimization

Aim:

To implement **iSCSI storage networking** for optimized data management and to configure **IP address allocation** using subnetting for efficient and scalable network design.

Procedure:

Part A: iSCSI Storage Implementation

1. **Setup the iSCSI Target (Windows Server or Ubuntu):**
   - Install iSCSI Target Server role (Windows) or `tgt` package (Linux).
   - Configure a virtual disk (VHD) or block device.
   - Define the iSCSI target and set initiator permissions.
2. **Setup the iSCSI Initiator (Client Machine):**
   - Open iSCSI Initiator (Windows) or use `iscsiadm` (Linux).
   - Discover the target using the IP address of the server.
   - Connect to the target and bring the new disk online via Disk Management or `fdisk`.

Part B: IP Addressing and Subnetting

1. **IP Planning:**
   - Define the network: e.g., `192.168.10.0/24`
   - Subnet for departments:
     - IT: `192.168.10.0/26`
     - HR: `192.168.10.64/26`
     - Sales: `192.168.10.128/26`
     - Admin: `192.168.10.192/26`
2. **Assign IPs:**
   - Assign static IPs to servers, gateways, printers.
   - Reserve IP blocks for DHCP scopes and dynamic clients.
3. **Document the IP Allocation:**
   - Maintain a spreadsheet of IP addresses, hostnames, MACs, and assigned users.

Result:

- iSCSI target was successfully configured and mounted on the initiator machine.
- A new disk appeared on the client, demonstrating successful storage over IP.
- The network was successfully segmented using subnetting, providing controlled and organized IP address allocation.
- Devices were connected without conflict, and IP usage was optimized across departments.

Conclusion:

The implementation of **iSCSI** enabled centralized storage provisioning, offering scalability, flexibility, and efficient storage utilization. Simultaneously, the strategic configuration of **IP addressing using subnetting** allowed for effective network segmentation, minimized broadcast domains, and optimized IP resource usage. Together, these configurations enhance **performance**, **security**, and **manageability** of the organization's IT infrastructure.

Practical: Strategic IP Address Allocation and Subnetting

Aim:

To **plan and implement strategic IP address allocation** through effective subnetting and assignment techniques in order to optimize network resource utilization and ensure **seamless connectivity** across organizational devices and services.

Procedure:

1. Understand the Network Requirements:

- Total number of departments: 4 (Admin, HR, IT, Sales)
- Approximate devices per department:
    - Admin: 50
    - HR: 30
    - IT: 60
    - Sales: 40

2. **Choose a Base Network Address:**

- Example: 192.168.10.0/24 (Private IP Range)

3. **Subnetting the Network:**

- Break down /24 into smaller subnets using VLSM (Variable Length Subnet Masking)

Department	Required Hosts	Subnet Assigned	Subnet Mask	Host Range
IT	60	192.168.10.0/26	255.255.255.192	192.168.10.1–62
Admin	50	192.168.10.64/26	255.255.255.192	192.168.10.65–126
Sales	40	192.168.10.128/26	255.255.255.192	192.168.10.129–190
HR	30	192.168.10.192/27	255.255.255.224	192.168.10.193–222

4. **IP Address Assignment:**

- **Static IPs:** Assigned to servers, routers, printers, and network infrastructure.
- **Dynamic IPs (via DHCP):** Assigned to user devices within each subnet range.
- Maintain a clear **IP allocation sheet** with fields like:
    - Device Name
    - MAC Address
    - Assigned IP
    - Subnet
    - Department

5. **Implement and Test Connectivity:**

- Assign IPs to virtual machines or test devices.
- Use ping and tracert/traceroute to verify connectivity within and across subnets.
- Confirm no IP conflicts or broadcast domain issues.

Result:

- Each department was successfully assigned its own subnet, tailored to its size.
- IPs were allocated and documented without overlap or conflict.
- All devices were able to communicate within their subnet and across departments via routers/gateways.
- The network was logically segmented, improving performance and simplifying troubleshooting.

Conclusion:

Through the strategic application of **IP address planning and subnetting**, the organization's network was efficiently organized into logical segments. This not only ensured optimal use of IP space but also enhanced **security**, **scalability**, and **network manageability**. Proper IP assignment eliminated address conflicts and supported seamless communication across the enterprise.

