

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

Design and Implementation of an  
Enterprise Network IT Infrastructure

Documentation

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

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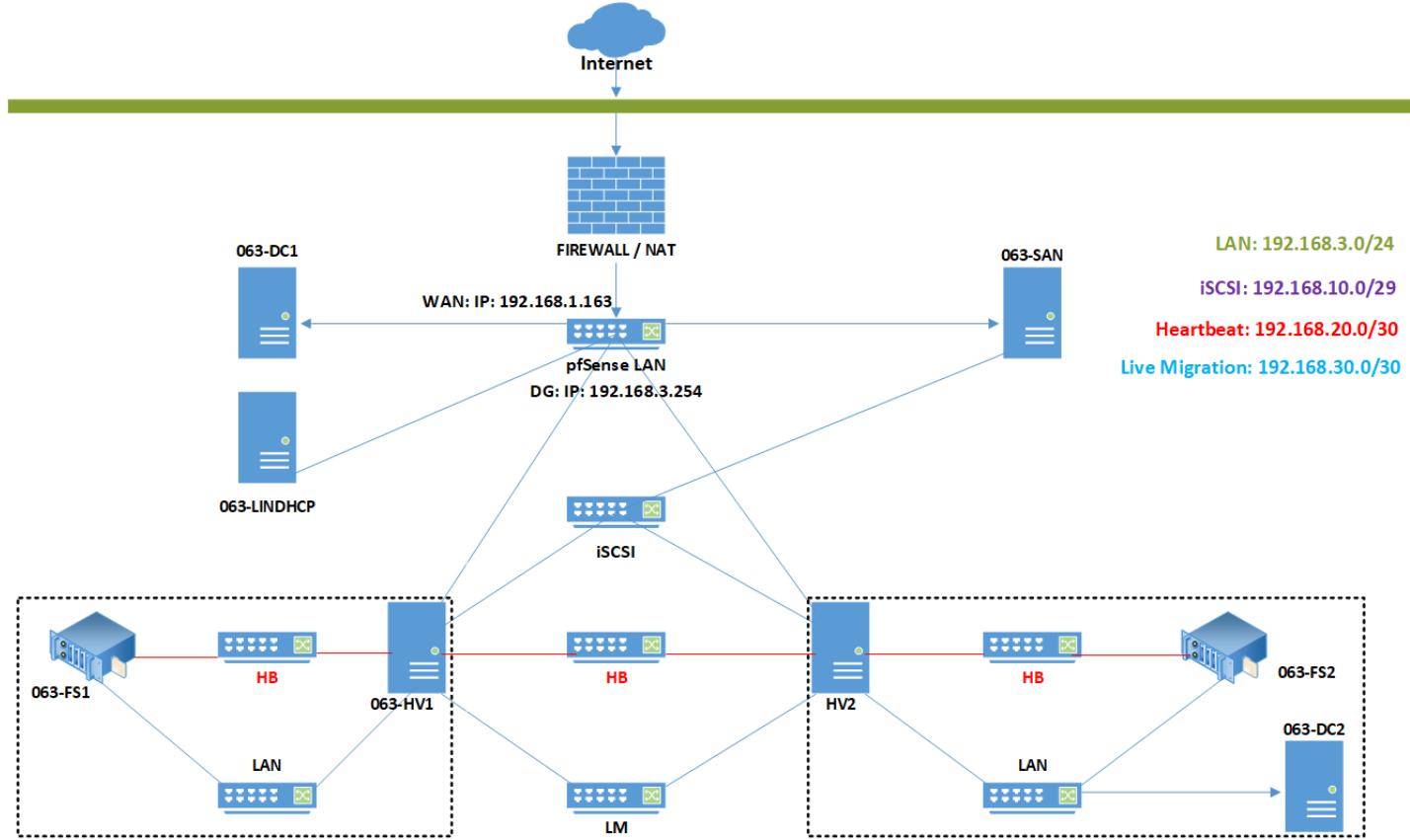
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## Diagram Topology:



## Interface IP Table:

Interface	IPs
063-DC1 – LAN	192.168.3.2
063-TEST – LAN	192.168.3.12
063-DC2 – LAN	192.168.3.13
063-FS1 – HB, LAN	192.168.20.1, 192.168.3.8
063-FS2 – HB, LAN	192.168.20.2, 192.168.3.10, 192.168.3.11, 192.168.3.9
063-HV1 – APIPA, iSCSI, LAN, LM	169.254.204.5, 192.168.10.2, 192.168.3.5, 192.168.3.7, 192.168.30.1
063-HV2 – APIPA, iSCSI, LAN, LM	169.254.51.39, 192.168.10.3, 192.168.3.6, 192.168.30.2
063-SAN – iSCSI, LAN	192.168.10.1, 192.168.3.4
FS – HB, LAN	192.168.20.2, 192.168.3.10, 192.168.3.11, 192.168.3.9

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FSCluster – HB, LAN	192.168.20.2, 192.168.3.10, 192.168.3.11, 192.168.3.9
HyperVCluster – APIPA, iSCSI, LAN, LM	169.254.204.5, 192.168.10.2, 192.168.3.5, 192.168.3.7, 192.168.30.1
063-DC1 DNS Server	192.168.3.2
063-DC2 DNS Server	192.168.3.13
/24 – Subnet mask	255.255.255.0
/29 – Subnet mask	255.255.255.248
/30 – Subnet mask	255.255.255.252

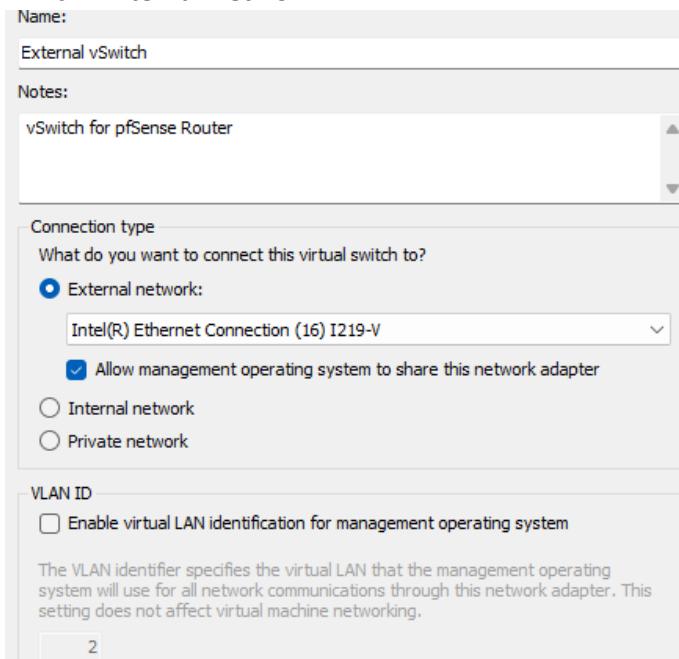
### Project Prerequisites:

- Download the following image files:
  - o PFSENSE 2.7.1: <https://www.pfsense.org/download/>
  - o Windows Server 2022 (Core): <https://www.microsoft.com/en-us/evalcenter/evaluate-windows-server-2022>
  - o CentOS: [https://mirror.dst.ca/centos/7.9.2009/isos/x86\\_64/](https://mirror.dst.ca/centos/7.9.2009/isos/x86_64/)

### Configure a NAT/Firewall Router:

#### Create Virtual Switch:

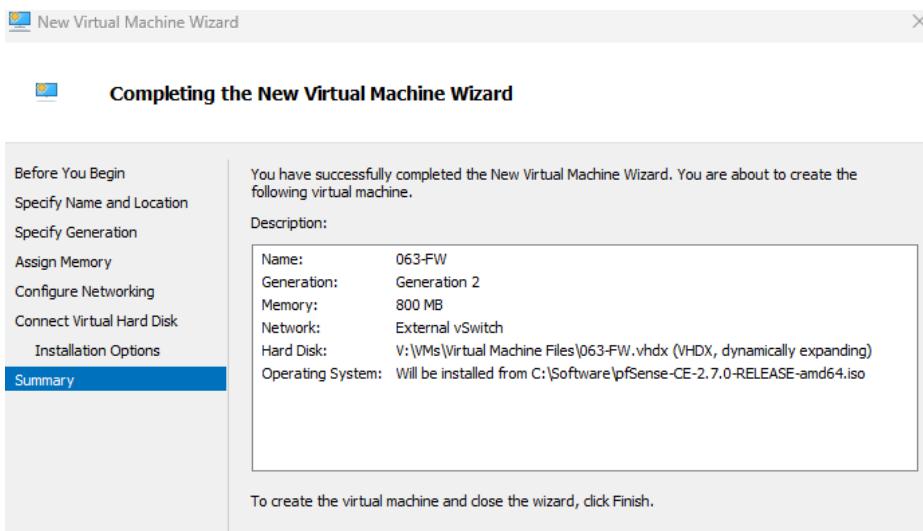
- Hyper-V Manager > Virtual Switch Manager > New virtual network switch
- Connection Type:
  - o External Network



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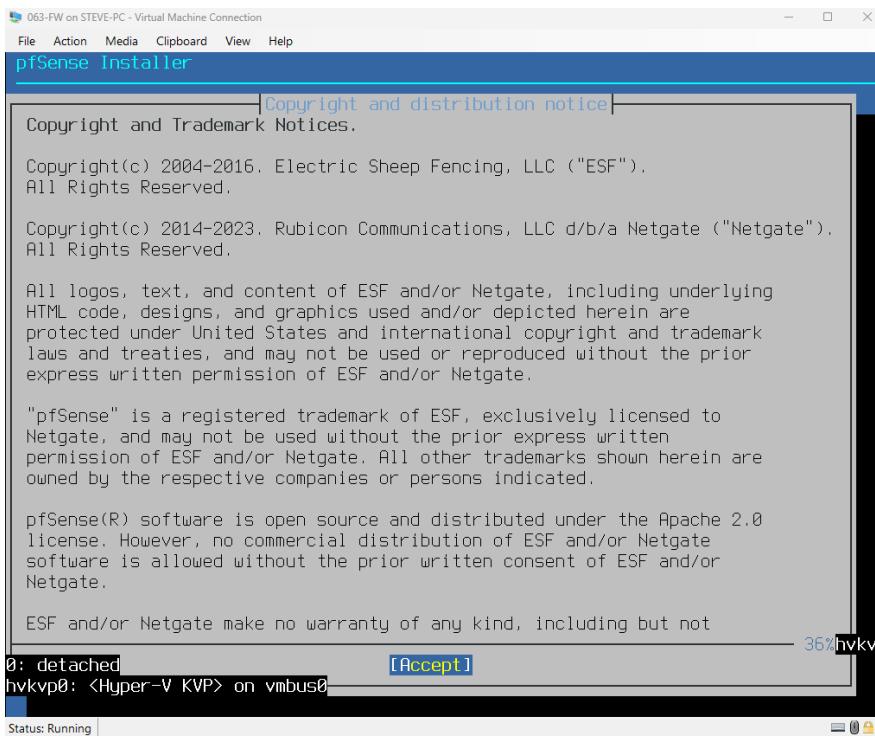
### Installing pfSense:

- **Hyper-V Manager > New > Virtual Machine**
- For pfSense we will focus on applying these attributes:
  - o We'll specify the name **063-FW**
    - Location will be **V:\VM's\VHDX\**
  - o **Generation 2**
  - o **800MB** of Dynamic Memory
  - o Virtual hard disk size
    - **30GB**



- Right click on **pfSense > Settings**
  - o Firmware:
    - Click the up arrow to move the **Hard Drive** all the way to the top so it doesn't read the **DVD Drive** first
  - o Integration Services:
    - Enable Guest Services
  - o Checkpoints:
    - Disable the automatic checkpoints
  - o Security:
    - Disable Secure Boot

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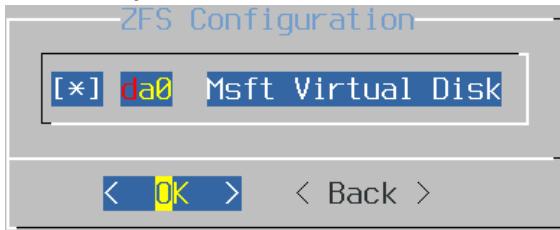


- **Install pfSense:**



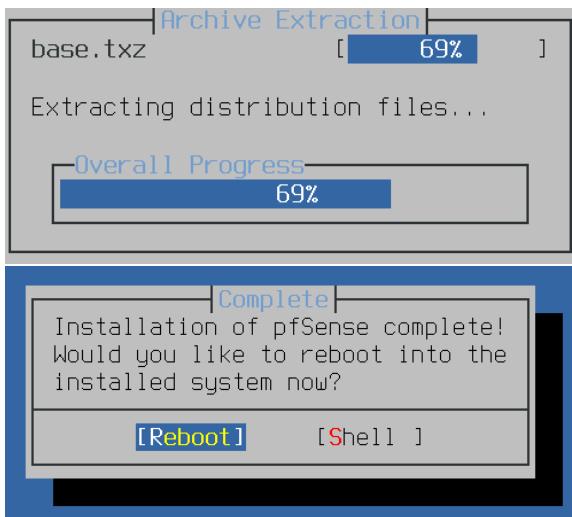
- **Enable the following options when configuring installation:**

- *Select Auto (ZFS)*
- *Stripe – No Redundancy*
- *Msft Virtual Disk*



- **Last Chance!** Are you sure you want to destroy the current contents of the following disks: **da0**
  - **Reply with YES**

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### Configure pfSense WAN:

- Upon reboot we arrive at a screen asking should VLANs be set up
  - o We select N for No

```
Do VLANs need to be set up first?  
If VLANs will not be used, or only for optional interfaces, it is typical to  
say no here and use the webConfigurator to configure VLANs later, if required.
```

- Enter the WAN interface name or 'a' for auto-detection
  - o (hn0 or a):
- We will set it to *hn0*

```
Enter the WAN interface name or 'a' for auto-detection  
(hn0 or a): hn0
```

- Press **Enter** to bypass:  
Enter the LAN interface name or 'a' for auto-detection  
NOTE: this enables full Firewalling/NAT mode.  
( a or nothing if finished):

- The interfaces will be assigned as follows:
  - o **WAN -> hn0**
  - o **Y (yes) to proceed**

```
The interfaces will be assigned as follows:
```

```
WAN -> hn0
```

```
Do you want to proceed [y/n]? 
```

- The WAN will begin to configure itself
  - o Trying to capture DHCP

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```
WAN (wan)      -> hn0      -> v4/DHCP4: 192.168.1.163/24

0) Logout (SSH only)          9) pfTop
1) Assign Interfaces          10) Filter Logs
2) Set interface(s) IP address 11) Restart webConfigurator
3) Reset webConfigurator password 12) PHP shell + pfSense tools
4) Reset to factory defaults   13) Update from console
5) Reboot system               14) Enable Secure Shell (sshd)
6) Halt system                 15) Restore recent configuration
7) Ping host                   16) Restart PHP-FPM
8) Shell

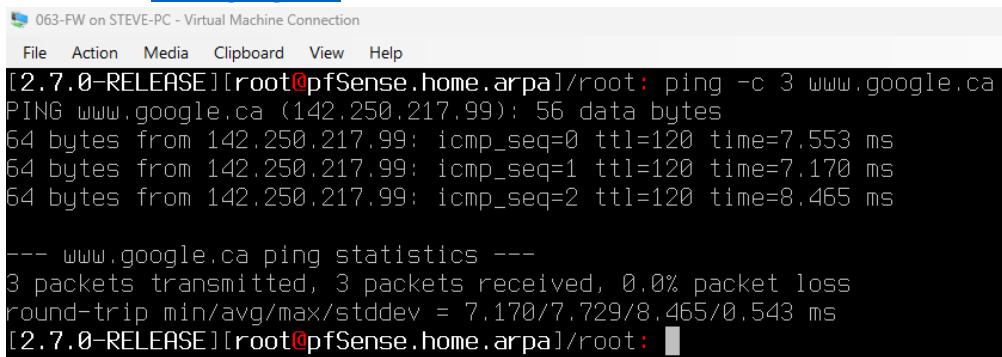
Enter an option: █
```

- The External Switch is set to **192.168.1.163/24**

### Test the WAN connection:

- In the console menu selection option 8) Shell
- Enter the command:

- o **-c 3 www.google.ca**



```
File Action Media Clipboard View Help
[2.7.0-RELEASE][root@pfSense.home.arpa]# ping -c 3 www.google.ca
PING www.google.ca (142.250.217.99): 56 data bytes
64 bytes from 142.250.217.99: icmp_seq=0 ttl=120 time=7.553 ms
64 bytes from 142.250.217.99: icmp_seq=1 ttl=120 time=7.170 ms
64 bytes from 142.250.217.99: icmp_seq=2 ttl=120 time=8.465 ms

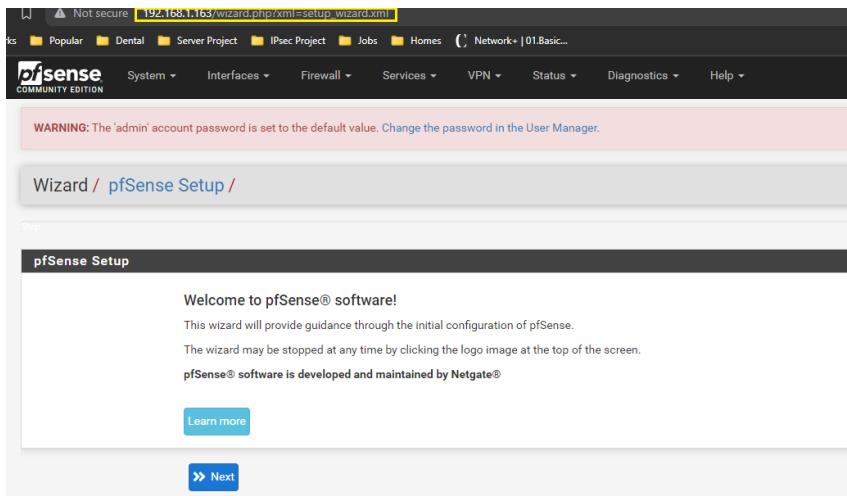
--- www.google.ca ping statistics ---
3 packets transmitted, 3 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 7.170/7.729/8.465/0.543 ms
[2.7.0-RELEASE][root@pfSense.home.arpa]# █
```

- Exit to return to the console menu

### Access pfSense Dashboard:

- o On the host machine web browser access the web configuration console for pfSense by navigating to the default gateway set by pfSense WAN configuration: **192.168.1.163/24**
  - o Click advanced and accept the terms of agreement
  - o The default username and password:
    - **(admin/pfsense)**

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- Use the web console to configure the pfSense router:
- Change the host name from pfSense to **063-FW**



- Time Server Information:



- Configure WAN Interface:



- Assign password: **Pa\$\$w0rd**

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Step 6 of 9

### Set Admin WebGUI Password

On this screen the admin password will be set, which is used to access the WebGUI and also SSH services if enabled.

Admin Password	.....
Admin Password AGAIN	.....

- Reload pfSense with the new configuration:

Step 9 of 9

### Wizard completed.

Congratulations! pfSense is now configured.

We recommend that you check to see if there are any software updates available. Keeping your software up to date is one of the most important things you can do to maintain the security of your network.

[Check for updates](#)

- Check for updates:

<b>Version</b>	<b>2.7.0-RELEASE (amd64)</b>
	built on Wed Jun 28 03:53:34 UTC 2023
	FreeBSD 14.0-CURRENT
Version <a href="#">2.7.2</a> is available.	
Version information updated at Thu Apr 4 6:52:32 UTC 2024	

Please wait while the system update completes.  
This may take several minutes. Do not leave or refresh the page!

System Update    [Update Settings](#)

- Create a new User Manager:

- o **System > User Manager > Users**
- o Select **Add** to add a new user

System / [User Manager](#) / [Users](#)

[?](#)

Users	Groups	Settings	Authentication Servers										
<b>Users</b>													
<table border="1"> <thead> <tr> <th>Username</th> <th>Full name</th> <th>Status</th> <th>Groups</th> <th>Actions</th> </tr> </thead> <tbody> <tr> <td><input type="checkbox"/> admin</td> <td>System Administrator</td> <td>✓</td> <td>admins</td> <td></td> </tr> </tbody> </table>	Username	Full name	Status	Groups	Actions	<input type="checkbox"/> admin	System Administrator	✓	admins				
Username	Full name	Status	Groups	Actions									
<input type="checkbox"/> admin	System Administrator	✓	admins										
					Add	Delete							

- We will use **\_Lsysadmin**
- Password: **Pa\$\$w0rd**

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**User Properties**

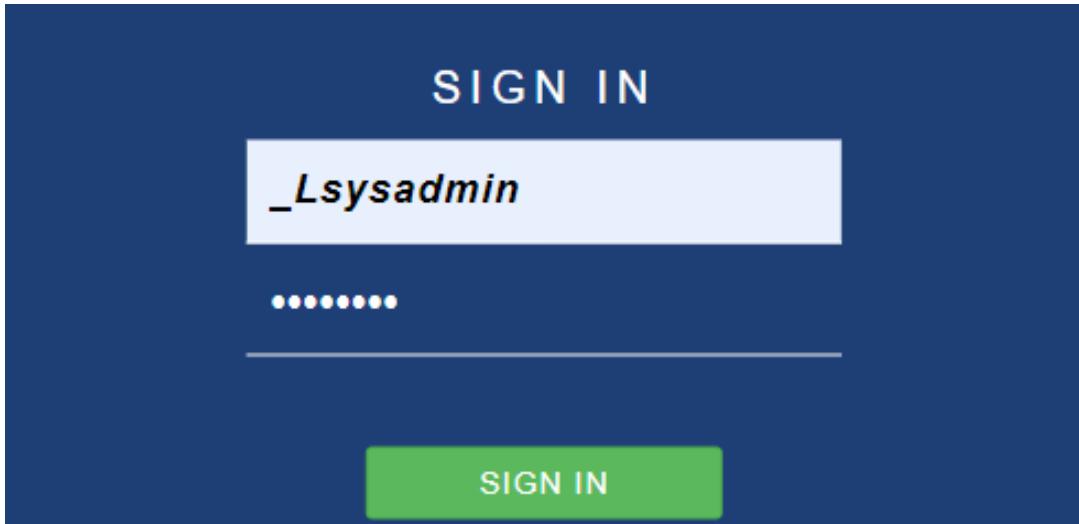
Defined by	USER
Disabled	<input type="checkbox"/> This user cannot login
Username	_Lsysadmin
Password	*****

- Ensure the user is a member of **admins** Group Membership

<b>Group membership</b> <input type="text"/> Not member of	<b>Member of</b> <input type="text"/> admins
<a href="#">» Move to "Member of" list</a> <a href="#">« Move to "Not member of" list</a>	

Hold down CTRL (PC)/COMMAND (Mac) key to select multiple items.

- Save
- Sign out of pfSense, log back in using the **\_Lsysadmin** account



- Verify if NAT is configured:
  - o In the pfSense web interface locate **Firewall** dropdown menu
    - Select **NAT > Outbound**
- This page show that NAT is automatically configured on the WAN side

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**Outbound NAT Mode**

Mode	<input checked="" type="radio"/> Automatic outbound NAT rule generation. (IPsec passthrough included)	<input type="radio"/> Hybrid Outbound NAT rule generation. (Automatic Outbound NAT + rules below)	<input type="radio"/> Manual Outbound NAT rule generation. (AON - Advanced Outbound NAT)	<input type="radio"/> Disable Outbound NAT rule generation. (No Outbound NAT rules)
------	--	--	---	--

**Mappings**

Interface	Source	Source Port	Destination	Destination Port	NAT Address	NAT Port	Static Port	Description	Actions
WAN	127.0.0.0/8 ::1/128	*	*	500	WAN address	*	<input checked="" type="checkbox"/>	Auto created rule for ISAKMP	
WAN	127.0.0.0/8 ::1/128	*	*	*	WAN address	*		Auto created rule	

**Automatic Rules**

Interface	Source	Source Port	Destination	Destination Port	NAT Address	NAT Port	Static Port	Description
WAN	127.0.0.0/8 ::1/128	*	*	500	WAN address	*	<input checked="" type="checkbox"/>	Auto created rule for ISAKMP
WAN	127.0.0.0/8 ::1/128	*	*	*	WAN address	*		Auto created rule

- Next, disable the ability for this pfSense router to resolve DNS
  - o Navigate to **Services > DNS Resolver > General Settings**
    - Uncheck **Enable DNS Resolver**

**General Settings / DNS Resolver / General Settings**

**General DNS Resolver Options**

Enable	<input type="checkbox"/> Enable DNS resolver
--------	--

**Enable SSL/TLS Service**

<input type="checkbox"/> Respond to incoming SSL/TLS queries from local clients
---

- Save > Apply

### Configure pfSense LAN:

- Create the vSwitch (Virtual Switch)
- In Hyper-V Manager select **Virtual Switch Manager**
- Create an **Internal** switch

**Virtual Switch Properties**

Name:  
**pfSense LAN**

Notes:  
192.168.3.254/24

Connection type  
What do you want to connect this virtual switch to?

External network:  
Intel(R) Ethernet Connection (16) I219-V

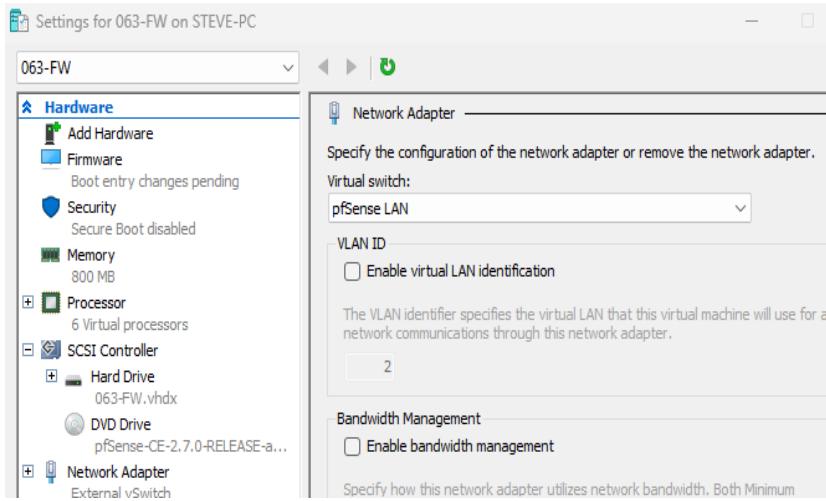
Allow management operating system to share this network adapter

Internal network

Private network

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- We will assign the static IP address of **192.168.3.254/24** for the LAN
- Next, we want to add the internal vSwitch to pfSense **063-FW**
- Right click **063-FW > Settings > Network Adapter > Add Hardware**
  - o **Add Network Adapter**



- The LAN is connected to the internal network vSwitch pfSense LAN