Practical: Implementing DHCP for IPv6 (DHCPv6)

Aim:

To strategically implement DHCP for IPv6 (DHCPv6) in a network environment, ensuring preparedness for the transition to the next generation Internet Protocol and enabling scalable, efficient IP address management.**

Procedure:

1. Prerequisites:

- Ensure IPv6 is enabled on your DHCP server and client devices.
- Use Windows Server 2016 with DHCP role installed.
- Clients should support IPv6 (e.g., Windows 10, Linux).

2. Enable DHCPv6 Role (if not already done):

```
Install-WindowsFeature -Name DHCP -IncludeManagementTools
```

3. Configure IPv6 Address on Server Interface:

Example IPv6: `2001:db8:abcd::1/64`

```
New-NetIPAddress -InterfaceAlias "Ethernet" -IPAddress 2001:db8:abcd::1 -PrefixLength
64
```

4. Create a DHCPv6 Scope:

```
Add-DhcpServerv6Scope -Name "CorpIPv6" -Prefix 2001:db8:abcd:: -PrefixLength 64 -
StartRange 2001:db8:abcd::1000 -EndRange 2001:db8:abcd::2000
```

5. Configure Additional Options (Optional):

Set DNS server and domain name for IPv6 clients:

```
Set-DhcpServerv6OptionValue -DnsServer 2001:db8:abcd::1 -DomainName "corp.local"
```

6. Client-Side Configuration:

- Ensure client is set to obtain IPv6 address automatically.
- Restart networking or use:

```
# Linux
dhclient -6

# Windows
ipconfig /renew6
```

7. Verify IP Assignment:

On client:

```
ip -6 addr  # Linux
ipconfig /all  # Windows
```

Check if the IPv6 address is within the DHCPv6 scope and if DNS settings are applied.

Result:

- The DHCPv6 server successfully assigned IPv6 addresses to all compatible clients within the defined address range.
- Clients also received DNS and domain name information.
- The network demonstrated readiness for IPv6-only or dual-stack environments.

Conclusion:

By implementing **DHCPv6**, the network is now **prepared for the future of internet addressing**, where IPv4 exhaustion is a growing concern. This deployment supports **scalability**, **security**, and **better routing efficiency**, laying a solid foundation for modern cloud, IoT, and mobile-first infrastructures. Transitioning to IPv6 ensures long-term connectivity and reduces reliance on NAT or IPv4 workarounds.

Practical: Deploying Multiple Web Servers Using IPv4 Addressing

Aim:

To amplify the reach and resilience of online services by configuring multiple web servers on a network using IPv4 addressing, enabling redundancy, load distribution, and improved service availability.

Procedure:

1. Plan the Web Server Infrastructure:

- Number of web servers: 2 or more (e.g., Web01 and Web02)
- Use **Windows Server IIS** or **Apache/Nginx on Linux**
- Assign static IPv4 addresses to each web server

Server Name	IP Address	OS	Web Server Software
Web01	192.168.10.101	Windows Server	IIS
Web02	192.168.10.102	Ubuntu Linux	Apache

2. Configure Static IPv4 Addresses:

On each server:

```
# Linux (Netplan or interfaces config)
address: 192.168.10.102
netmask: 255.255.255.0
gateway: 192.168.10.1
```

On Windows Server:

- Use Network Settings > IPv4 > Set manually

3. Install and Configure Web Server Software:

Windows (IIS):

```
Install-WindowsFeature -Name Web-Server -IncludeManagementTools
```

Linux (Apache):

```
sudo apt update && sudo apt install apache2 -y
```

- Customize index.html or default landing page to identify each server uniquely.

4. Test Access from Clients:

- Open browser and visit:
  - http://192.168.10.101 (Web01)
  - http://192.168.10.102 (Web02)

- Use ping, tracert, or curl for CLI testing.

5. Optional: Configure DNS or Load Balancer (Advanced)

- Set up DNS entries (e.g., web01.corp.local, web02.corp.local)
- Use a reverse proxy or load balancer (like HAProxy or NGINX) for traffic distribution

Result:

- Two independent web servers were successfully deployed with unique IPv4 addresses.
- Clients were able to access both services using their respective IPs.
- The infrastructure allows for high availability and resilience, as one server can handle requests if the other is down.

Conclusion:

Deploying multiple web servers using distinct **IPv4 addresses** enhances the **resilience**, **scalability**, and **availability** of online services. This architecture supports fault tolerance, load distribution, and seamless maintenance cycles—ensuring that users experience minimal disruption and consistent service delivery.