```
Message from syslogd@063-FW at Apr 4 07:01:30 ...
php-fpm[2784]: /index.php: Successful login for user '_Lsysadmin' from: 192.168.1.133
  (Local Database)
hn1: <Hyper-V Network Interface> on vmbus0
```

- Reboot/Shutdown
- Assign Interface
- Select Option 2) in the pfSense Console

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```

063-FW on STEVE-PC - Virtual Machine Connection
File Action Media Clipboard View Help
http://dhcp/

Press <ENTER> to continue.
Hyper-V Virtual Machine - Netgate Device ID: 6c953ab11d2f2ab155c4

*** Welcome to pfSense 2.7.2-RELEASE (amd64) on 063-FW ***

WAN (wan)      -> hn0      -> v4/DHCP4: 192.168.1.163/24

0) Logout (SSH only)      9) pfTop
1) Assign Interfaces       10) Filter Logs
2) Set interface(s) IP address 11) Restart webConfigurator
3) Reset webConfigurator password 12) PHP shell + pfSense tools
4) Reset to factory defaults 13) Update from console
5) Reboot system          14) Enable Secure Shell (sshd)
6) Halt system            15) Restore recent configuration
7) Ping host              16) Restart PHP-FPM
8) Shell

Enter an option: 1

Valid interfaces are:

hn0      00:15:5d:01:85:b1  (up) Hyper-V Network Interface
hn1      00:15:5d:01:85:b5  (down) Hyper-V Network Interface

Do VLANs need to be set up first?
If VLANs will not be used, or only for optional interfaces, it is typical to
say no here and use the webConfigurator to configure VLANs later, if required.

Should VLANs be set up now [y|n]? ■

- Should VLANs be set up now? [y|n]?
  ○ N
- Enter the WAN interface name or 'a' for auto-detection
  ○ hn0
- Enter the LAN interface name or 'a' for auto-detection
  ○ hn1
- The interfaces will be assigned as follows:
- WAN -> hn0
- LAN -> hn1
- Do you want to proceed? [y|n]?
  ○ Y

*** Welcome to pfSense 2.7.2-RELEASE (amd64) on 063-FW ***

WAN (wan)      -> hn0      -> v4/DHCP4: 192.168.1.163/24
LAN (lan)      -> hn1      ->

```

- Select 2) for Set Interface(s) IP Address then, 2 again to select LAN

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

```
Enter an option: 2
```

```
Available interfaces:
```

```
1 - WAN (hn0 - dhcp)  
2 - LAN (hn1)
```

```
Enter the number of the interface you wish to configure: 2
```

```
Configure IPv4 address LAN interface via DHCP? (y/n) █
```

- Configure IPv4 Address LAN interface via DHCP? (y/n)
  - o **N** for No
- Enter the new LAN IPv4 address –
  - o **192.168.3.254**
  - o **24 bits** for the subnet mask
- For a WAN, enter the new LAN Ipv4 upstream gateway address.
  - o For a LAN, press enter for none
    - We press **Enter**
- Configure IPv6 address LAN interface via DHCP6? (y/n)
  - o Choose **N**
- Enter the new LAN IPv6 address, press enter for none
  - We press **Enter**
- Do you want to enable the DHCP server on LAN? (y/n)
  - o Choose **N**

```
Enter the new LAN IPv4 address. Press <ENTER> for none:  
█ 192.168.3.254
```

```
Subnet masks are entered as bit counts (as in CIDR notation) in pfSense.  
e.g. 255.255.255.0 = 24  
      255.255.0.0   = 16  
      255.0.0.0     = 8
```

```
Enter the new LAN IPv4 subnet bit count (1 to 32):  
█ 24
```

```
For a WAN, enter the new LAN IPv4 upstream gateway address.  
For a LAN, press <ENTER> for none:  
█
```

```
Please wait while the changes are saved to LAN...  
Reloading filter...  
Reloading routing configuration...  
DHCPD...
```

```
The IPv4 LAN address has been set to 192.168.3.254/24  
You can now access the webConfigurator by opening the following URL in your web browser:  
http://192.168.3.254/
```

```
Press <ENTER> to continue. █
```

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

```
*** Welcome to pfSense 2.7.2-RELEASE (amdb4) on 063-FW ***

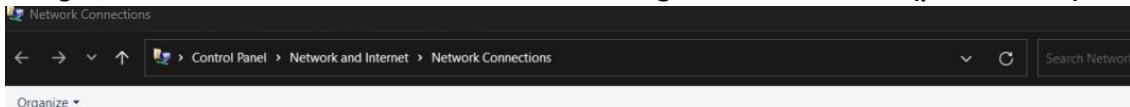
WAN (wan)      -> hn0      -> v4/DHCP4: 192.168.1.163/24
LAN (lan)      -> hn1      -> v4: 192.168.3.254/24

0) Logout (SSH only)          9) pfTop
1) Assign Interfaces          10) Filter Logs
2) Set interface(s) IP address 11) Restart webConfigurator
3) Reset webConfigurator password 12) PHP shell + pfSense tools
4) Reset to factory defaults   13) Update from console
5) Reboot system               14) Enable Secure Shell (sshd)
6) Halt system                 15) Restore recent configuration
7) Ping host                   16) Restart PHP-FPM
8) Shell
```

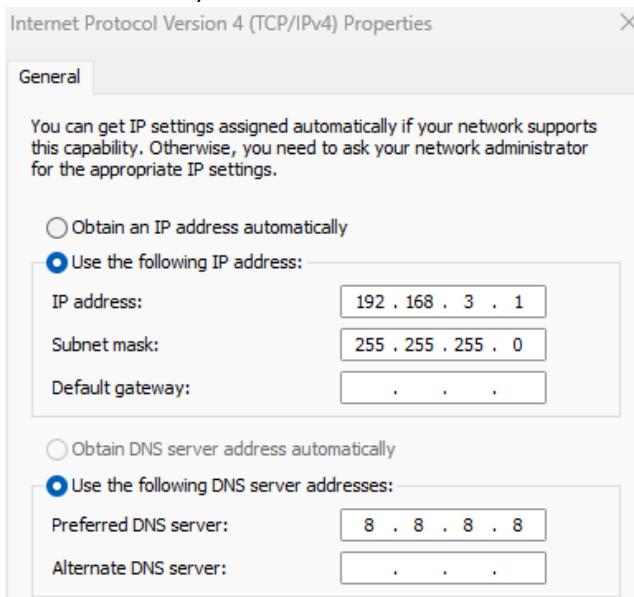
- The LAN IP is now present in the pfSense CLI Console
- It represents the LAN side address for the firewall to communicate with our internal network

### Set Static IP for LAN vSwitch on Host Machine:

- Navigate to **Control Panel > Network Connections > Right click > vEthernet (pfSense LAN)**

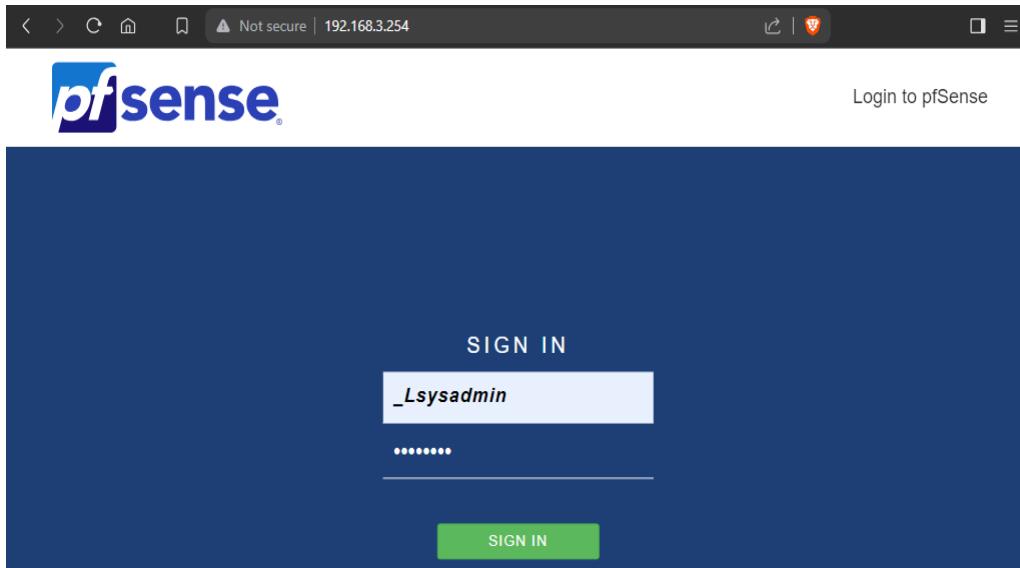


- Open the properties box for Internet Protocol Version 4 (TCP/IPv4)
- Define the static IP for the inbound LAN connection
  - o IP: **192.168.3.1**
  - o Subnet Mask: **255.255.255.0**
  - o DNS: **8.8.8.8** (Temporary until the Domain Controller establishes DNS infrastructure services)



## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Once this is defined, we can try to access the web configuration dashboard for pfSense via the firewall address of **192.168.3.254**

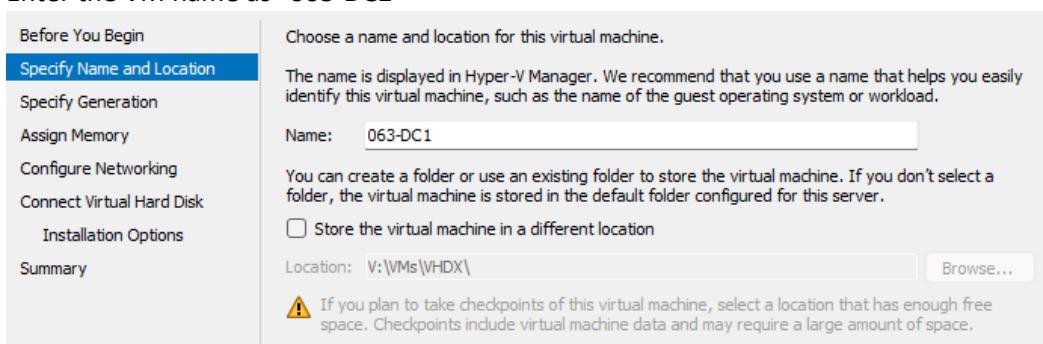


- We can check to see if DHCP is off when we log in:



### Create a Virtual Domain Controller (Core):

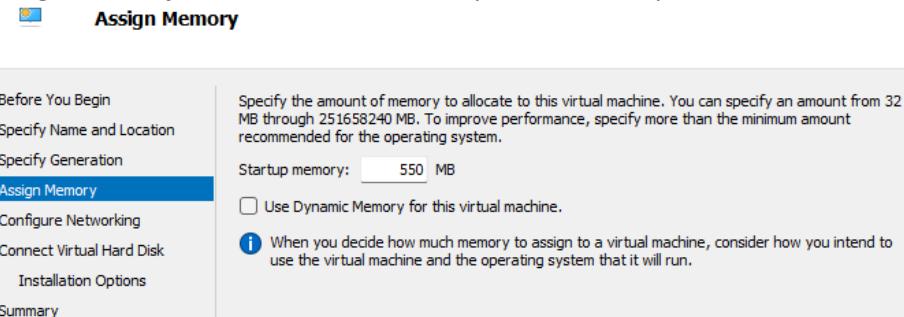
- **Open Hyper-V Manager:**
  - o Select **New > Virtual Machine**
  - o Click **Next** on the initial page of the New Virtual Machine Wizard
- **Specify Virtual Machine Name:**
  - Enter the VM name as "**063-DC1**"



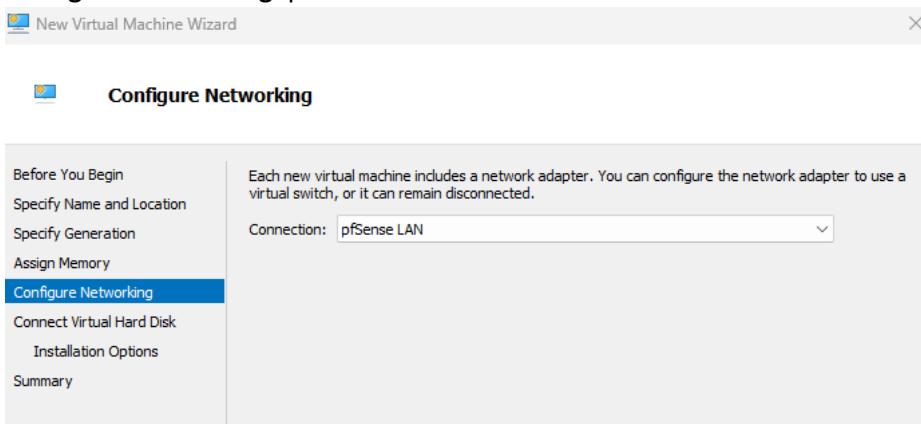
- Save Location: **V:\VMs\VHDX\** Click **Next**
- **Specify Generation: Generation 2** Click **Next**

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

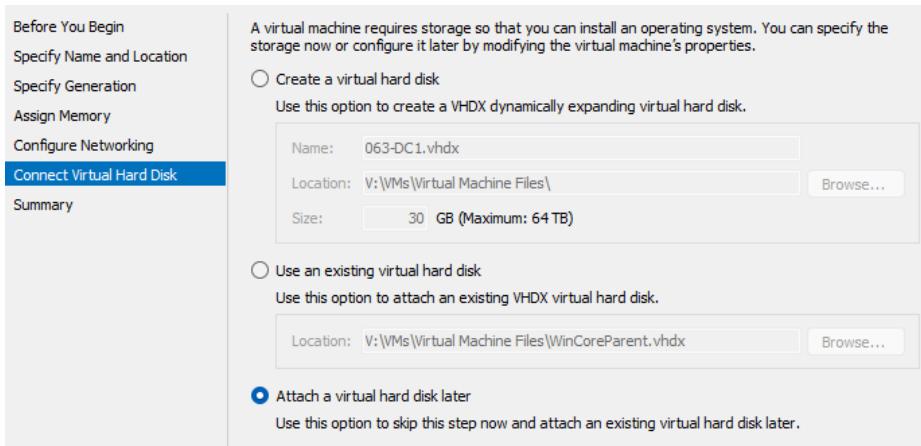
- **Assign Memory: 550MB (Uncheck Use Dynamic Memory) Click Next**



- **Configure Networking: pfSense LAN Click Next**

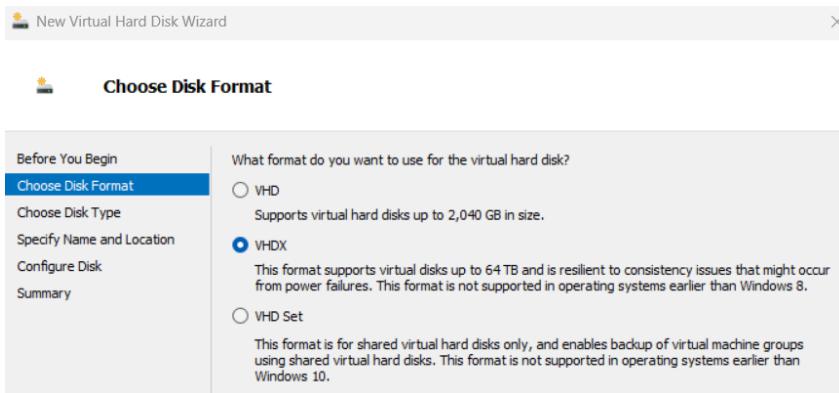


- **Connect Virtual Hard Disk: Choose Attach a virtual hard disk later**

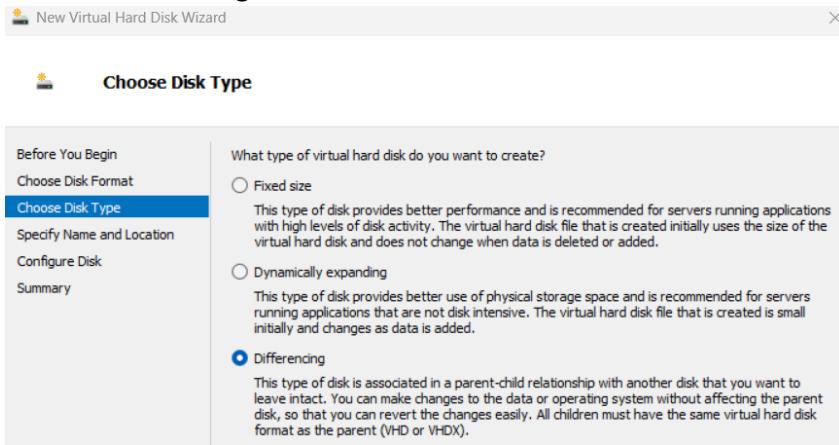


- **Completing the New Virtual Machine Wizard:**
  - o Review your settings and click **Finish** to create the VM
- **Add Differencing Disk:**
  - o Click **063-DC1 > New > Hard Disk**
- **Choose VHDX:**

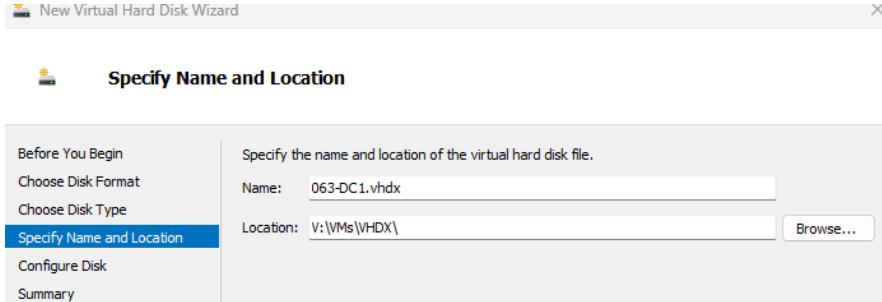
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



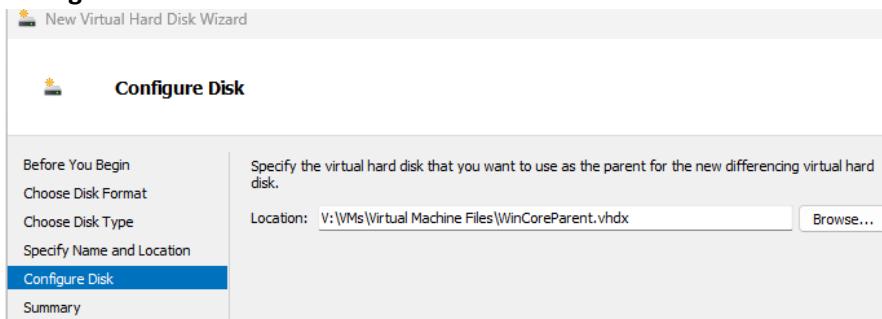
- **Choose Differencing:**



- **Specify name and Location:**



- **Configure Disk: Browse to the location of the Core Parent Disk:**

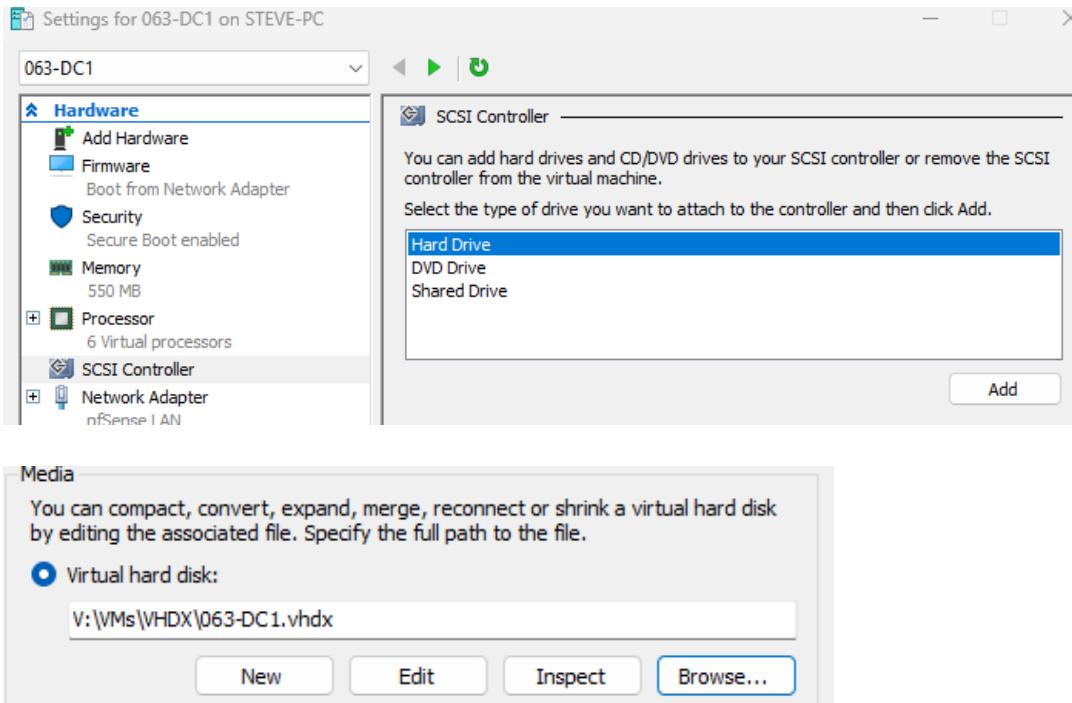


- **Click Finish**

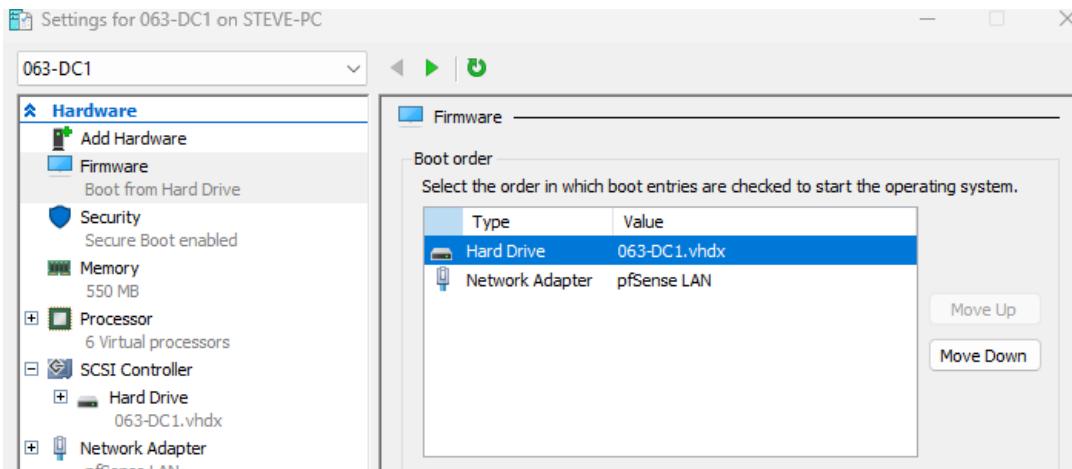
- Attach a hard drive to **063-DC1** in **Settings**: Select the differencing disk

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- **SCSI Controller > Select Add**



- **Apply**
- **Checkpoints:**
  - Disable Use automatic checkpoints
- **Integration Services:**
  - Enable Guest Services
- Ensure that under **Settings** the boot order displays the **Hard Drive** first followed by the **Network Adapter** second



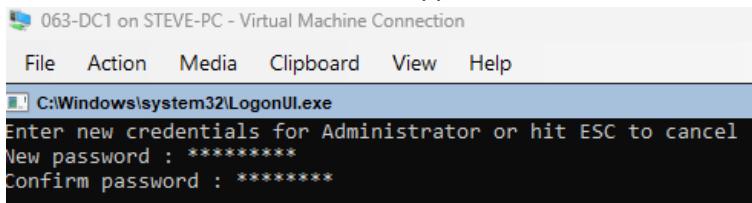
- Boot **063-DC1**: We will get the out of box experience

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

### Configure 063-DC1:

#### Change Computer Name:

- Set an Administrator Password: **Pa\$\$w0rd**



063-DC1 on STEVE-PC - Virtual Machine Connection

File Action Media Clipboard View Help

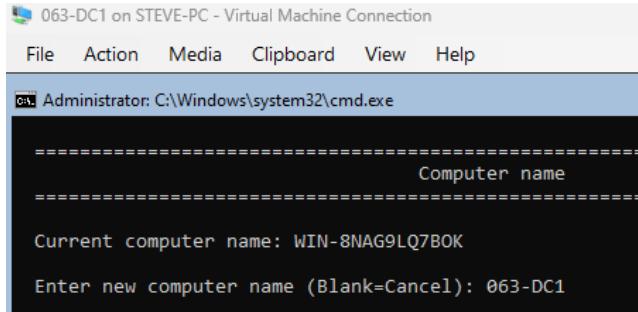
C:\Windows\system32\LogonUI.exe

Enter new credentials for Administrator or hit ESC to cancel

New password : \*\*\*\*\*

Confirm password : \*\*\*\*\*

- Arrive at the Main Menu:
- Change computer name to **063-DC1**:
  - o Select Option (2)



063-DC1 on STEVE-PC - Virtual Machine Connection

File Action Media Clipboard View Help

Administrator: C:\Windows\system32\cmd.exe

=====

Computer name

=====

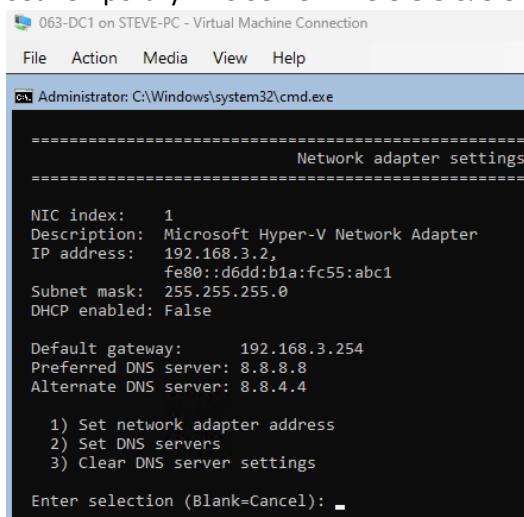
Current computer name: WIN-8NAG9LQ7BOK

Enter new computer name (Blank=Cancel): 063-DC1

- Restart the computer so the changes take effect

#### Configure Static IP Settings for 063-DC1:

- From the Console menu Select Option (8)
- Select (S) to set a Static IP Address
  - o 192.168.3.2
  - o Subnet Mask: 255.255.255.0
  - o Default Gateway: 192.168.3.254
- Set Temporary DNS Server IP: 8.8.8.8 & 8.8.4.4 (Google's DNS Resolver)



063-DC1 on STEVE-PC - Virtual Machine Connection

File Action Media View Help

Administrator: C:\Windows\system32\cmd.exe

=====

Network adapter settings

=====

NIC index: 1

Description: Microsoft Hyper-V Network Adapter

IP address: 192.168.3.2,  
fe80::d6dd:b1a:fc55:abc1

Subnet mask: 255.255.255.0

DHCP enabled: False

Default gateway: 192.168.3.254

Preferred DNS server: 8.8.8.8

Alternate DNS server: 8.8.4.4

1) Set network adapter address  
2) Set DNS servers  
3) Clear DNS server settings

Enter selection (Blank=Cancel): -

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Test Connectivity:
- From the Console menu Select Option (15) CLI (PowerShell)
  - o Ping [www.google.ca](http://www.google.ca)

```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> ping www.google.ca

Pinging www.google.ca [142.251.33.99] with 32 bytes of data:
Reply from 142.251.33.99: bytes=32 time=8ms TTL=119
Reply from 142.251.33.99: bytes=32 time=9ms TTL=119
Reply from 142.251.33.99: bytes=32 time=11ms TTL=119
Reply from 142.251.33.99: bytes=32 time=9ms TTL=119

Ping statistics for 142.251.33.99:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 8ms, Maximum = 11ms, Average = 9ms
PS C:\Users\Administrator>
```

### Install Updates:

- From the Console menu Select Option (6)
- Followed by Option (1) All Quality Updates

```
Administrator: C:\Windows\system32\cmd.exe
=====
Install updates
=====

Search for:

1) All quality updates
2) Recommended quality updates only
3) Feature updates

Select an update category (Blank=Cancel): 1
Searching for all applicable updates...
```

- Select (A) to Install all Updates

```
Available update(s):
 1) 2024-01 Security Update for Microsoft server operating system version 21H2 for x64-based Systems (KB5034439)
 2) 2024-02 Cumulative Update for .NET Framework 3.5, 4.8 and 4.8.1 for Microsoft server operating system version 21H2 for x64 (KB5034682)
 3) Security Intelligence Update for Microsoft Defender Antivirus - KB2267602 (Version 1.409.36.0) - Current Channel (Broad)

Install (A)ll updates, (N)o updates or select a (S)ingle update? (Blank=Cancel): A
Downloading update(s)...
```

- Enable server response to Ping:

- o From the Console menu Select Option (4) Remote Management
  - o Select Option (3)

```
=====
Configure remote management
=====

Remote management is enabled.
Server response to ping is disabled.

1) Enable remote management
2) Disable remote management
3) Enable server response to ping
4) Disable server response to ping

Enter selection (Blank=Cancel): 3
Enabling server response to ping...
Successfully enabled server response to ping.
(Press ENTER to continue):
```

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

### Rename the Administrator account:

- SConfig > PowerShell (15) on the Console Menu
  - o Rename-LocalUser -Name "Administrator" -NewName "\_sysadmin"
- Sign out, Sign back in with \_sysadmin

```
063-DC1 on STEVE-PC - Virtual Machine Connection
File Action Media View Help
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> Rename-LocalUser -Name "Administrator" -NewName "_sysadmin"
PS C:\Users\Administrator> net user

User accounts for \\063-DC1

-----
_sysadmin          DefaultAccount      Guest
WDAGUtilityAccount
The command completed successfully.

PS C:\Users\Administrator>
```

- Verify username change on Windows Server 2022 Core in PowerShell using the command:
  - o Get-LocalUser -Name "\_sysadmin"

```
PS C:\Users\Administrator> Get-LocalUser -Name "_sysadmin"

Name      Enabled Description
---      ---      ---
_sysadmin True    Built-in account for administering the computer/domain
```

### Renaming the Network Adapter for 063-DC1:

- Open PowerShell
- Show a list of all network adapters to determine the name or interface index of the adapter you wish you rename

- o Get-NetAdapter

```
PS C:\Users\Administrator> Get-NetAdapter

Name           InterfaceDescription           ifIndex Status      MacAddress      LinkSpeed
---           ---           ---           ---      ---           ---           ---
Ethernet       Microsoft Hyper-V Network Adapter           5 Up      00-15-5D-01-85-B6   10 Gbps
PS C:\Users\Administrator>
```

- Rename the Network Adapter:
  - o Rename-NetAdapter -Name "Ethernet" -NewName "pfSense LAN"

```
PS C:\Users\Administrator> Rename-NetAdapter -Name "Ethernet" -NewName "pfSense LAN"
PS C:\Users\Administrator>
```

- Verify the Name Change

- o Get-NetAdapter

```
PS C:\Users\Administrator> Get-NetAdapter

Name           InterfaceDescription           ifIndex Status      MacAddress      LinkSpeed
---           ---           ---           ---      ---           ---           ---
pfSense LAN     Microsoft Hyper-V Network Adapter           5 Up      00-15-5D-01-85-B6 ...s
PS C:\Users\Administrator>
```

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

### Promoting 063-DC1 to Primary Domain Controller:

- Before promoting a server to a domain controller, ensure that the **Active Directory Domain Services (AD DS)** role is installed. You can install it using PowerShell:
  - o SConfig > PowerShell (15) on the Console Menu
  - o Install Active Directory Domain Services (AD DS):

#### ▪ Install-WindowsFeature AD-Domain-Services -IncludeManagementTools

The screenshot shows a Windows PowerShell window with the following command history and output:

```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> whoami
Collecting data...
6%
[oooooooo]

Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> whoami
063-dc1\sysadmin
PS C:\Users\Administrator> Install-WindowsFeature AD-Domain-Services -IncludeManagementTools

Success Restart Needed Exit Code      Feature Result
----- ----- -----      -----
True    No        Success      {Active Directory Domain Services, Group P...}

PS C:\Users\Administrator>
```

### Create a Secondary Disk for 063-DC1 via PowerShell:

- We will create a secondary storage disk to hold all **Database files**
  - o Run script on Host using **PowerShell ISE Administrator**
- - \$VHDXname = Read-Host -Prompt 'Input VHDX name'  
- \$SizeInGB = Read-Host -Prompt 'Input the size in GB. Ex 5, 10'  
- \$VMName = Read-Host -Prompt 'Input target VM name'  
- \$VHDPath = "V:\VMs\VHDX\" + \$VHDXname + ".vhdx"  
- \$SizeBytes = (\$SizeInGB/1 \* 1073741824)  
- \$alreadyExists = Test-Path -Path \$VHDPath  
  
- if (\$alreadyExists) {  
- Write-Error "Error. The VHDX already exists"  
- return  
- }  
  
- New-VHD -Path \$VHDPath -Dynamic -SizeBytes \$SizeBytes | Mount-VHD -Passthru | Initialize-Disk -Passthru  
| New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS -Confirm:\$false -Force  
- Dismount-VHD -Path \$VHDPath  
- # Optimize-VHD -Path \$VHDPath -Mode Full  
- Add-VMHardDiskDrive -VMName \$VMName -Path \$VHDPath

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

```
PS C:\Windows\system32> C:\Users\Steve\Desktop\Secondary Disk Script.ps1
Input VHDX name: 063-DC1db
Input the size in GB. Ex 5, 10: 30
Input target VM name: 063-DC1

DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining     Size
E                               NTFS      Fixed       Healthy        OK           29.92 GB 29.98 GB

PS C:\Windows\system32>
```

### Bring Disk Online 063-DC1:

- From PowerShell:-
  - o **Get-Disk** (to see the disks)

```
PS C:\Users\Administrator> Get-Disk
Number F Serial Number          HealthStatus   OperationalStatus Total Size Partition Style
  1   N  063-DC1db             Healthy        Online          30 GB GPT
  2   M  063-DC1db             Healthy        Offline         30 GB GPT

PS C:\Users\Administrator>
```

- **Set-Disk -Number 1 -IsOffline \$False** (to bring disk 1 online)
- **Set-Disk -Number 1 -Isreadonly \$False** (to make the disk writable)

```
PS C:\Users\Administrator> Set-Disk -Number 1 -IsOffline $False
PS C:\Users\Administrator> Set-Disk -Number 1 -Isreadonly $False
PS C:\Users\Administrator>
```

- **Get-Volume** (shows detailed information about the D: drive)

```
PS C:\Users\Administrator> Get-Volume -DriveLetter D
DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining     Size
D                               NTFS      Fixed       Healthy        OK           29.91 GB 29.98 GB

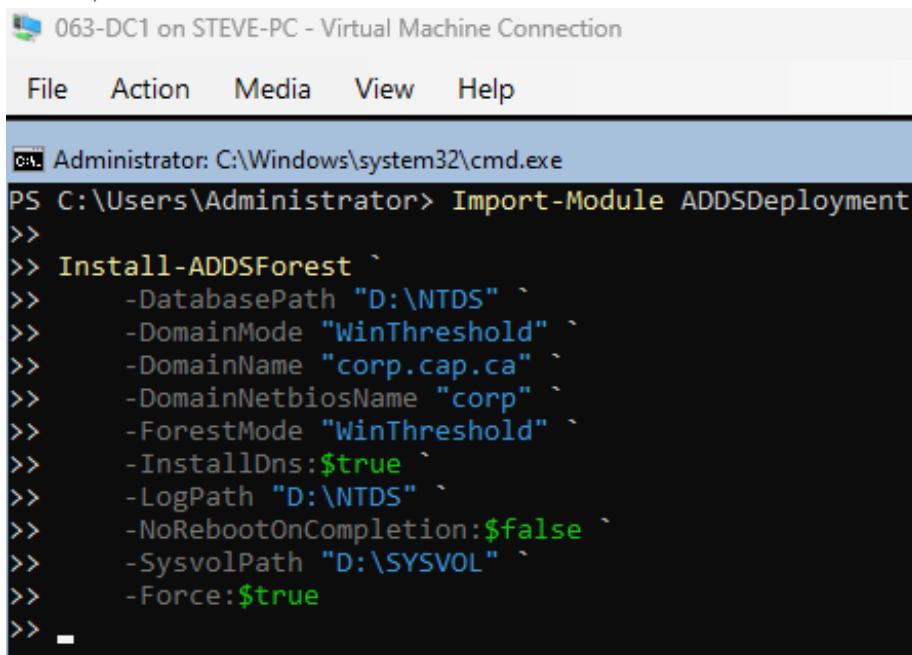
PS C:\Users\Administrator>
```

### Run PowerShell Script to Promote 063-DC1:

- This script will help install the role for Domain Controller to create a domain in an active directory forest or add additional domain controllers to the domain for load balancing and failover
  - **063-DC1** will also be able to authenticate and validate users on a network, including group policies, user credentials and computer names to determine and validate user access
  - New Forest Root is **corp.cap.ca**
  - We will run a script to store the Database files on the **D:\ Drive**:
- 
- Import-Module ADDSDeployment
  - Install-ADDSForest `
  - -DatabasePath "D:\NTDS" `

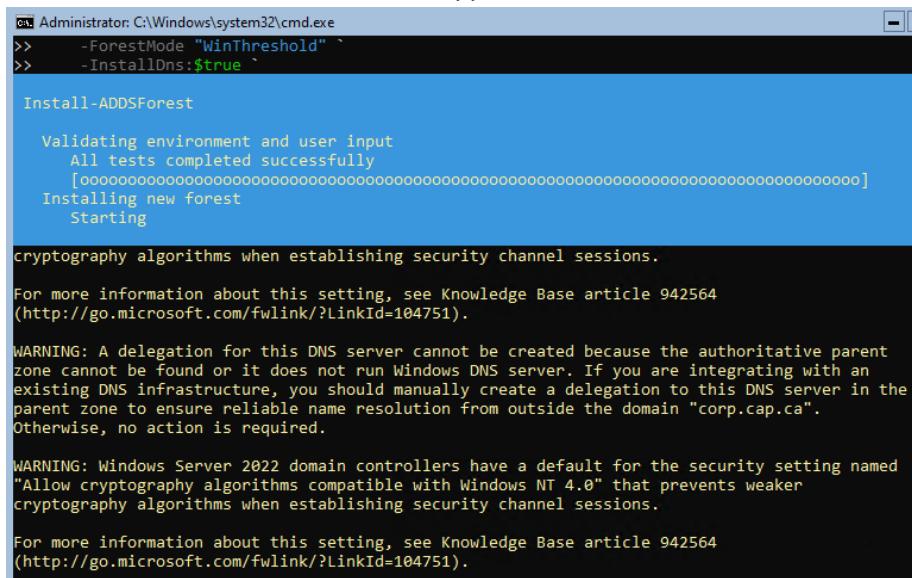
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- -DomainMode "WinThreshold"
- -DomainName "corp.cap.ca"
- -DomainNetbiosName "corp"
- -ForestMode "WinThreshold"
- -InstallDns:\$true
- -LogPath "D:\NTDS"
- -NoRebootOnCompletion:\$false
- -SysvolPath "D:\SYSVOL"
- -Force:\$true



```
Administrator: C:\Windows\system32\cmd.exe
PS C:\Users\Administrator> Import-Module ADDSDeployment
>>
>> Install-ADDSForest
>> -DatabasePath "D:\NTDS"
>> -DomainMode "WinThreshold"
>> -DomainName "corp.cap.ca"
>> -DomainNetbiosName "corp"
>> -ForestMode "WinThreshold"
>> -InstallDns:$true
>> -LogPath "D:\NTDS"
>> -NoRebootOnCompletion:$false
>> -SysvolPath "D:\SYSVOL"
>> -Force:$true
>>
```

- SafeModeAdministratorPassword: Pa\$\$w0rd



```
Administrator: C:\Windows\system32\cmd.exe
>> -ForestMode "WinThreshold"
>> -InstallDns:$true

Install-ADDSForest

Validating environment and user input
All tests completed successfully
[oooooooooooooooooooooooooooooooooooooooooooooooooooooooooooo]
Installing new forest
Starting

cryptography algorithms when establishing security channel sessions.

For more information about this setting, see Knowledge Base article 942564
(http://go.microsoft.com/fwlink/?LinkId=104751).

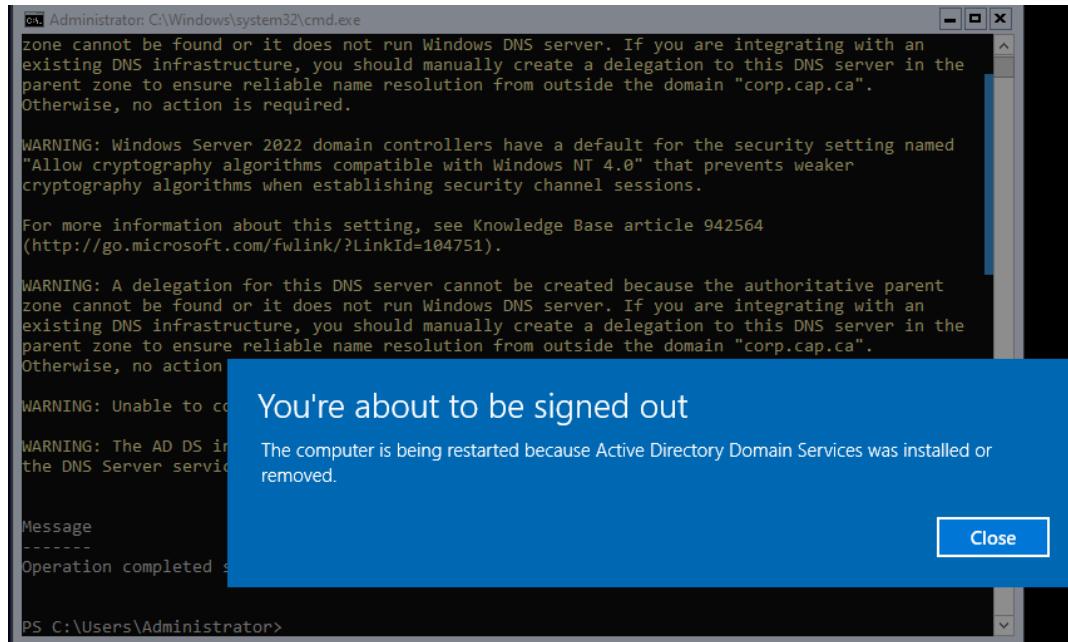
WARNING: A delegation for this DNS server cannot be created because the authoritative parent
zone cannot be found or it does not run Windows DNS server. If you are integrating with an
existing DNS infrastructure, you should manually create a delegation to this DNS server in the
parent zone to ensure reliable name resolution from outside the domain "corp.cap.ca".
Otherwise, no action is required.

WARNING: Windows Server 2022 domain controllers have a default for the security setting named
"Allow cryptography algorithms compatible with Windows NT 4.0" that prevents weaker
cryptography algorithms when establishing security channel sessions.

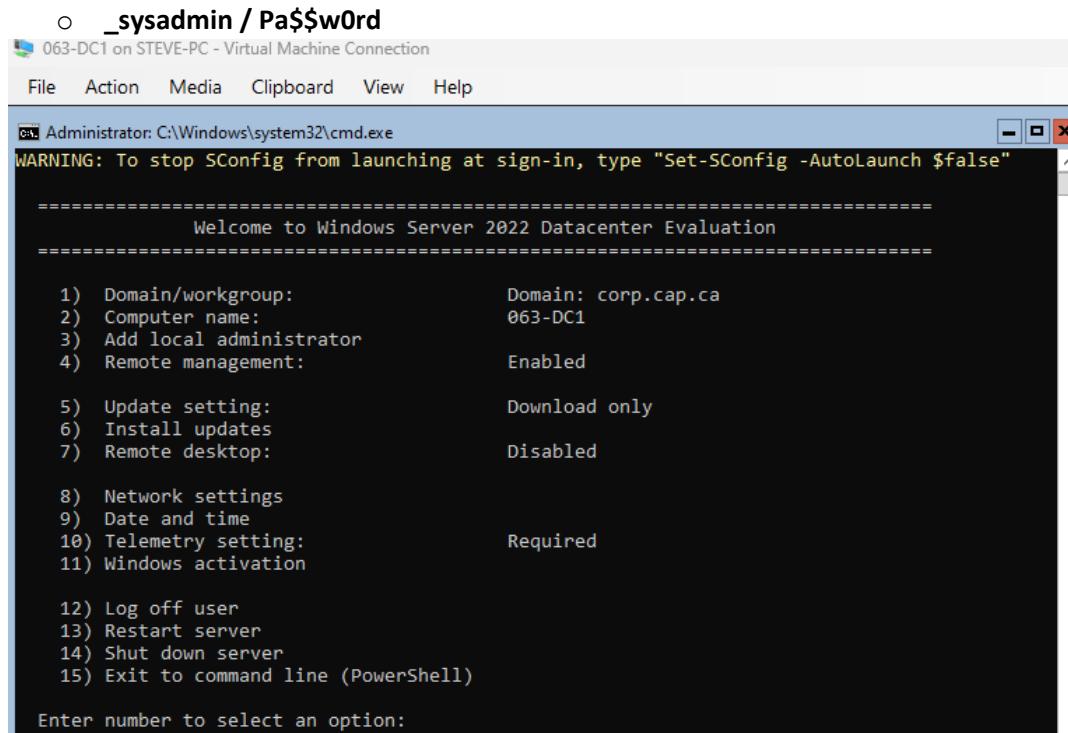
For more information about this setting, see Knowledge Base article 942564
(http://go.microsoft.com/fwlink/?LinkId=104751).
```