Practical: Establishing a Primary DNS Zone

Aim:

To assume control over DNS resolution within a network by configuring a **Primary DNS Zone**, making the server the authoritative source for domain name mapping and resolution.**

Procedure:

1. Install DNS Server Role (Windows Server 2016):

Open PowerShell or Server Manager and install the DNS role:

```
Install-WindowsFeature -Name DNS -IncludeManagementTools
```

2. Open DNS Manager:

- Go to **Start > Administrative Tools > DNS**.
- Expand the server node.

3. Create a New Primary DNS Zone:

1. Right-click **Forward Lookup Zones → New Zone**.
2. In the wizard:
    - Choose **Primary zone**.
    - Select **Store the zone in Active Directory** (if using AD).
    - Zone name: e.g., corp.local
    - Choose **Allow only secure dynamic updates** (if integrated with AD).
3. Finish the wizard.

4. Add Host (A) Records:

- Right-click the new zone → **New Host (A or AAAA)**.
- Enter:
    - **Name**: web01
    - **IP Address**: 192.168.10.101
- Repeat for other hosts like web02, printer, dc, etc.

5. Configure Reverse Lookup Zone (Optional but Recommended):

- Right-click **Reverse Lookup Zones → New Zone**.
- Follow the wizard to create a zone for 192.168.10.x.
- Add PTR records for reverse DNS (IP to hostname).

6. Test DNS Resolution:

On a client machine:

```
nslookup web01.corp.local
ping web01.corp.local
```

Verify the server correctly resolves names to IPs.

Result:

- A **Primary DNS Zone** named corp.local was successfully created.
- Host records were added and resolved correctly from clients.
- The DNS server now acts as the **authoritative resolver** for internal domain queries.

Conclusion:

By establishing a **Primary DNS Zone**, full control over internal **DNS resolution** was achieved, allowing centralized management of domain names and IP address mappings. This setup enhances network efficiency, simplifies resource access, and provides a scalable naming infrastructure for the organization.

Practical: Implementing an FTP Server for Efficient File Transfer

Aim:

To implement an **FTP server** that facilitates efficient, centralized, and secure file transfers between users and systems across a network.

Procedure:

1. Install FTP Server Role (Windows Server 2016):

Use **Server Manager**:

- Go to **Manage > Add Roles and Features**.
- Select:
  - **Web Server (IIS)**
  - Under **Role Services**, check **FTP Server → FTP Service** and **FTP Extensibility**.
- Complete the installation.

Alternatively, via PowerShell:

```
Install-WindowsFeature Web-Ftp-Server -IncludeManagementTools
```

2. Configure FTP Site:

1. Open **IIS Manager**.
2. Right-click **Sites → Add FTP Site**.
3. Name it (e.g., CorpFTP) and specify the **physical path** (e.g., C:\FTPShare).
4. Set **IP address** (e.g., 192.168.10.105) and select **No SSL** for basic setup (can configure SSL later).
5. Authentication:
   - Enable **Basic Authentication**.
   - Authorization: Allow **Specified users** or **All users**, grant **Read/Write** permissions.

3. Set File/Folder Permissions:

- Ensure the FTP folder (e.g., C:\FTPShare) has the right NTFS permissions.
- Grant **Modify** permissions to the intended FTP users or group.

4. Create and Configure FTP User Account:

- Create a local user (or use domain user if in Active Directory):

```
net user ftpuser P@ssw0rd123 /add
```

- Add to a group if needed (e.g., FTPUsers)

5. Allow FTP through Firewall:

```
netsh advfirewall firewall add rule name="FTP" action=allow protocol=TCP localport=21
```

6. Test FTP Access:

- Use a browser or FTP client:
  - ftp://192.168.10.105
- Login using ftpuser credentials.
- Upload/download a test file to verify read/write access.

Result:

- An FTP server was successfully deployed on the network.
- Authorized users could securely upload and download files.
- Network file transfers were centralized and efficient.

Conclusion:

The implementation of an **FTP server** significantly enhances the efficiency of file distribution within an organization. It supports centralized management, controlled access, and scalable infrastructure for internal or external file sharing needs. While basic setup uses unencrypted channels, future enhancements can include **FTPS** or **SFTP** for secure file transfers.