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- By creating a secondary disk beforehand we can run the script, use **Get-Volume** to determine our drive letter and adjust the script to write to that location in one instance
- Finish Install. **063-DC1** will automatically restart



- Sign in with credentials:



# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

## Install DNS Server Role:

- Install the DNS Server Role on **063-DC1**
  - o **Install-WindowsFeature DNS -IncludeManagementTools**

```
c:\ Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> Install-WindowsFeature DNS -IncludeManagementTools
Collecting data...
6%
[oooooooo]
```

## Configure DNS Server:

- Open PowerShell Administrator Mode:
  - o Create the DNS Zone for your Domain:
    - **Add-DnsServerPrimaryZone -Name "corp.cap.ca" -ReplicationScope "Forest" -DynamicUpdate "Secure"**

```
c:\ Administrator: C:\Windows\system32\cmd.exe
PS C:\Users\Administrator> Add-DnsServerPrimaryZone -Name "corp.cap.ca" -ReplicationScope "Forest" -DynamicUpdate "Secure"
PS C:\Users\Administrator>
```

- o Verify the zone:
  - **Get-DnsServerZone -Name "corp.cap.ca"**

```
PS C:\Users\Administrator> Get-DnsServerZone -Name "corp.cap.ca"
ZoneName          ZoneType      IsAutoCreated  IsDsIntegrated  IsReverseLookupZone  IsSigned
-----          Primary        False           True            False             False
corp.cap.ca

PS C:\Users\Administrator>
```

- o Check if the DNS Server is functioning correctly:
  - **Resolve-DnsName -Name "google.com"**

```
PS C:\Users\Administrator> Resolve-DnsName -Name "google.com"
Name          Type    TTL   Section  IPAddress
----          ----   --   -----  -----
google.com    AAAA   296  Answer   2607:f8b0:400a:807::200e
google.com    A      269  Answer   142.251.33.110

PS C:\Users\Administrator>
```

## Set the DNS Server's Forwarder:

- **Set-DnsServerForwarder -IPAddress 8.8.8.8**
- We will assign 8.8.8.8 for our DNS Server Forwarder:
  - We will use Google's Public DNS

```
PS C:\Users\Administrator> Set-DnsServerForwarder -IPAddress 8.8.8.8
PS C:\Users\Administrator>
```

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

Remove the Temporary DNS Configuration:

- In SConfig for **063-DC1**:
  - o Use **Option (8) Network settings** to remove the temporary DNS setting of **8.8.8.8** and replace it with the new prefered DNS **IP: 192.168.3.2**

```
=====
          Network adapter settings
=====

NIC index:    1
Description:  Microsoft Hyper-V Network Adapter
IP address:   192.168.3.2,
              fe80::d6dd:b1a:fc55:abc1
Subnet mask:  255.255.255.0
DHCP enabled: False

Default gateway:     192.168.3.254
Preferred DNS server: 192.168.3.2
Alternate DNS server:

  1) Set network adapter address
  2) Set DNS servers
  3) Clear DNS server settings

Enter selection (Blank=Cancel): -
```

Prepare the Windows Server Core for Remote Management:

Enable Remote Management and Remote Desktop:

- o On the Server Console select Option (15) to access PowerShell
- o Enter commands:
  - Configure-SMRemoting.exe -enable
  - Set-ItemProperty -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server' -name "fDenyTSConnections" -value 0
  - Enable-NetFirewallRule -DisplayGroup "Remote Desktop"

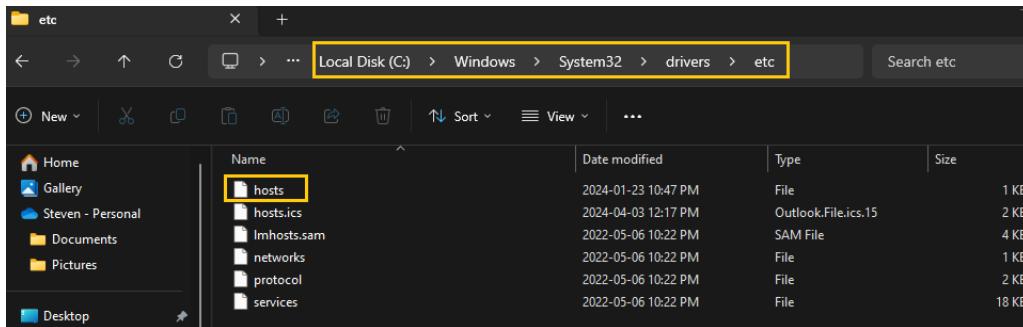
```
063-DC1 on STEVE-PC - Virtual Machine Connection
File Action Media View Help

Select Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> Configure-SMRemoting.exe -enable
>> Set-ItemProperty -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server' -name "fDenyTSConnections" -value 0
>> Enable-NetFirewallRule -DisplayGroup "Remote Desktop"
>>
Server Manager Remoting is already enabled
PS C:\Users\Administrator>
```

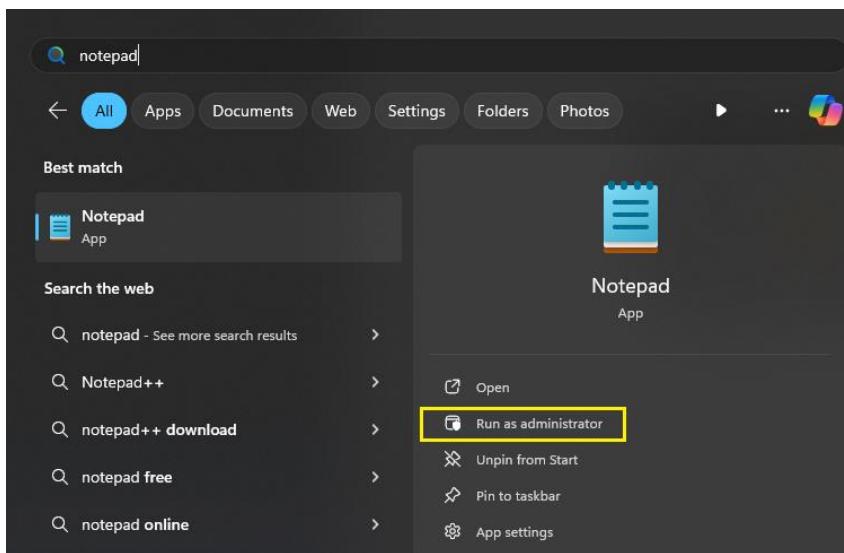
Modify Hosts and Trusted Hosts for Name Resolution and Trust:

- o Locate the Hosts File:
- o **C:\Windows\System32\drivers\etc\hosts**

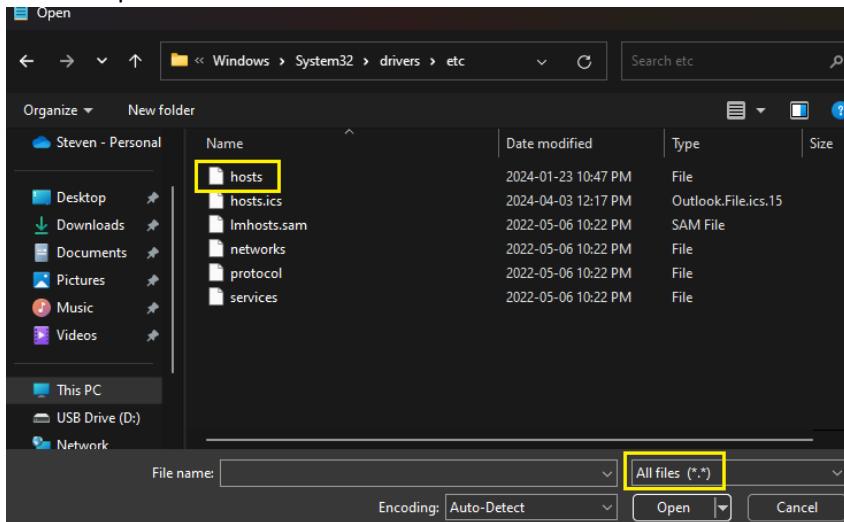
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- Open the Hosts File with Administrator Privileges:
  - o Press the Windows key, type **Notepad**, then right-click on Notepad and select Run as administrator



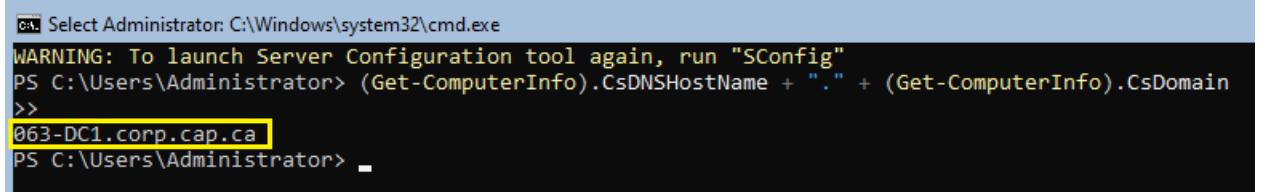
- o In Notepad, go to File > Open, navigate to **C:\Windows\System32\drivers\etc**, and select **All Files** in the bottom-right corner to make the hosts file visible. Click on hosts to open it



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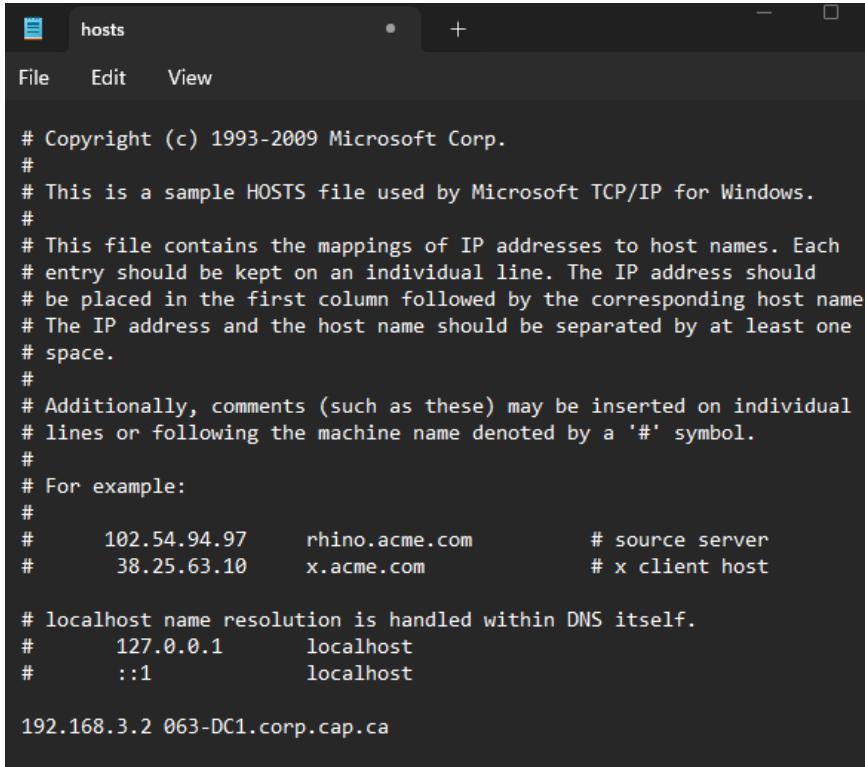
### Edit the Hosts File:

- The format for each entry is the IP address of the server followed by the fully qualified domain name (FQDN) and optionally the hostname
- To discover what the (FQDN) run this command in PowerShell on **063-DC1**:
  - o `(Get-ComputerInfo).CsDNSHostName + "." + (Get-ComputerInfo).CsDomain`



```
PS C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> (Get-ComputerInfo).CsDNSHostName + "." + (Get-ComputerInfo).CsDomain
>>
063-DC1.corp.cap.ca
PS C:\Users\Administrator>
```

- **192.168.3.2** is the IP address of the DC
- **063-DC1.corp.cap.ca** is the FQDN



```
hosts

File Edit View

# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97    rhino.acme.com        # source server
#      38.25.63.10      x.acme.com            # x client host

# localhost name resolution is handled within DNS itself.
#      127.0.0.1        localhost
#      ::1              localhost

192.168.3.2 063-DC1.corp.cap.ca
```

- Save the changes:
  - o Click File > Save in Notepad
- Verify the Changes:
  - o Ping **063-DC1** from the Windows 11 Machine

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```
PS C:\Users\Steve> ping 063-DC1

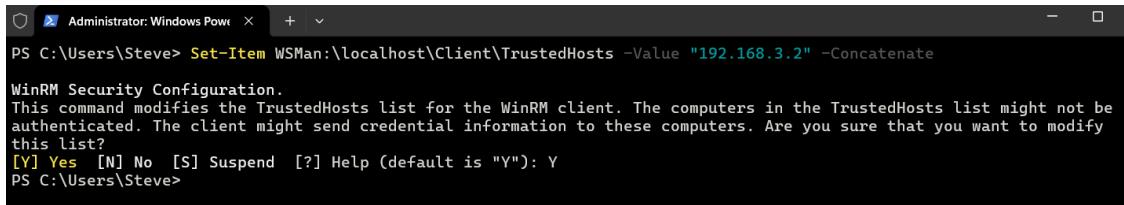
Pinging 063-DC1.local [fe80::d6dd:b1a:fc55:abc1%81] with 32 bytes of data:
Reply from fe80::d6dd:b1a:fc55:abc1%81: time<1ms
Reply from fe80::d6dd:b1a:fc55:abc1%81: time<1ms
Reply from fe80::d6dd:b1a:fc55:abc1%81: time=1ms
Reply from fe80::d6dd:b1a:fc55:abc1%81: time<1ms

Ping statistics for fe80::d6dd:b1a:fc55:abc1%81:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

- If the ping command returns replies from **192.168.3.2** it means the hosts file is correctly resolving the hostnames to IP addresses

### Configure Trusted Hosts:

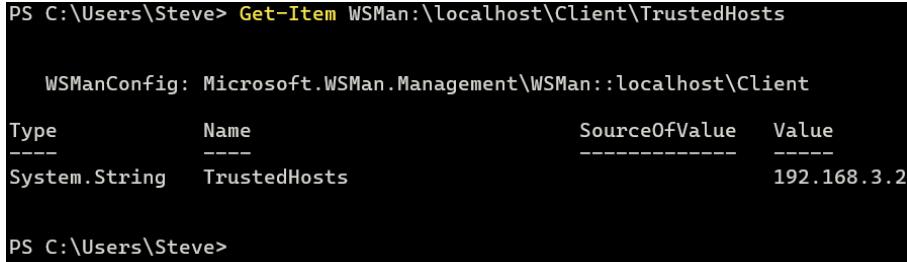
- On the Windows 11 laptop, add the server to the list of trusted hosts for PowerShell remoting:
  - o **Set-Item WSMAN:\localhost\Client\TrustedHosts -Value "192.168.3.2" -Concatenate**
- Choose Yes to accept modifying the TrustedHosts file for the WinRM Client



```
PS C:\Users\Steve> Set-Item WSMAN:\localhost\Client\TrustedHosts -Value "192.168.3.2" -Concatenate

WinRM Security Configuration.
This command modifies the TrustedHosts list for the WinRM client. The computers in the TrustedHosts list might not be authenticated. The client might send credential information to these computers. Are you sure that you want to modify this list?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y
PS C:\Users\Steve>
```

- Verify the list of Trusted Hosts:
  - o **Get-Item WSMAN:\localhost\Client\TrustedHosts**



```
PS C:\Users\Steve> Get-Item WSMAN:\localhost\Client\TrustedHosts

WSManConfig: Microsoft.WSMAN.Management\WSMAN::localhost\Client

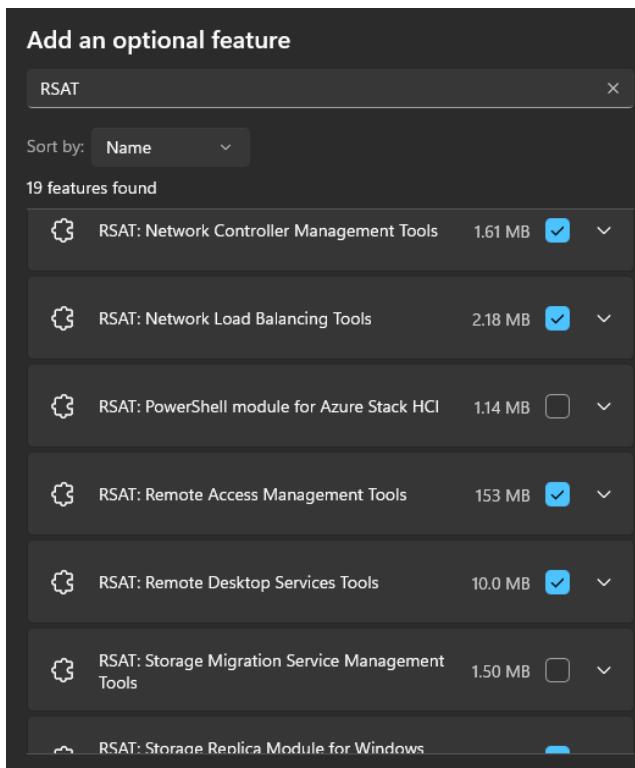
Type          Name           SourceOfValue   Value
----          --           -----          --
System.String TrustedHosts               192.168.3.2

PS C:\Users\Steve>
```

### Install Remote Server Administration Tools (RSAT) on Windows 11:

- Add RSAT Features:
  - o Go to **Settings > System > Optional Features > Add a feature**
  - o Search for RSAT features you need including DHCP Server Tools, DNS Server Tools, and Remote Access Management Tools etc.

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- Click Next > Install

### Join Windows 11 (Lenovo) Machine to the Domain:

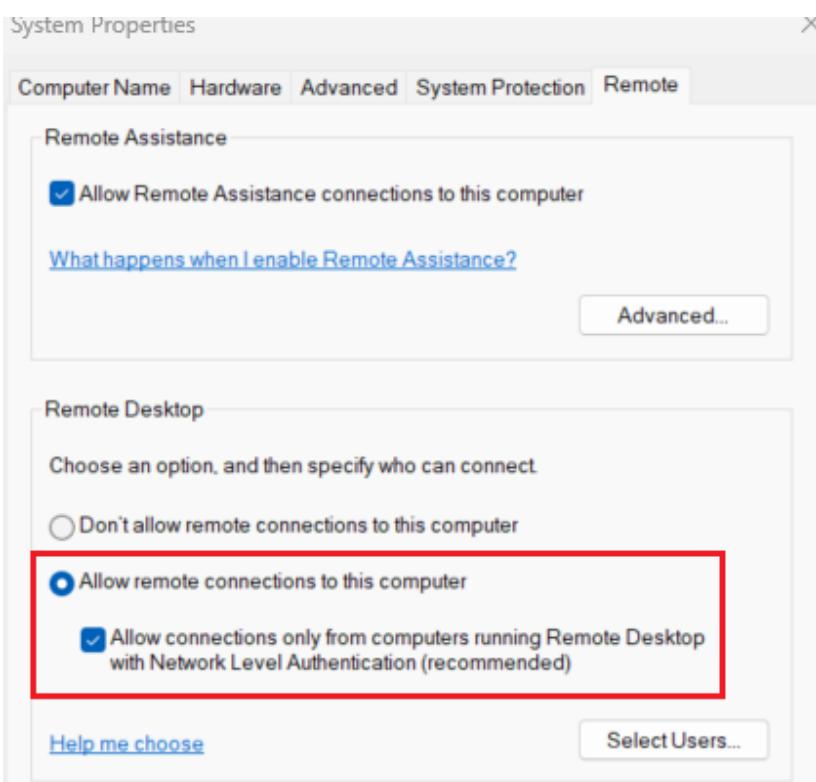
- Allow remote connections to this computer:
  - Open **Settings > System > About > Domain or workgroup > Remote tab**

The screenshot shows the 'Device specifications' page in Windows Settings. At the top, there is an 'i' icon, the title 'Device specifications', a 'Copy' button, and a collapse arrow. Below the title is a table of device information:

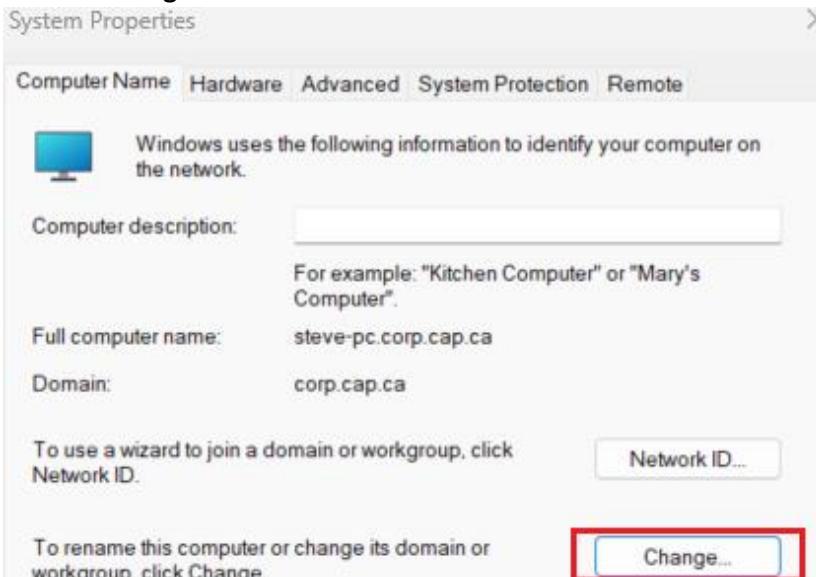
Device name	steve-pc
Full device name	steve-pc.corp.cap.ca
Processor	12th Gen Intel(R) Core(TM) i7-1255U 1.70 GHz
Installed RAM	16.0 GB (15.7 GB usable)
Device ID	B7335598-EAAA-48CE-BF46-FB4E518C88C5
Product ID	00330-80000-00000-AA859
System type	64-bit operating system, x64-based processor
Pen and touch	No pen or touch input is available for this display

At the bottom, there are 'Related links' with options: **Domain or workgroup** (which is highlighted with a yellow box), System protection, and Advanced system settings.

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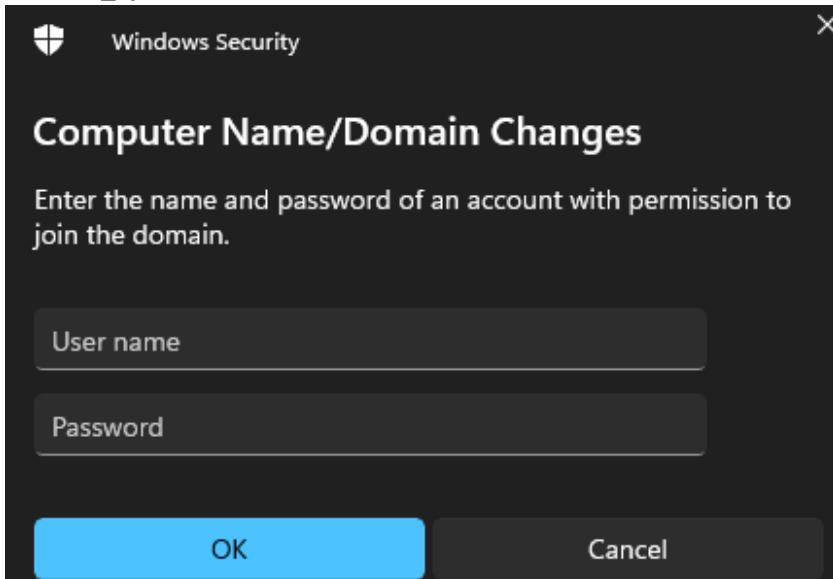
- Click on the **Computer Name** tab
- Click on **Change...**



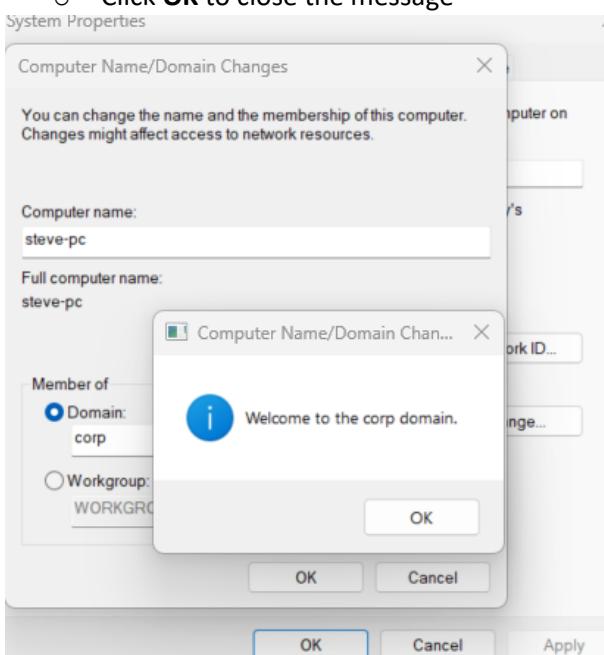
- Join the Domain
  - o In the "Computer Name/Domain Changes" window, select Domain under "Member of"
  - o Enter the domain name: **corp.cap.ca**
  - o Click **OK**

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- Enter the name and password of an account with permission to join the domain
  - o `_sysadmin / Pa$$w0rd`



- Welcome to the Domain
  - o You should see a welcome message indicating that you have successfully joined the domain
  - o Click **OK** to close the message



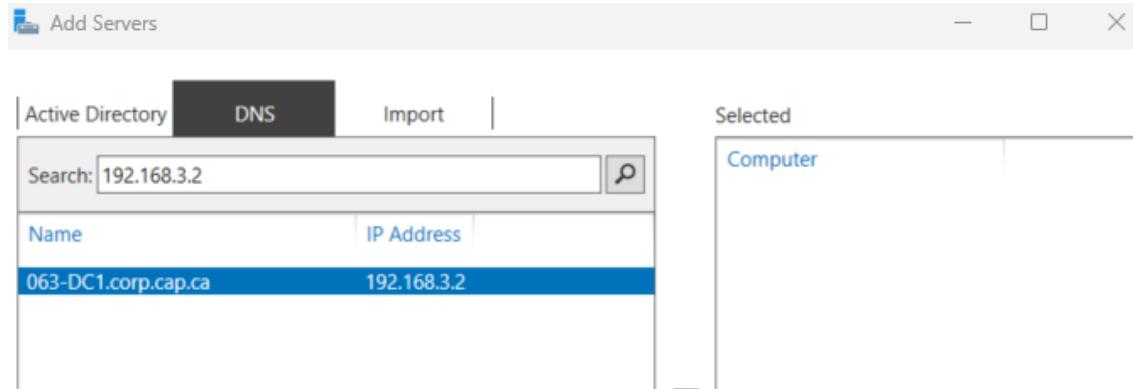
- Restart the Computer

Add 063-DC1 in Server Manager:

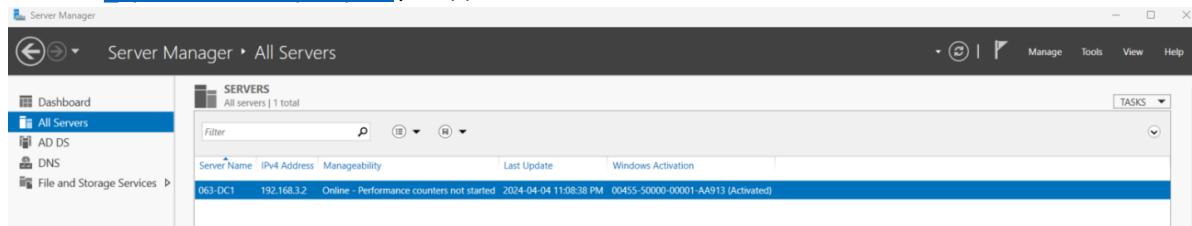
- Open Server Manager

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- Right click on **All Servers > Add Server**
- Look up by DNS

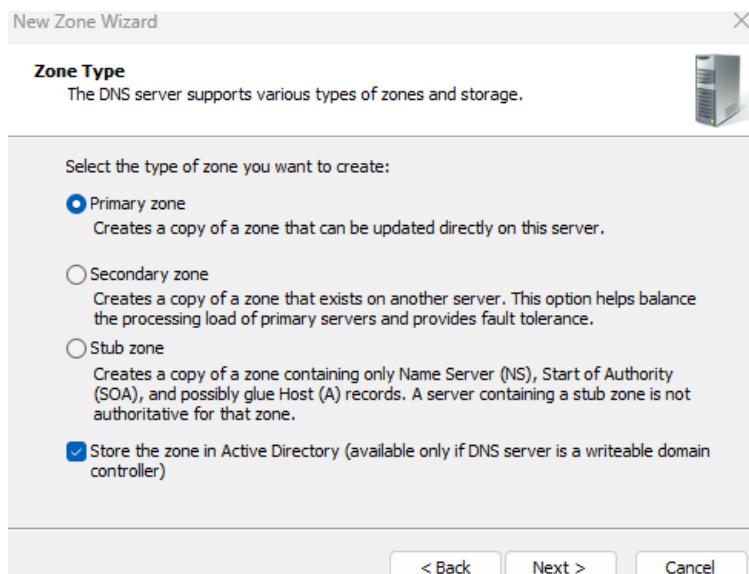


- o Add the Server > Right click > Manage as
- o Enter User Credentials
- o sysadmin@corp.cap.ca / Pa\$\$w0rd



### Create a DNS Reverse Lookup Zone:

- Open **DNS Manager**
- Right click on *Reverse Lookup Zones*:
  - o Click **New Zone**
    - Create **Primary Zone**:



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- Choose to replicate to all DNS server running on domain controllers

New Zone Wizard



### Active Directory Zone Replication Scope

You can select how you want DNS data replicated throughout your network.



Select how you want zone data replicated:

- To all DNS servers running on domain controllers in this forest: corp.proj.ca
- To all DNS servers running on domain controllers in this domain: corp.proj.ca
- To all domain controllers in this domain (for Windows 2000 compatibility): corp.proj.ca
- To all domain controllers specified in the scope of this directory partition:



- IPv4 Reverse Lookup Zone

New Zone Wizard



### Reverse Lookup Zone Name

A reverse lookup zone translates IP addresses into DNS names.



Choose whether you want to create a reverse lookup zone for IPv4 addresses or IPv6 addresses.

- IPv4 Reverse Lookup Zone
- IPv6 Reverse Lookup Zone

- Network ID: 192.168.3

New Zone Wizard



### Reverse Lookup Zone Name

A reverse lookup zone translates IP addresses into DNS names.



To identify the reverse lookup zone, type the network ID or the name of the zone.

- Network ID:

192 .168 .3 .

The network ID is the portion of the IP addresses that belongs to this zone. Enter the network ID in its normal (not reversed) order.

If you use a zero in the network ID, it will appear in the zone name. For example, network ID 10 would create zone 10.in-addr.arpa, and network ID 10.0 would create zone 0.10.in-addr.arpa.

- Reverse lookup zone name:

3.168.192.in-addr.arpa

- Choose the Dynamic update option

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**Dynamic Update**  
You can specify that this DNS zone accepts secure, nonsecure, or no dynamic updates.

Dynamic updates enable DNS client computers to register and dynamically update their resource records with a DNS server whenever changes occur.

Select the type of dynamic updates you want to allow:

Allow only secure dynamic updates (recommended for Active Directory)  
This option is available only for Active Directory-integrated zones.

Allow both nonsecure and secure dynamic updates  
Dynamic updates of resource records are accepted from any client.  
 This option is a significant security vulnerability because updates can be accepted from untrusted sources.

Do not allow dynamic updates  
Dynamic updates of resource records are not accepted by this zone. You must update these records manually.

- Complete the Wizard

Configure OU structure in ADUC:

- Right-click **corp.cap.ca**
- Select **New > Organizational Unit**
- Create Sub-OUs under the Main OU
  - Clients
  - Servers
    - DHCP
    - FILE
    - HYPERV
  - Domain Users
    - FIN
      - Finance Management
    - IT
      - IT Managers
      - IT Service Desk
  - Security Groups

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The screenshot shows the Active Directory Users and Computers (ADUC) interface. The left pane displays a tree view of the directory structure under 'corp.cap.ca'. A green box highlights the 'Domain Controllers' and 'HYPERV' folder under 'Servers'. The right pane shows a table with three entries:

Name	Type	Description
063-HV1	Computer	
063-HV2	Computer	
HyperVCluster	Computer	Failover cluster virtual network name account

### Linux DHCP Server:

- In Hyper-V Manager select New > Virtual Machine
- Name it 063-LinDHCP

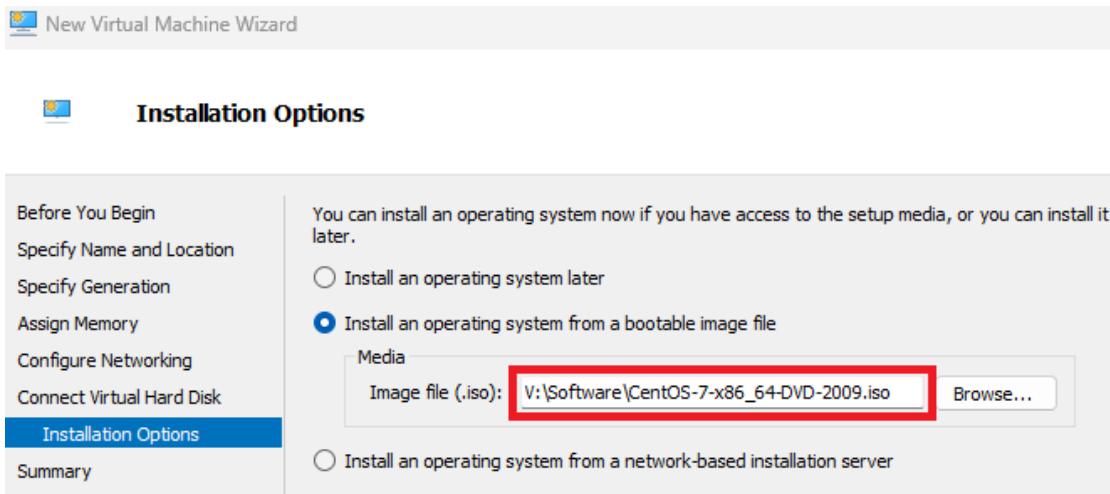
The screenshot shows the 'Specify Name and Location' step of the Hyper-V Manager wizard. The left sidebar lists steps: Before You Begin, Specify Name and Location (selected), Specify Generation, Assign Memory, Configure Networking, Connect Virtual Hard Disk, Installation Options, and Summary. The main area shows the following details:

- 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:
- 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:

A warning message at the bottom states: **!** 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.

- Generation 2
- 700MB of RAM
- Connect it to the pfSense LAN vSwitch
- 30GB Hard Disk

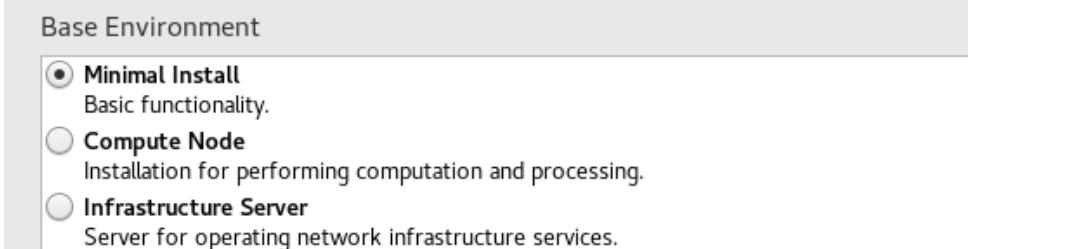
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- From Hyper-V:
- Right click on **063-LinDHCP > Settings**
  - Disable automatic checkpoints
  - Enable Guest Services
  - Disable Secure Boot
  - Boot from the DVD Drive
- Begin installation:

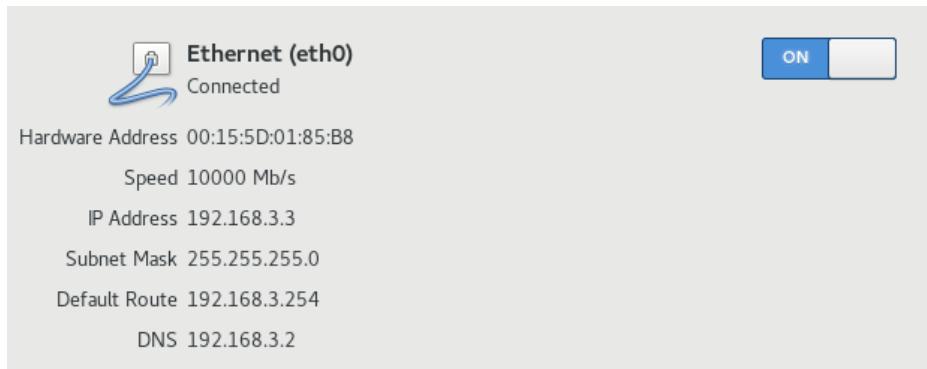


- In Software Selection:
  - Choose Minimal Installation



- Installation Destination:
  - Select the 30GB Msft Virtual Disk
- Network Configuration will show static IP settings:
  - IP: **192.168.3.3**
  - Netmask: **24**
  - DG: **192.168.3.254**
  - DNS: **192.168.3.2**

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- Set Root Password:
  - o Pa\$\$w0rd
- User Creation:
  - o \_sysadmin

USER SETTINGS

**ROOT PASSWORD**  
Root password is set

**USER CREATION**  
Administrator \_sysadmin will be created

Full name	_sysadmin
User name	_sysadmin
Tip: Keep your user name shorter than 32 characters and do not use spaces.	
<input checked="" type="checkbox"/> Make this user administrator	
<input checked="" type="checkbox"/> Require a password to use this account	
Password	***** <div style="background-color: #ccc; width: 100%; height: 10px; margin-top: 5px;"></div> Weak

- Log into CentOS

```
lindhcp login: _sysadmin
Password:
Last login: Mon Jan 22 01:58:55 on tty1
[_sysadmin@lindhcp ~]# su -
Password:
Last login: Mon Jan 22 02:01:28 EST 2024 on tty1
[root@lindhcp ~]#
```

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### Configure CentOS:

- First, update the system to ensure all existing packages are up to date
- **sudo yum update:**

```
Total
Retrieving key from file:///etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-7
Importing GPG key 0xF4A80E85:
  Userid : "CentOS-7 Key (CentOS 7 Official Signing Key) <security@centos.org>"
  Fingerprint: 6341 ab27 53d7 8a78 a7c2 7bb1 24c6 a8a7 f4a8 0eb5
  Package : centos-release-7-9.2009.0.el7.centos.x86_64 (@anaconda)
  From   : /etc/pki/rpm-gpg/RPM-GPG-KEY-CentOS-7
Is this ok [y/N]: y
```

- **yum install net-tools:**

Package	Arch	Version	Repository	Size
Installing: net-tools	x86_64	2.8-0.25.2013004git.el7	base	306 k

```
Transaction Summary
=====
Install 1 Package

Total download size: 306 k
Installed size: 917 k
Is this ok [y/N]:
```

- **hostnamectl set-hostname "LinDHCP"**

```
[root@localhost ~]# hostnamectl set-hostname "063-LinDHCP"
[root@localhost ~]#
```

- **Reboot**

```
[root@localhost ~]# hostname
063-lindhcp
[root@localhost ~]# sudo systemctl restart network
[root@localhost ~]# sudo reboot
```

- **Log back in**

- **\_sysadmin / Pa\$SwoRd**

```
CentOS Linux 7 (Core)
Kernel 3.10.0-1160.114.2.el7.x86_64 on an x86_64

063-lindhcp login: _sysadmin
Password:
```

- **Return to Root: Type:**

- **su -**

- **Display name should show root@063-LinDHCP**

- **Install Hyper-V Tools:**

- This will help with mouse integration:

- **CentOS 7** usually comes with Hyper-V tools available in the default repositories
    - **sudo yum install hyperv-daemons**

- **Verify Installation:**

- **systemctl status hypervkvpd**

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```
[root@0063-lindhcp ~]# systemctl status hypervvpd
● hypervvpd.service - Hyper-V KVP daemon
  Loaded: loaded (/usr/lib/systemd/system/hypervvpd.service; static; vendor preset: enabled)
  Active: active (running) since Fri 2024-04-05 12:43:42 EDT; 4min 37s ago
    Main PID: 1050 (hypervvpd)
   CGroup: /system.slice/hypervvpd.service
           └─1050 /usr/sbin/hypervvpd -n

Apr 05 12:43:42 063-lindhcp systemd[1]: Started Hyper-V KVP daemon.
Apr 05 12:43:42 063-lindhcp KVP[1050]: KVP starting: pid is:1050
Apr 05 12:43:42 063-lindhcp KVP[1050]: KVP LIC Version: 3.1
[root@0063-lindhcp ~]# _

- systemctl status hypervssd
[root@0063-lindhcp ~]# systemctl status hypervssd
● hypervssd.service - Hyper-V USS daemon
  Loaded: loaded (/usr/lib/systemd/system/hypervssd.service; static; vendor preset: enabled)
  Active: active (running) since Fri 2024-04-05 12:43:41 EDT; 6min ago
    Main PID: 722 (hypervssd)
   CGroup: /system.slice/hypervssd.service
           └─722 /usr/sbin/hypervssd -n

Apr 05 12:43:41 063-lindhcp systemd[1]: Started Hyper-V USS daemon.
Apr 05 12:43:41 063-lindhcp hypervssd[722]: Hyper-V USS: USS starting: pid is:722
Apr 05 12:43:41 063-lindhcp hypervssd[722]: Hyper-V USS: USS: kernel module version: 129
[root@0063-lindhcp ~]# _

- systemctl status hypervfcopyd
[root@0063-lindhcp ~]# systemctl status hypervfcopyd
● hypervfcopyd.service - Hyper-V FCOPY daemon
  Loaded: loaded (/usr/lib/systemd/system/hypervfcopyd.service; static; vendor preset: enabled)
  Active: active (running) since Fri 2024-04-05 12:43:41 EDT; 6min ago
    Main PID: 706 (hypervfcopyd)
   CGroup: /system.slice/hypervfcopyd.service
           └─706 /usr/sbin/hypervfcopyd -n

Apr 05 12:43:41 063-lindhcp systemd[1]: Started Hyper-V FCOPY daemon.
Apr 05 12:43:41 063-lindhcp HU_FCOPY[706]: starting; pid is:706
Apr 05 12:43:41 063-lindhcp HU_FCOPY[706]: kernel module version: 1
```

### Test Connectivity:

- Ping:
  - **Google**
  - **063-DC1 (192.168.3.2)**
  - **Default Gateway (192.168.3.254)**

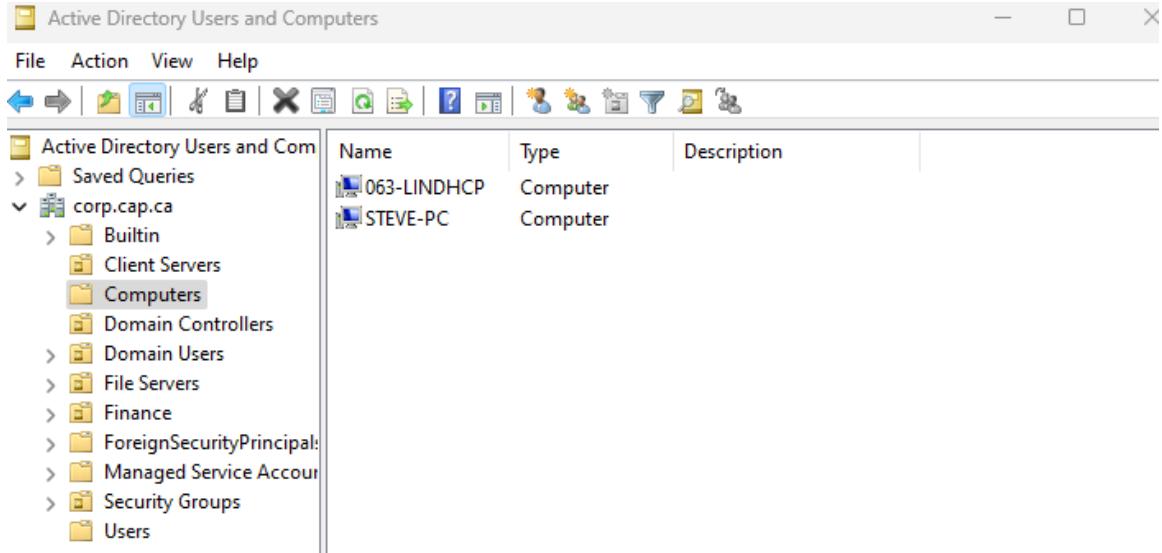
```
[root@0063-lindhcp ~]# ping www.google.ca
PING www.google.ca (172.217.14.195) 56(84) bytes of data.
64 bytes from sea30s01-in-f3.1e100.net (172.217.14.195): icmp_seq=1 ttl=119 time=11.8 ms
64 bytes from sea30s01-in-f3.1e100.net (172.217.14.195): icmp_seq=2 ttl=119 time=10.6 ms
64 bytes from sea30s01-in-f3.1e100.net (172.217.14.195): icmp_seq=3 ttl=119 time=11.6 ms
64 bytes from sea30s01-in-f3.1e100.net (172.217.14.195): icmp_seq=4 ttl=119 time=9.11 ms
64 bytes from sea30s01-in-f3.1e100.net (172.217.14.195): icmp_seq=5 ttl=119 time=109 ms
64 bytes from sea30s01-in-f3.1e100.net (172.217.14.195): icmp_seq=6 ttl=119 time=9.47 ms
^C
--- www.google.ca ping statistics ---
6 packets transmitted, 6 received, 0% packet loss, time 5007ms
rtt min/avg/max/mdev = 9.112/27.018/109.339/36.828 ms
[root@0063-lindhcp ~]# ping 192.168.3.2
PING 192.168.3.2 (192.168.3.2) 56(84) bytes of data.
64 bytes from 192.168.3.2: icmp_seq=1 ttl=128 time=0.358 ms
64 bytes from 192.168.3.2: icmp_seq=2 ttl=128 time=0.543 ms
64 bytes from 192.168.3.2: icmp_seq=3 ttl=128 time=2.04 ms
64 bytes from 192.168.3.2: icmp_seq=4 ttl=128 time=1.06 ms
64 bytes from 192.168.3.2: icmp_seq=5 ttl=128 time=0.981 ms
^C
--- 192.168.3.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4005ms
rtt min/avg/max/mdev = 0.358/0.998/2.043/0.585 ms
[root@0063-lindhcp ~]# ping 192.168.3.254
PING 192.168.3.254 (192.168.3.254) 56(84) bytes of data.
64 bytes from 192.168.3.254: icmp_seq=1 ttl=64 time=0.498 ms
64 bytes from 192.168.3.254: icmp_seq=2 ttl=64 time=0.888 ms
64 bytes from 192.168.3.254: icmp_seq=3 ttl=64 time=1.26 ms
64 bytes from 192.168.3.254: icmp_seq=4 ttl=64 time=1.01 ms
^C
--- 192.168.3.254 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 0.498/0.914/1.268/0.282 ms
[root@0063-lindhcp ~]#
```

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## Install Realmd:

- **realmd:** It's typically used to integrate Linux systems with AD for user authentication
- The command is used to install a set of tools and services on a Linux system that are commonly used for integrating the system with a Windows-based Active Directory domain for user authentication and management
- **To install DNF on RHEL/CentOS 7 systems, you need to set up and enable epel YUM REPO before installing DNF**
- **# yum install epel-release -y**
- **# yum install dnf -y**
- **# dnf install realmd sssd oddjob oddjob-mkhomedir adcli samba-common-tools krb5-workstation**
- **Finish downloading then,**
- **realm join --user=\_sysadmin corp.cap.ca**  

```
[root@0063-lindhcp ~]# realm join --user=_sysadmin corp.cap.ca
Password for _sysadmin:
[root@0063-lindhcp ~]#
```



- **Run Command:**
- **# realm list**

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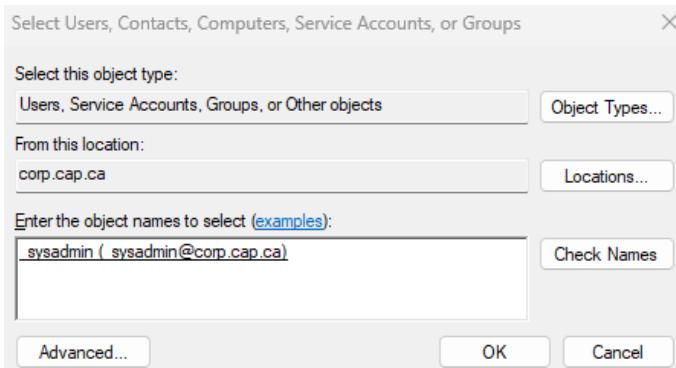
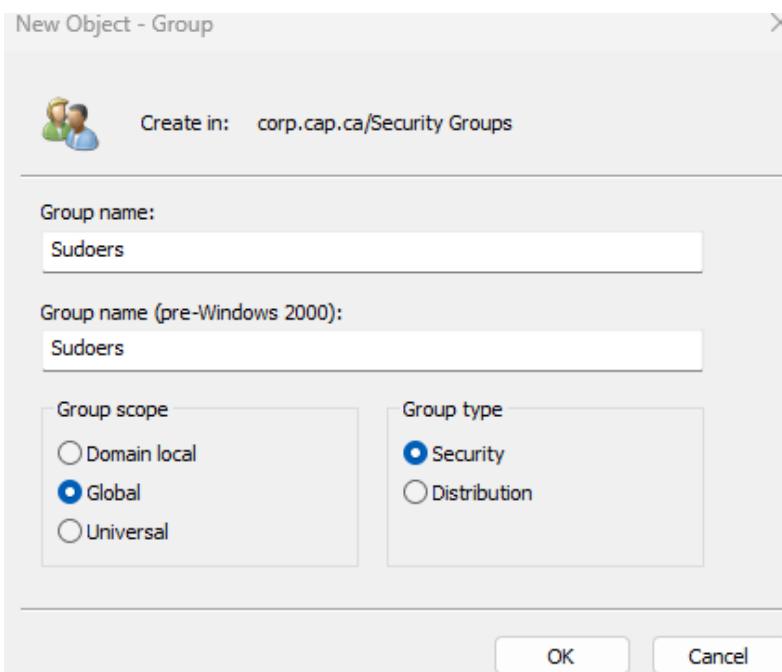
```
[root@0063-lindhcp ~]# realm list
corp.cap.ca
  type: kerberos
  realm-name: CORP.CAP.CA
  domain-name: corp.cap.ca
  configured: kerberos-member
  server-software: active-directory
  client-software: sssd
  required-package: odd-job
  required-package: odd-job-mkhomedir
  required-package: sssd
  required-package: adcli
  required-package: samba-common-tools
  login-formats: %U@corp.cap.ca
  login-policy: allow-realm-logins
[root@0063-lindhcp ~]#
```

- Authenticate against **063-DC1**:
  - o Log in as [\\_sysadmin@corp.cap.ca](mailto:_sysadmin@corp.cap.ca)  

```
CentOS Linux 7 (Core)
Kernel 3.10.0-1160.114.2.el7.x86_64 on an x86_64

063-lindhcp login: _sysadmin@corp.cap.ca
Password:
Creating home directory for _sysadmin@corp.cap.ca.
[_sysadmin@corp.cap.ca@063-lindhcp ~]$ _
```
- In **063-DC1**, ADUC:
  - o Create a Group in “Security Groups” called “**Sudoers**”
  - o Add \_sysadmin to the group

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- Log back into Root:  
Last login: Fri Apr 5 14:14:29 EDT 2024 on tty1  
[root@063-lindhcp ~]# \_

### Configuring 063-LinDHCP Server:

- As root:
  - o # yum install -y nano
    - This installs the nano file editor
  - o # nano /etc/sudoers
- Edit the Configuration File:
  - o Scroll to the end and add:
    - %corp\\\\$Sudoers ALL=(ALL) ALL

```
## Read drop-in files from /etc/sudoers.d (the # here does not mean a comment)
#include /etc/sudoers.d
%corp\$Sudoers ALL=(ALL) ALL
```

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- Ctrl-o to save
- Ctrl-x to exit
- Logout
- Enter:
  - o # \_sysadmin@corp.tsp.ca
  - o # sudo -s

```
CentOS Linux 7 (Core)
Kernel 3.10.0-1160.114.2.el7.x86_64 on an x86_64

[063-lindhcp login: _sysadmin@corp.cap.ca
Password:
Last login: Fri Apr  5 14:43:35 on tty1
[_sysadmin@corp.cap.ca@063-lindhcp ~]$ sudo -s

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

#1) Respect the privacy of others.
#2) Think before you type.
#3) With great power comes great responsibility.
```

```
[sudo] password for _sysadmin@corp.cap.ca:
[root@063-lindhcp _sysadmin@corp.cap.ca]#
```

### Install DHCP Service:

- To start the DHCP Service:
  - o # sudo dnf install dhcp
- Edit the file:
  - o # nano /etc/dhcp/.conf or
  - o # nano /usr/share/doc/dhcp\*/dhcpd.conf.example

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```
GNU nano 2.3.1                               File: /etc/dhcp/dhcpd.conf

#
# DHCP Server Configuration file.
#   see /usr/share/doc/dhcp*/dhcpd.conf.example
#   see dhcpd.conf(5) man page
#
default-lease-time 600;
max-lease-time 7200;
authoritative;

subnet 192.168.3.0 netmask 255.255.255.0 {
    option routers           192.168.3.254;
    option subnet-mask        255.255.255.0;
    option broadcast-address 192.168.3.255;
    option domain-search      "corp.cap.ca";
    option domain-name-servers 192.168.3.2;
    range 192.168.3.10       192.168.3.200;
host 063-DC1 {
    hardware ethernet        00:15:5D:01:85:B6;
    fixed-address            192.168.3.2; }_
```

- Enable DHCP service on boot:
  - o # sudo systemctl start dhcpcd
- Check the status of the DHCP Service:
  - o # sudo systemctl status dhcpcd

```
[root@063-lindhcp _sysadmin@corp.cap.ca]# sudo systemctl start dhcpcd
[root@063-lindhcp _sysadmin@corp.cap.ca]# sudo systemctl status dhcpcd
● dhcpcd.service - DHCPv4 Server Daemon
   Loaded: loaded (/usr/lib/systemd/system/dhcpcd.service; disabled; vendor preset: disabled)
   Active: active (running) since Fri 2024-04-05 15:24:16 EDT; 14s ago
     Docs: man:dhcpcd(8)
           man:dhcpcd.conf(5)
 Main PID: 18607 (dhcpcd)
   Status: "Dispatching packets..."
   CGroup: /system.slice/dhcpcd.service
          └─18607 /usr/sbin/dhcpcd -f -cf /etc/dhcp/dhcpcd.conf -user dhcpcd -group dhcpcd --no-pid

Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: For info, please visit https://www.isc.org/software/dhcp/
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: WARNING: Host declarations are global. They are not limited to the scope you...em in
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: Not searching LDAP since ldap-server, ldap-port and ldap-base-dn were not spe...g file.
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: Wrote 0 deleted host decls to leases file.
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: Wrote 0 new dynamic host decls to leases file.
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: Wrote 0 leases to leases file.
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: Listening on LPF/eth0/00:15:5d:01:85:b8/192.168.3.0/24
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: Sending on LPF/eth0/00:15:5d:01:85:b8/192.168.3.0/24
Apr 05 15:24:16 063-lindhcp dhcpcd[18607]: Sending on Socket/fallback/fallback-net
Apr 05 15:24:16 063-lindhcp systemd[1]: Started DHCPv4 Server Daemon.
hint: Some lines were ellipsized, use -l to show in full.
[root@063-lindhcp _sysadmin@corp.cap.ca]#
```

- o # systemctl enable dhcpcd.service

```
[root@063-lindhcp _sysadmin@corp.cap.ca]# systemctl enable dhcpcd.service
Created symlink from /etc/systemd/system/multi-user.target.wants/dhcpcd.service to /usr/lib/systemd/system/dhcpcd.service.
[root@063-lindhcp _sysadmin@corp.cap.ca]#
```

### Configuring the Firewall:

- # sudo firewall-cmd --add-service=dhcp --permanent
  - # sudo firewall-cmd --reload
- ```
[root@063-lindhcp _sysadmin@corp.cap.ca]# sudo firewall-cmd --add-service=dhcp --permanent
success
[root@063-lindhcp _sysadmin@corp.cap.ca]# sudo firewall-cmd --reload
success
[root@063-lindhcp _sysadmin@corp.cap.ca]#
```

### Configure a DHCP Reservation for 063-DC1:

- First, you need to find out the MAC address of the network interface on the domain controller that you want to reserve the IP for. This is typically done on the domain controller

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itself, using a command like `ip addr` or `ifconfig` in Linux, or `ipconfig /all` in Windows

- We will use the MAC address of **063-DC1**
- Open DHCP Configuration file in a text editor:
  - `sudo nano /etc/dhcp/dhcpd.conf`
  - Add the Reservation for **063-DC1** at the end of the file
  - Restart DHCP Service
    - `sudo systemctl restart dhcpcd`

```
GNU nano 2.3.1   File: /etc/dhcp/dhcpd.conf

#
# DHCP Server Configuration file.
#   see /usr/share/doc/dhcp*/dhcpd.conf.example
#   see dhcpd.conf(5) man page
#
default-lease-time 600;
max-lease-time 7200;
authoritative;

subnet 192.168.3.0 netmask 255.255.255.0 {
    option routers              192.168.3.254;
    option subnet-mask          255.255.255.0;
    option broadcast-address    192.168.3.255;
    option domain-search        "corp.cap.ca";
    option domain-name-servers 192.168.3.2;
    range 192.168.3.10          192.168.3.200;
}

host 063-DC1 {
    hardware ethernet          00:15:5D:01:85:B6;
    fixed-address               192.168.3.2; }
```

### Test the Configuration for 063-LinDHCP:

- Connect a client machine to the same network segment as your DHCP server. The client should automatically receive an IP address from your DHCP server
- We will use a Windows 10 Machine to see if it gets DHCP with Static IP off
  - Open Adapter Properties:
    - Right-click on the relevant network adapter "**Properties**"
  - Select Internet Protocol Version 4 (**TCP/IPv4**):
  - Set to Obtain IP Address Automatically:
    - In the properties window, select the option "**Obtain an IP address automatically**"

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```
PS C:\Windows\system32> ipconfig /all

Windows IP Configuration

Host Name . . . . . : Test
Primary Dns Suffix . . . . . : corp.cap.ca
Node Type . . . . . : Mixed
IP Routing Enabled. . . . . : No
WINS Proxy Enabled. . . . . : No
DNS Suffix Search List. . . . . : corp.cap.ca

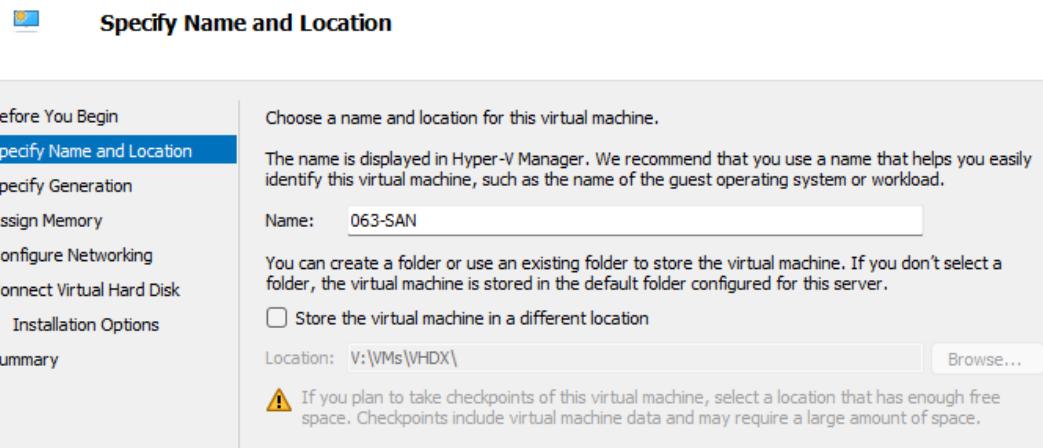
Ethernet adapter Ethernet:

Connection-specific DNS Suffix . . . . . : corp.cap.ca
Description . . . . . . . . . : Microsoft Hyper-V Network Adapter
Physical Address. . . . . . . . . : 00-15-5D-01-85-B9
DHCP Enabled. . . . . . . . . : Yes
Autoconfiguration Enabled . . . . . . . . . : Yes
Link-local IPv6 Address . . . . . . . . : fe80::edc5:b67:1cd7:4455%5(PREFERRED)
IPv4 Address. . . . . . . . . : 192.168.3.10(PREFERRED)
Subnet Mask . . . . . . . . . : 255.255.255.0
Lease Obtained. . . . . . . . . : Friday, April 5, 2024 1:07:57 PM
Lease Expires . . . . . . . . . : Friday, April 5, 2024 1:17:57 PM
Default Gateway . . . . . . . . . : 192.168.3.254
DHCP Server . . . . . . . . . : 192.168.3.3
DHCPv6 IAID . . . . . . . . . : 100668765
DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-2D-A2-1E-B2-00-15-5D-01-85-B9
DNS Servers . . . . . . . . . : 192.168.3.2
NetBIOS over Tcpip. . . . . . . . : Enabled
Connection-specific DNS Suffix Search List :
corp.cap.ca
```

### Software RAID6 Configuration:

Create the VM 063-SAN and attach the disks to it:

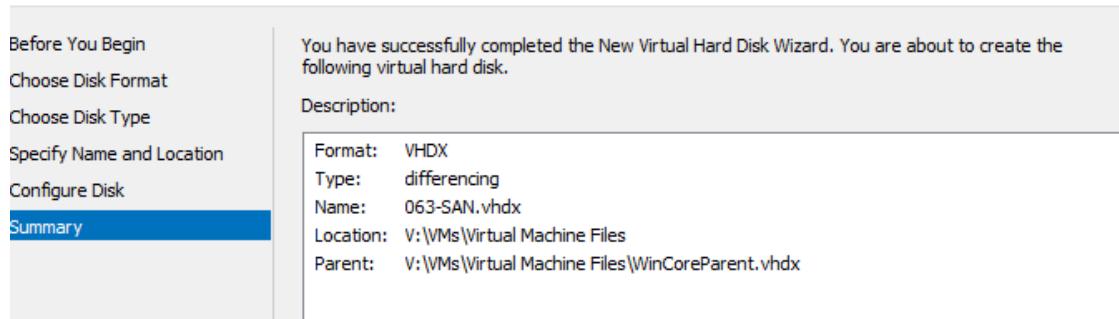
- From Hyper-V on the host machine click: **New > Virtual Machine Wizard**
- Create a new Storage Virtual Machine:



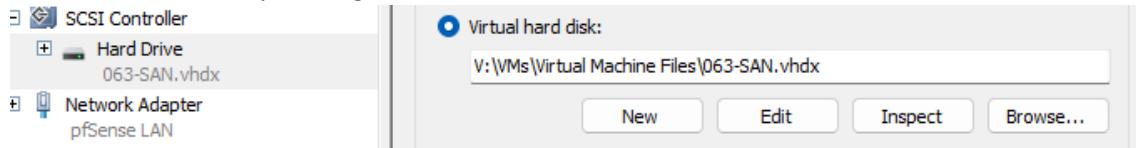
- **Generation 2**
- 500MB of RAM
- We will use a differencing disk to spool up a Windows Server Core VM
  - o Hyper-V Manager > New Virtual Hard Disk Wizard > VHDX > Differencing

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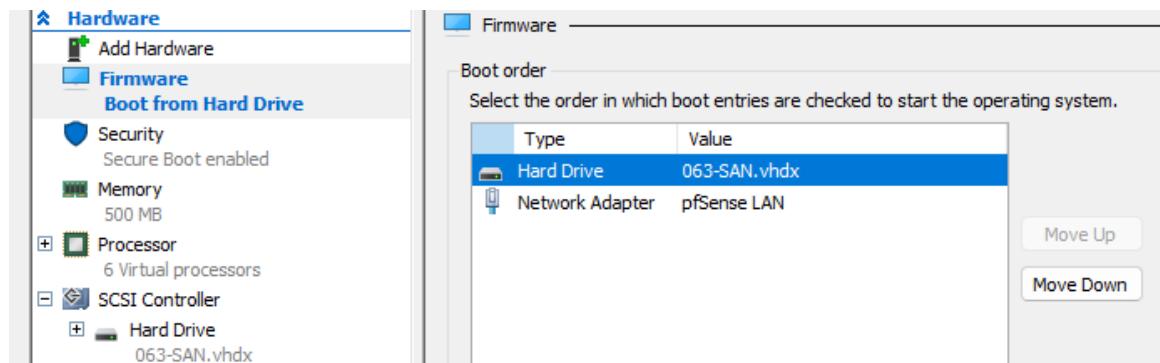
- Name it **063-SAN**
  - Use **WinCoreParent.vhdx** image file
- Completing the New Virtual Hard Disk Wizard**



- In Hyper-V Manager right click on **063-SAN** select Settings
- Add **063-SAN.vhdx** by clicking on **SCSI Controller > Hard Drive > Add > Browse**



- In the **063-SAN** Settings:
  - Disable automatic checkpoints
  - Enable guest services
  - Move the Hard Drive **063-SAN.vhdx** to the top of the boot order under Firmware



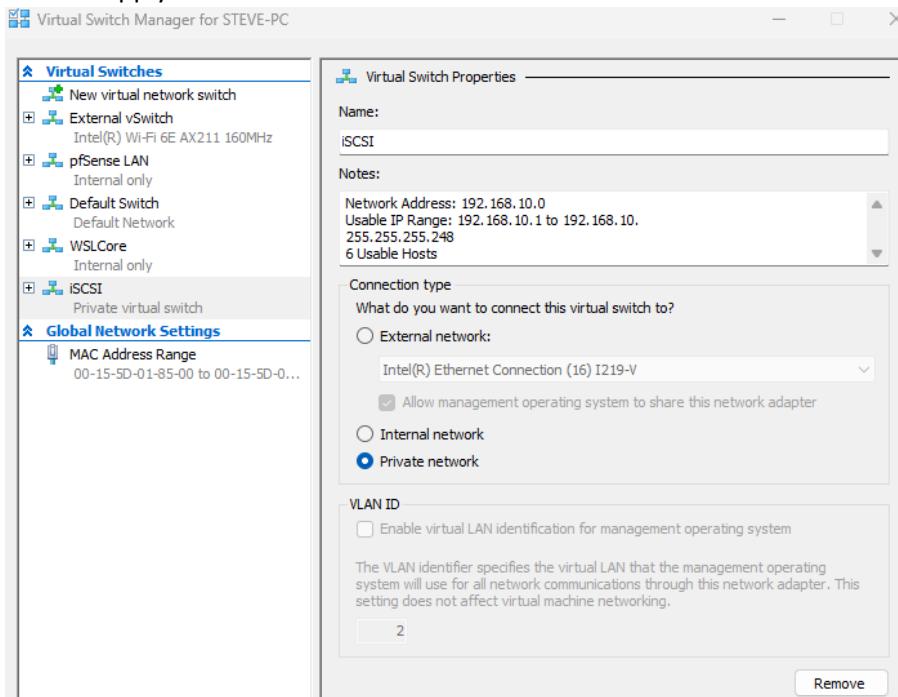
- Boot the VM
- Rename the Machine
 

```
Enter new computer name (Blank=Cancel): 063-SAN
Changing computer name...
WARNING: The changes will take effect after you restart the computer WIN-OGGL7DKE6UQ.
Restart now? (Y)es or (N)o: y-
```
- ***This machine will not be domain joined***

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## Create iSCSI Network Switch:

- **Hyper-V > Virtual Switch Manager > New Virtual Network Switch**
  - o Create a new **Private** Network Switch
  - o **iSCSI**
  - o **Apply > OK**



- Attach this Private vSwitch to **063-SAN** in Settings or when Creating the Server in Hyper-V

## Create 7 50GB Dynamic VHDXs:

- Create a RAID vDisk that will survive 2 disk failure:
  - o On Windows 11 Host Machine open **Windows PowerShell ISE as Administrator**
  - o Enter Script:

```
$location = "V:\VMs\vhdx" # Replace with the path where you want to store your VHDS
$size = 50GB # The size of each VHD
$vmName = "063-SAN" # Replace with your VM's name
```

```
1..7 | ForEach-Object {
    $vhdName = "Disk$_" # Disk name will be Disk1, Disk2, etc.
    $vhdPath = Join-Path -Path $location -ChildPath "$vhdName.vhdx"
    New-VHD -Path $vhdPath -Dynamic -SizeBytes $size
    Add-VMHardDiskDrive -VMName $vmName -Path $vhdPath
}
```

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The screenshot shows two windows. The top window is 'Administrator: Windows PowerShell ISE' with the title 'Untitled1.ps1\*'. It contains the following PowerShell script:

```
1 $location = "V:\VMs\vhdx" # Replace with the path where you want to store your VHDS
2 $size = 50GB # The size of each VHD
3 $vmName = "063-SAN" # Replace with your VM's name
4
5 1..7 | ForEach-Object {
6     $vhdName = "Disk$_" # Disk name will be Disk1, Disk2, etc.
7     $vhdPath = Join-Path -Path $location -ChildPath "$vhdName.vhdx"
8     New-VHD -Path $vhdPath -Dynamic -SizeBytes $size
9     Add-VMHardDiskDrive -VMName $vmName -Path $vhdPath
10 }
11
```

The bottom window is a table showing disk properties:

| IsPMMCompatible         | : False                                |
|-------------------------|----------------------------------------|
| AddressAbstractionType  | : None                                 |
| Number                  | :                                      |
| ComputerName            | : STEVE-PC                             |
| Path                    | : V:\VMs\vhdx\Disk7.vhdx               |
| VhdFormat               | : VHDX                                 |
| VhdType                 | : Dynamic                              |
| FileSize                | : 4194304                              |
| Size                    | : 53687091200                          |
| MinimumSize             | :                                      |
| LogicalSectorSize       | : 512                                  |
| PhysicalSectorSize      | : 4096                                 |
| BlockSize               | : 33554432                             |
| ParentPath              | :                                      |
| DiskIdentifier          | : CF1D7194-FF53-4AFC-9F51-8F962C918CBE |
| FragmentationPercentage | : 0                                    |
| Alignment               | : 1                                    |
| Attached                | : False                                |
| DiskNumber              | :                                      |
| IsPMMCompatible         | : False                                |
| AddressAbstractionType  | : None                                 |
| Number                  | :                                      |

PS C:\windows\system32>

Set LAN Static IP on 063-SAN:

- From the Console open **Network Adapter Settings**
- Enter index #
  - o Select 1 to configure the network adapter settings
- IP: **192.168.3.4**
- Default Gateway: **192.168.3.254**
- DNS: **192.168.3.2**

The screenshot shows a command-line interface for configuring network adapter settings. The menu options are:

```
=====
          Network adapter settings
=====

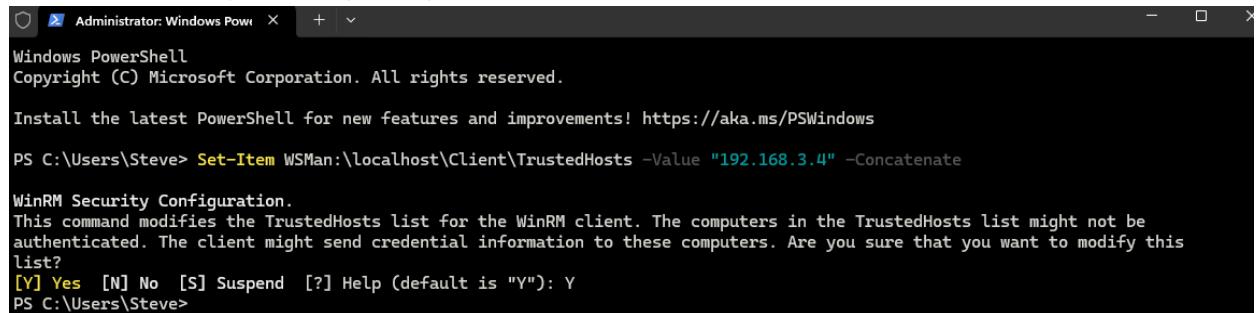
 1) Set network adapter address
 2) Set DNS servers
 3) Clear DNS server settings

Enter selection (Blank=Cancel):
```

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Add the IP to Trusted Hosts:

- Set-Item WSMAN:\localhost\Client\TrustedHosts -Value "063-SAN" -Concatenate



```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

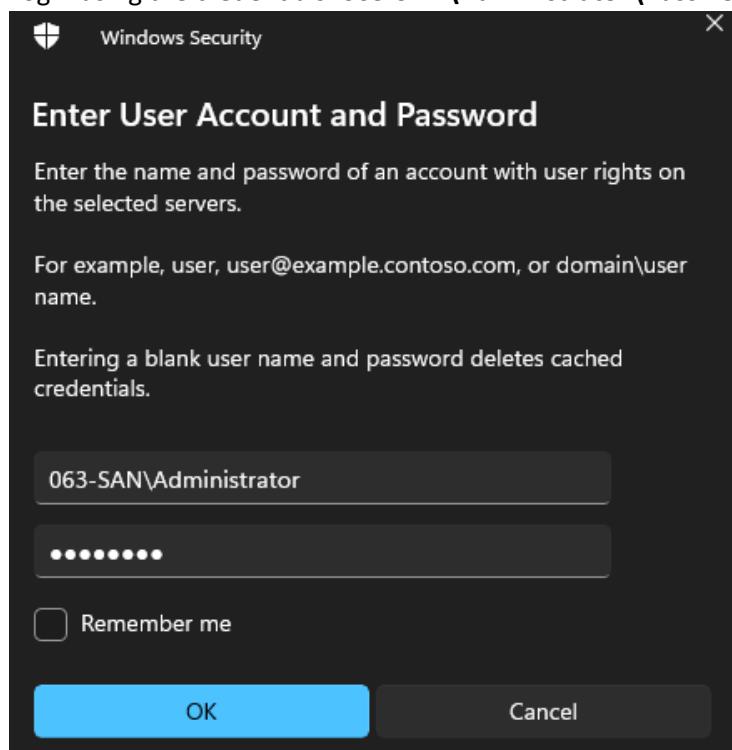
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\Steve> Set-Item WSMAN:\localhost\Client\TrustedHosts -Value "192.168.3.4" -Concatenate

WinRM Security Configuration.
This command modifies the TrustedHosts list for the WinRM client. The computers in the TrustedHosts list might not be
authenticated. The client might send credential information to these computers. Are you sure that you want to modify this
list?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y
PS C:\Users\Steve>
```

Add 063-SAN to Server Manager on Host:

- Open Server Manager Administrative Tool on the Lenovo
- Right click All Servers > Add Servers
- Search by DNS: **192.168.3.4**
- Add the Server and right click “Manage as”
- Login using the credentials: **063-SAN\Administrator (Password: Pa\$\$w0rd)**



- Go to the **063-SAN** Server VM
- Navigate to **Server Manager > File and Storage Services > Volumes > Storage Pools**
- Refresh the Server
- The Physical Disks should appear:

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**PHYSICAL DISKS**

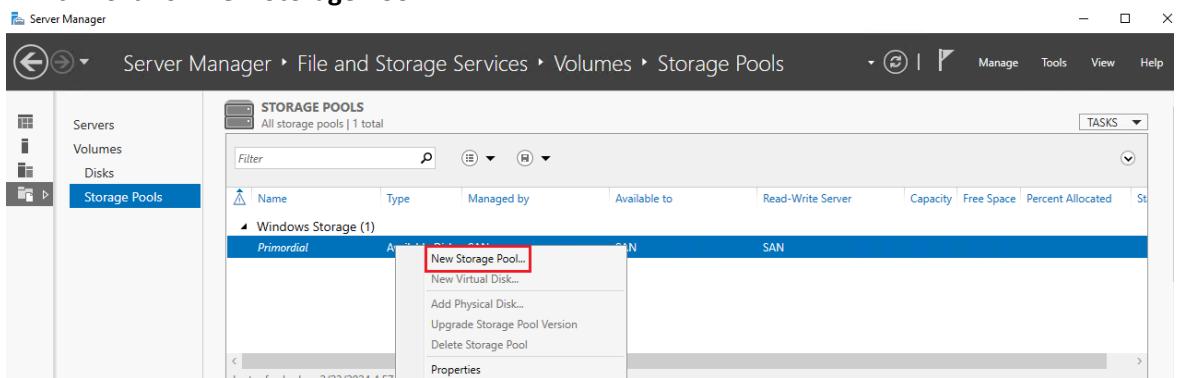
Primordial on 063-SAN

TASKS ▾

| Slot | Name                        | Status | Capacity | Bus | Usage     | Chassis                       |
|------|-----------------------------|--------|----------|-----|-----------|-------------------------------|
|      | Msft Virtual Disk (063-SAN) | Online | 50.0 GB  | SAS | Automatic | Integrated : Bus 0 : Device 0 |
|      | Msft Virtual Disk (063-SAN) | Online | 50.0 GB  | SAS | Automatic | Integrated : Bus 0 : Device 1 |
|      | Msft Virtual Disk (063-SAN) | Online | 50.0 GB  | SAS | Automatic | Integrated : Bus 0 : Device 2 |
|      | Msft Virtual Disk (063-SAN) | Online | 50.0 GB  | SAS | Automatic | Integrated : Bus 0 : Device 3 |
|      | Msft Virtual Disk (063-SAN) | Online | 50.0 GB  | SAS | Automatic | Integrated : Bus 0 : Device 4 |
|      | Msft Virtual Disk (063-SAN) | Online | 50.0 GB  | SAS | Automatic | Integrated : Bus 0 : Device 5 |
|      | Msft Virtual Disk (063-SAN) | Online | 50.0 GB  | SAS | Automatic | Integrated : Bus 0 : Device 6 |

## Configure Storage Pool on the Storage Server:

- Open Storage Pools. If the disks do not show up, bring them online
- From the available storage, create a storage pool:
  - o Right click on Primordial under Windows Storage
  - o Click on **New Storage Pool...**



- This opens the **New Storage Pool Wizard**

New Storage Pool Wizard

### Before you begin

#### Before You Begin

Storage Pool Name

Physical Disks

Confirmation

Results

This wizard helps you group physical disks into a storage pool, enabling you to make more efficient use of disk capacity. After creating a storage pool, you can use space in the pool to create volumes on virtual disks, which appear as normal disks to the operating system.

To create a storage pool, you must have at least one unused physical disk and a storage subsystem that can manage it, such as the included Storage Spaces subsystem or the subsystem included with a storage device.

To continue, click Next.

- Name the Pool: **Production** > Click Next

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## Specify a storage pool name and subsystem

Before You Begin

**Storage Pool Name**

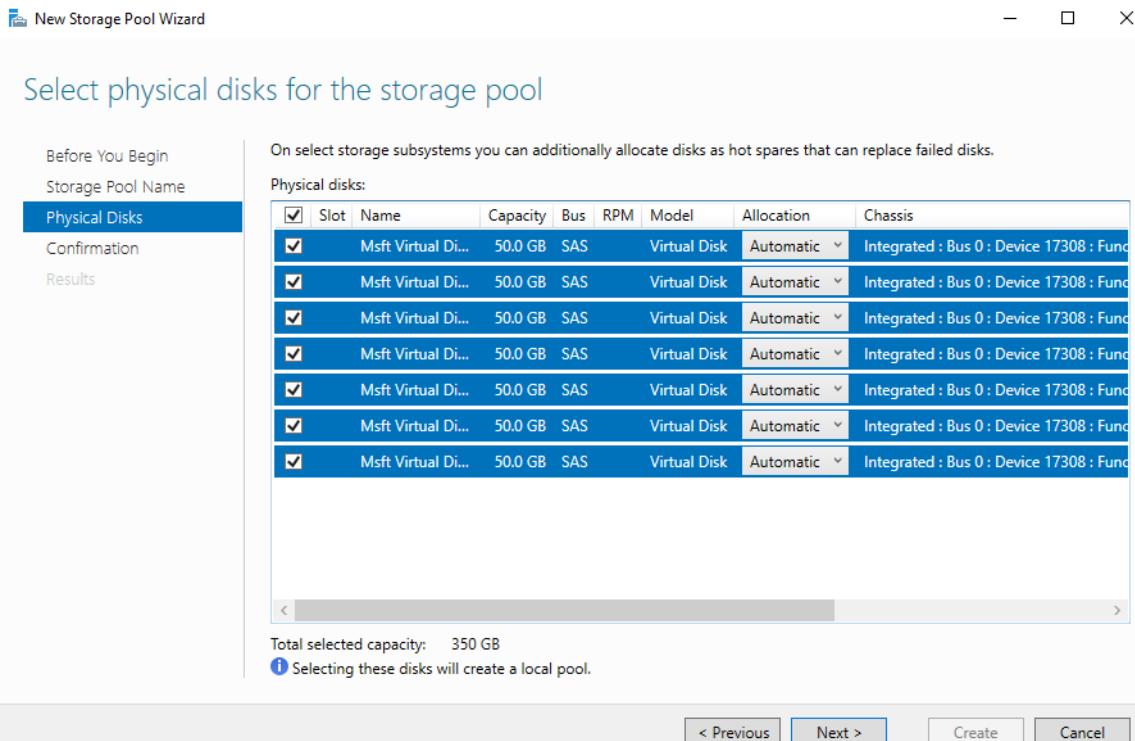
Physical Disks

Confirmation

Results

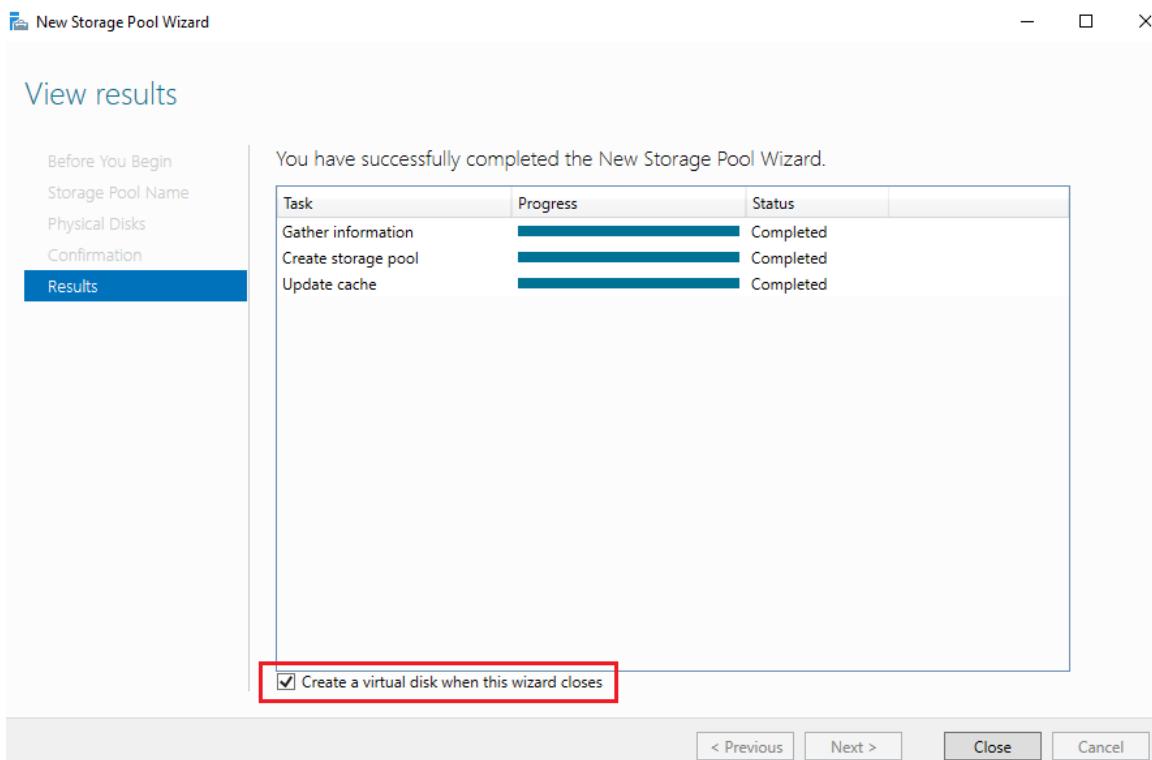
|                                                                                             |              |                 |                 |
|---------------------------------------------------------------------------------------------|--------------|-----------------|-----------------|
| Name:                                                                                       | Production   |                 |                 |
| Description:                                                                                |              |                 |                 |
| Select the group of available disks (also known as a primordial pool) that you want to use: |              |                 |                 |
| Managed by                                                                                  | Available to | Subsystem       | Primordial Pool |
| 063-SAN                                                                                     | 063-SAN      | Windows Storage | Primordial      |

- Select the **Disks** > Click **Next > Create**

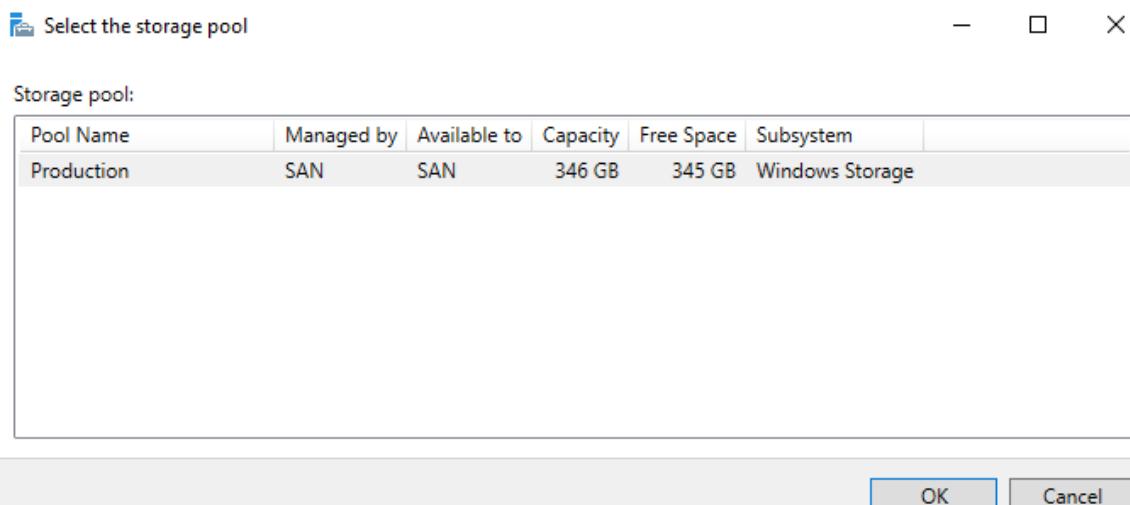


- Check mark “Create a virtual disk when this wizard closes”

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

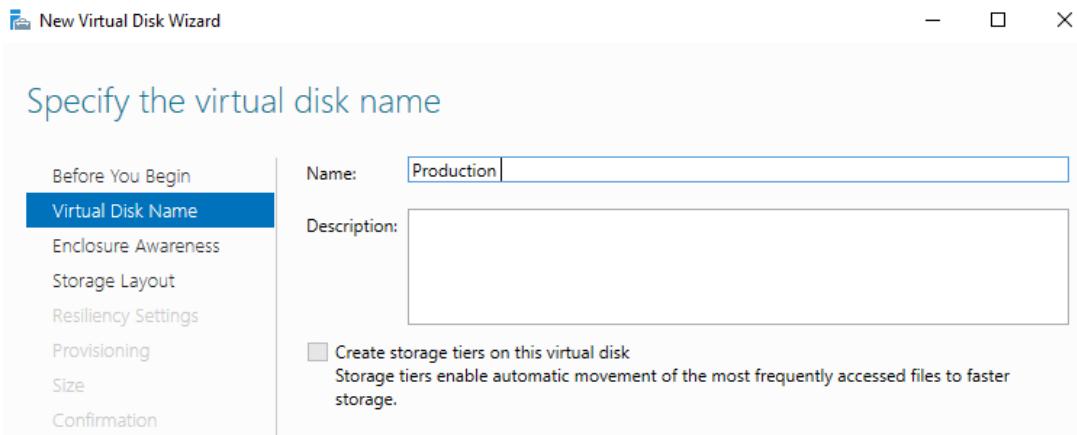


Create a Virtual Disk from the pool:

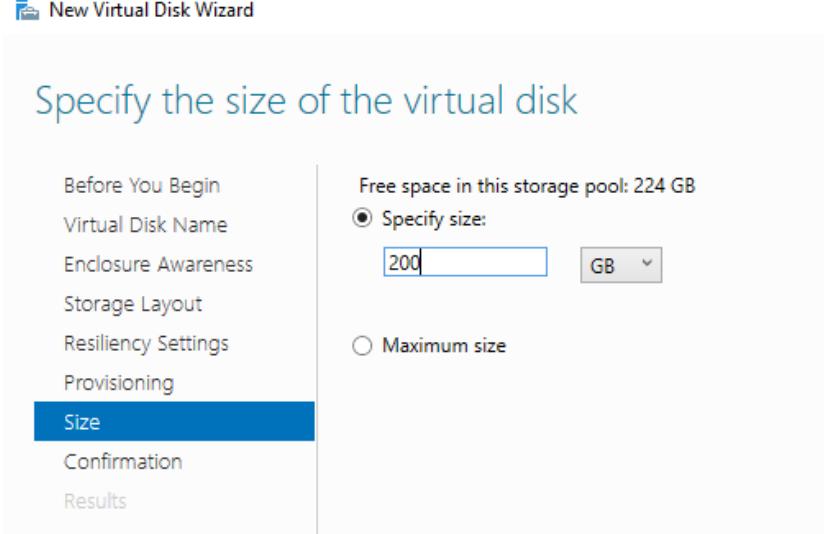


- Select the Pool, there should only be one
- The **New Virtual Disk Wizard** opens:
  - o This will enable to create one large disk instead of 7 Individual ones, the Wizard will combine them essentially
- Name: "**Production**"

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- Specify enclosure resiliency:
  - o Select **Default** > **Next**
- Select the storage layout:
  - o **Parity**
- Configure the resiliency settings:
  - o **Dual parity**
- Provisioning Type:
  - o **Fixed**
- Specify the size of the virtual disk:



- **Survive 2 Disk Failure. The vDisk must be a minimum of 220GB**
- Select: Create a Volume when the wizard closes

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New Virtual Disk Wizard

**View results**

Before You Begin  
Virtual Disk Name  
Enclosure Awareness  
Storage Layout  
Resiliency Settings  
Provisioning  
Size  
Confirmation  
**Results**

The New Virtual Disk Wizard successfully completed.

| Task                | Progress                         | Status    |
|---------------------|----------------------------------|-----------|
| Gather information  | <div style="width: 100%;"></div> | Completed |
| Create virtual disk | <div style="width: 100%;"></div> | Completed |
| Rescan disks        | <div style="width: 100%;"></div> | Completed |
| Initialize disk     | <div style="width: 100%;"></div> | Completed |
| Update cache        | <div style="width: 100%;"></div> | Completed |

Create a volume when this wizard closes

- The **New Volume Wizard** opens

New Volume Wizard

**Before you begin**

Before You Begin  
Server and Disk  
Size  
Drive Letter or Folder  
File System Settings  
Confirmation

This wizard helps you create a volume, assign it a drive letter or folder, and then format it with a file system.

You can create a volume on a physical disk or a virtual disk. A virtual disk is a collection of one or more physical disks from a previously created storage pool. The layout of data across the physical disks can increase the reliability and performance of the volume.

To continue, click Next.

- Select the vDisk: Disk 8 Production:

Select the server and disk

Before You Begin  
Server and Disk  
Size  
Drive Letter or Folder  
File System Settings  
Confirmation  
Results

**Server:**

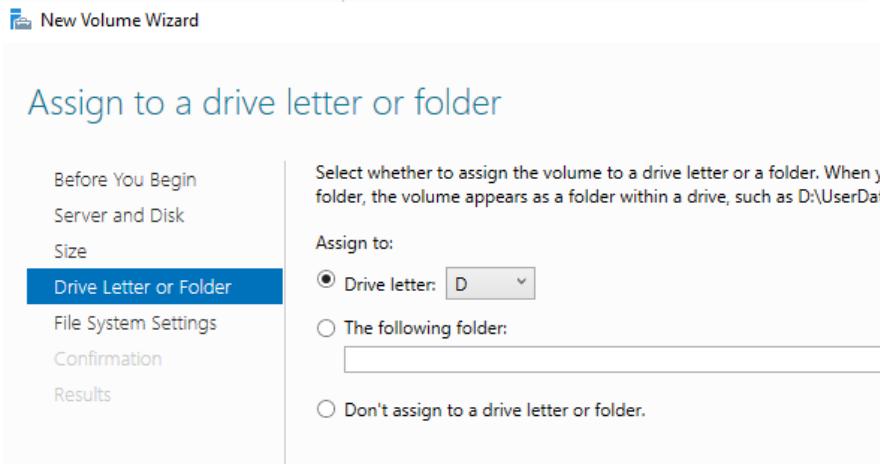
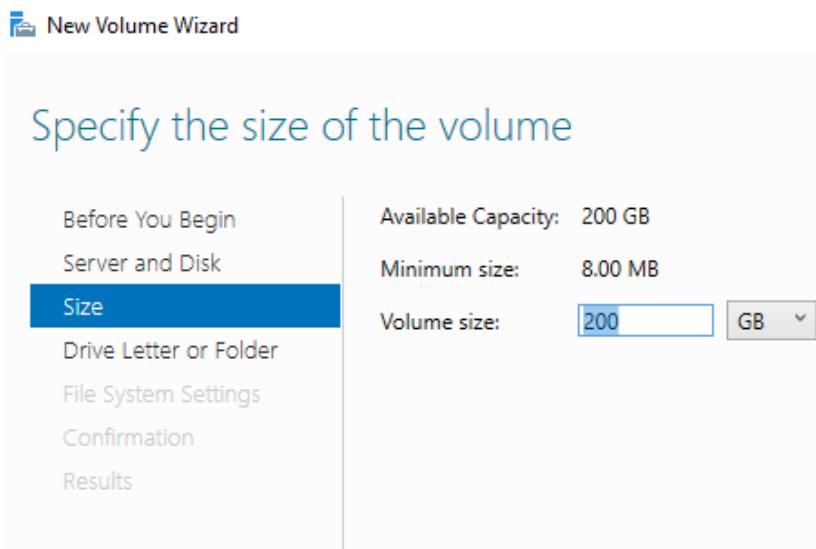
| Provision to | Status | Cluster Role  | Destination |
|--------------|--------|---------------|-------------|
| 063-DC1      | Online | Not Clustered | Local       |
| 063-SAN      | Online | Not Clustered | Local       |

**Disk:**

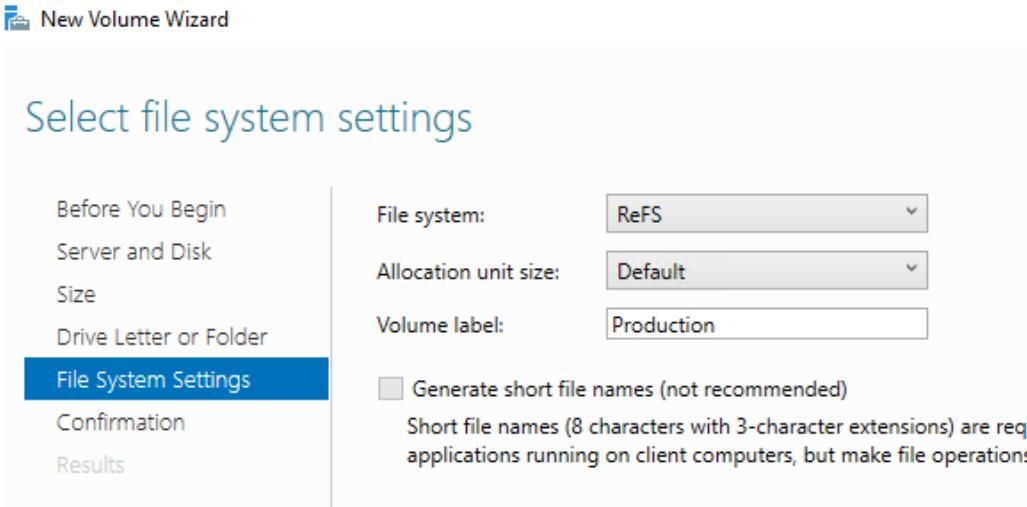
| Disk   | Virtual Disk | Capacity | Free Space | Subsystem       |
|--------|--------------|----------|------------|-----------------|
| Disk 8 | Production   | 200 GB   | 200 GB     | Windows Storage |

Refresh Rescan

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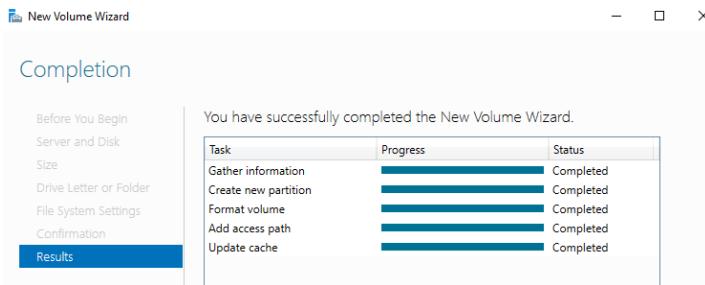


- Select file system settings:
  - o **ReFS (Resilient File System)**



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- Create the Volume:



### Test Redundancy:

- Create a directory on the new volume (**FileServerData**)
- **New-Item -Path D:\FileServerData -ItemType Directory**

```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> New-Item -Path D:\FileServerData -ItemType Directory

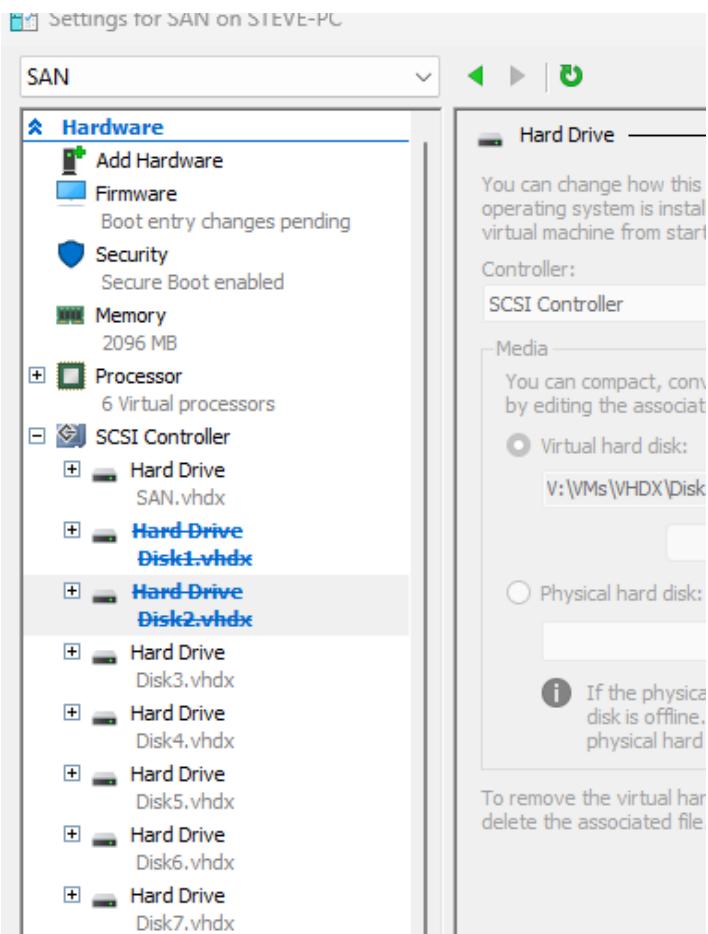
Directory: D:\

Mode          LastWriteTime      Length Name
----          <-----           ----- 
d----
```

The screenshot shows a PowerShell window with administrator privileges. The command 'New-Item -Path D:\FileServerData -ItemType Directory' is run, creating a new directory named 'FileServerData' on drive D. The output shows the directory structure and the creation time (4/5/2024 8:20 PM).

- Test redundancy by removing **two** disks through Hyper-V manager to see if the volume and folder is still available:
  - o Navigate to Hyper-V on the Host Machine, click on **063-SAN**
  - o Go to **Settings**
  - o Select 2 Disks and **Remove**:

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

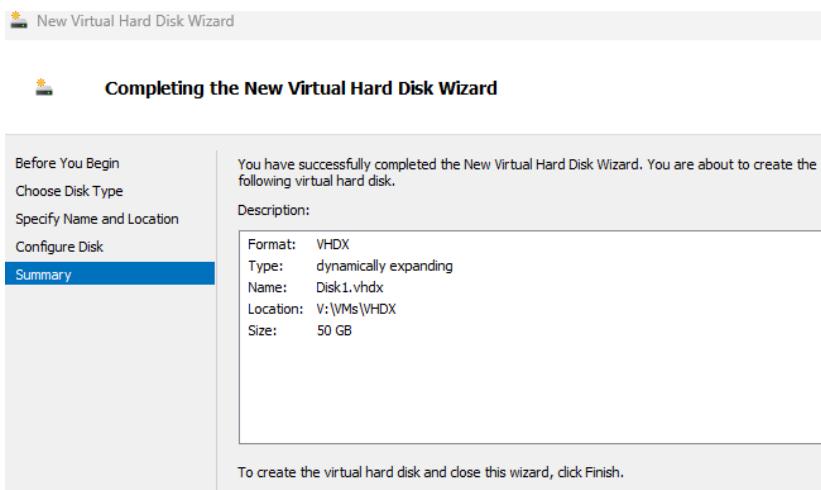


- **FileServerData** should still be preserved in the Production (D:)
- **To Check using PowerShell:**
  - o `Test-Path D:\FileServerData`
- If the folder exists, this PowerShell command will return **True**; if not, it will return **False**

```
PS C:\Users\Administrator> Test-Path D:\FileServerData
True
PS C:\Users\Administrator>
```

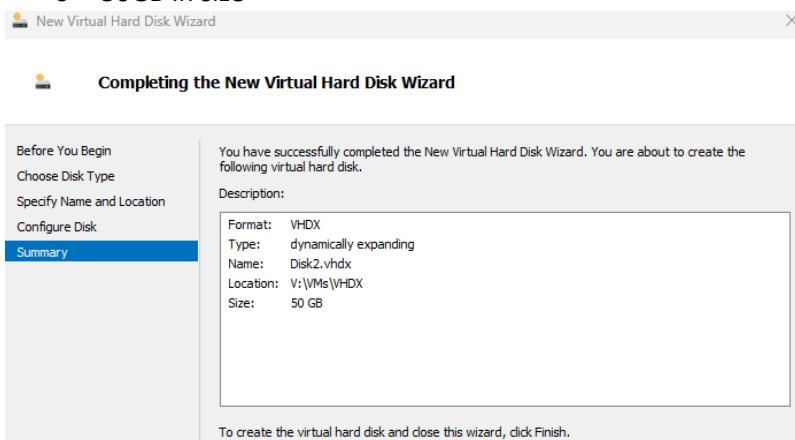
- **FileServerData** has not been deleted or changed
- Add **Two** new disks to the Storage Server to repair the array:
  - o From Hyper-V open **Settings for SAN**
  - o Click **SCSI Controller > Hard Drive > Add**
    - **New > Dynamically expanding**
    - **50GB in Size**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



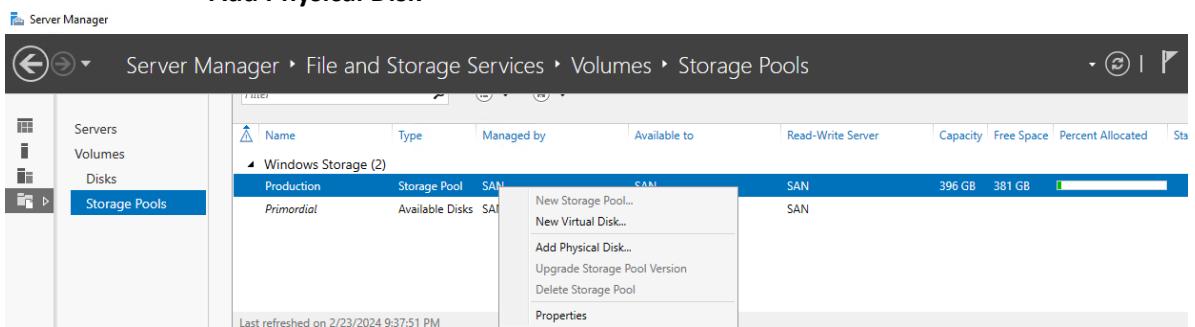
### - Recreate Disk2:

- 50GB in size



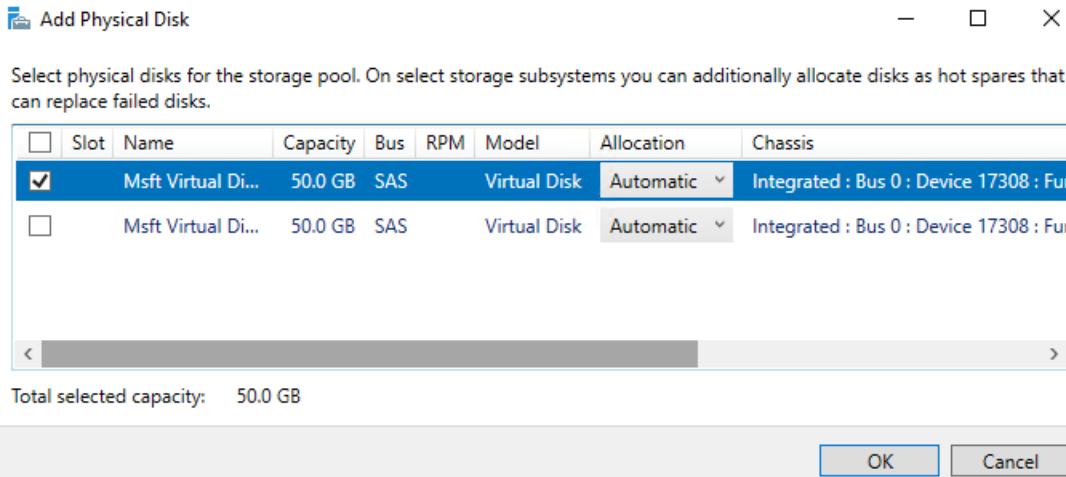
### - Add the disk to the Pool:

- Navigate to **Server Manager > File and Storage Services > Volumes > Storage Pools**
- Click on the “**Production**” Storage Pool
  - **Add Physical Disk**



- Select **Disk1**

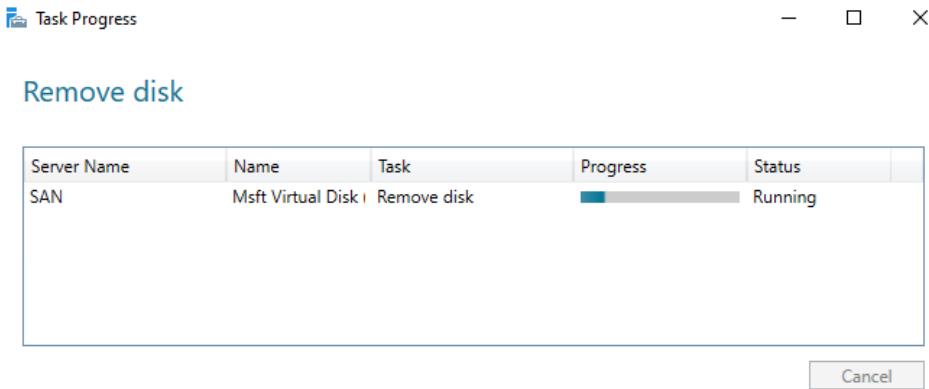
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



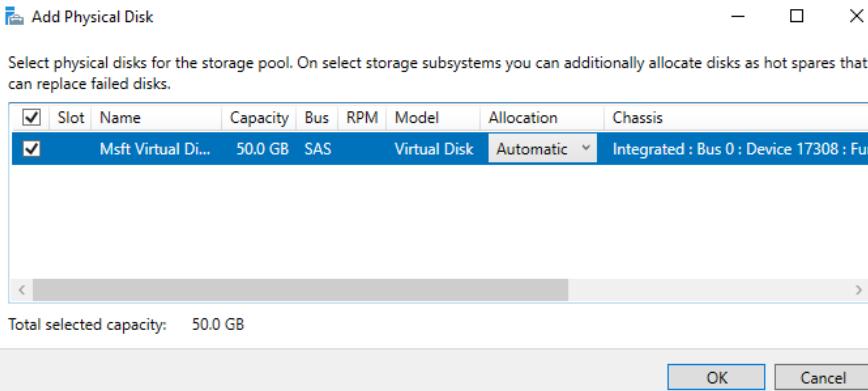
- The Disk should match the other disks in size and allocation (Automatic)
- Repair the volume:

- Remove the Dead Disk:

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- The Disk will show it's been Retired
  - o Remove the Retired Disk
- Repeat the steps for Disk2
  - o Right click on “Production”
  - o “Add Physical Disk”
  - o Select Disk2



- Repair the Volume
- Remove the Dead Disk
  - o The Disk will show that it has been retired as such:

The screenshot shows two windows side-by-side:

**VIRTUAL DISKS** (Production on SAN)

| Name       | Status     | Layout | Provisioning | Capacity | Allocated | Volume |
|------------|------------|--------|--------------|----------|-----------|--------|
| Production | Production | Thin   | 200 GB       | 5.00 GB  |           |        |

**PHYSICAL DISKS** (Production on SAN)

| Slot | Name                    | Status  | Capacity | Bus       | Usage                                        | Chassis |
|------|-------------------------|---------|----------|-----------|----------------------------------------------|---------|
| 1    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Automatic | Integrated : Bus 0 : Device 17308 : Function |         |
| 2    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Automatic | Integrated : Bus 0 : Device 17308 : Function |         |
| 3    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Automatic | Integrated : Bus 0 : Device 17308 : Function |         |
| 4    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Automatic | Integrated : Bus 0 : Device 17308 : Function |         |
| 5    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Retired   |                                              |         |
| 6    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Automatic | Integrated : Bus 0 : Device 17308 : Function |         |
| 7    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Automatic | Integrated : Bus 0 : Device 17308 : Function |         |
| 8    | Msft Virtual Disk (SAN) | 50.0 GB | SAS      | Automatic | Integrated : Bus 0 : Device 17308 : Function |         |

- Remove the Retired Disk

After the removal of the dead disk, you should see no errors, all back to normal

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The screenshot shows the Storage Pool Management interface. On the left sidebar, there are navigation links: Servers, Volumes, Disks, Storage Pools (which is selected), Shares, iSCSI, and Work Folders. The main area is divided into three sections:

- STORAGE POOLS:** Shows one storage pool named "Production" under "Windows Storage (1)".
- VIRTUAL DISKS:** Shows one virtual disk named "Production" with a capacity of 200 GB.
- PHYSICAL DISKS:** Shows eight physical disks, all labeled "Matt Virtual Disk (063-SAN)" with 50.0 GB capacity, SAS type, and integrated bus.

- Attach Private iSCSI vSwitch to the 063-SAN Server in Settings

Virtual Switch Manager for STEVE-PC

The screenshot shows the Virtual Switch Manager window. On the left, there's a tree view of network switches:
 

- New virtual network switch
- External vswitch (Intel(R) Wi-Fi 6 AX211 160MHz)
- pfSense LAN (Internal only)
- Default Switch (Default Network)
- WSLCore (Internal only)
- iSCSI** (Private virtual switch, selected)

 The main pane shows the "Virtual Switch Properties" for the iSCSI switch:
 

- Name:** iSCSI
- Notes:** Network Address: 192.168.10.0, Usable IP Range: 192.168.10.1 to 192.168.10.255, 255.255.255.248, 6 Usable Hosts
- Connection type:** Private network (radio button selected)
- VLAN ID:** VLAN 2 (checkbox checked)

## Rename Network Adapters:

- Access PowerShell on 063-SAN

- Get-NetAdapter

```

Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> Get-NetAdapter

Name                   InterfaceDescription           ifIndex Status      MacAddress      LinkSpeed
----                   ----
Ethernet 2             Microsoft Hyper-V Network Adapter #2      10 Up       00-15-5D-01-85-C1   10 Gbps
Ethernet               Microsoft Hyper-V Network Adapter          5 Up       00-15-5D-01-85-C0   10 Gbps

PS C:\Users\Administrator>

```

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- Rename the Network Adapters:
  - o **Rename-NetAdapter -Name "Ethernet" -NewName "pfSense LAN"**
  - o **Rename-NetAdapter -Name "Ethernet 2" -NewName "iSCSI"**

```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> Get-NetAdapter

Name           InterfaceDescription          ifIndex Status      MacAddress      LinkSpeed
----           -----                   -----   -----   -----
Ethernet 2     Microsoft Hyper-V Network Adapter #2    10 Up       00-15-5D-01-85-C1  10 Gbps
Ethernet       Microsoft Hyper-V Network Adapter          5 Up       00-15-5D-01-85-C0  10 Gbps

PS C:\Users\Administrator> Rename-NetAdapter -Name "Ethernet" -NewName "pfSense LAN"
PS C:\Users\Administrator> Rename-NetAdapter -Name "Ethernet 2" -NewName "iSCSI"
PS C:\Users\Administrator> Get-NetAdapter

Name           InterfaceDescription          ifIndex Status      MacAddress      LinkSpeed
----           -----                   -----   -----   -----
iSCSI          Microsoft Hyper-V Network Adapter #2    10 Up       00-15-5D-01-85-C1  10 Gbps
pfSense LAN    Microsoft Hyper-V Network Adapter          5 Up       00-15-5D-01-85-C0  10 Gbps

PS C:\Users\Administrator>
```

### Set Static IP for iSCSI Network Adapter:

- Set the Static IP of **192.168.10.1** on **063-SAN** Server:
- Subnet Mask: **255.255.255.248**
- Open PowerShell as an administrator on your Server Core machine
  - o Use **Get-NetAdapter** to identify the name of the network adapter you want to configure:
  - o Take note of the Name property of the adapter you wish to configure
- Set the static IP address using **New-NetIPAddress**. Replace Ethernet with the actual name of your network adapter:
  - o **New-NetIPAddress -InterfaceAlias "iSCSI" -IPAddress 192.168.10.1 -PrefixLength 29**
- This sets the IP address to **192.168.10.1** with a subnet mask of **255.255.255.248**, which corresponds to a **/29 CIDR** prefix

### Enable Jumbo Frames:

- To enable Jumbo Frames, you need to set the \*JumboPacket property to the desired size. The value should be set to the MTU size that you want, which is 9014 in your case. Replace Ethernet with the actual name of your network adapter:

```
PS C:\Users\Administrator> Get-NetAdapter

Name           InterfaceDescription          ifIndex Status      MacAddress      LinkSpeed
----           -----                   -----   -----   -----
iSCSI          Microsoft Hyper-V Network Adapter #2    10 Up       00-15-5D-01-85-C1  10 Gbps
pfSense LAN    Microsoft Hyper-V Network Adapter          5 Up       00-15-5D-01-85-C0  10 Gbps
```

- Note that the DisplayName property can vary based on the network adapter and its drivers. You may need to check the correct display name for Jumbo Packet on your adapter using **Get-NetAdapterAdvancedProperty**:
  - o **Get-NetAdapterAdvancedProperty -Name "iSCSI"**

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| Name  | DisplayName                    | DisplayValue                | RegistryKeyword        | RegistryValue |
|-------|--------------------------------|-----------------------------|------------------------|---------------|
| iSCSI | IPv4 Checksum Offload          | Rx & Tx Enabled             | *IPChecksumO... {3}    |               |
| iSCSI | TBSeC Offload                  | Auth Header and ESP Enabled | *IPsecOffloadV2 {3}    |               |
| iSCSI | Jumbo Packet                   | Disabled                    | *JumboPacket {1514}    |               |
| iSCSI | Large Send Offload Version ... | Enabled                     | *LsoV2IPv4 {1}         |               |
| iSCSI | Large Send Offload Version ... | Enabled                     | *LsoV2IPv6 {1}         |               |
| iSCSI | Max Number of RSS Processors   | 16                          | *MaxRssProce... {16}   |               |
| iSCSI | Network Direct (RDMA)          | Disabled                    | *NetworkDirect {0}     |               |
| iSCSI | Maximum Number of RSS Queues   | 16                          | *NumRssQueues {16}     |               |
| iSCSI | Packet Direct                  | Disabled                    | *PacketDirect {0}      |               |
| iSCSI | Recv Segment Coalescing (IPv4) | Enabled                     | *RscIPv4 {1}           |               |
| iSCSI | Recv Segment Coalescing (IPv6) | Enabled                     | *RscIPv6 {1}           |               |
| iSCSI | Receive Side Scaling           | Enabled                     | *RSS {1}               |               |
| iSCSI | RSS Base Processor Number      | 0                           | *RssBaseProc... {0}    |               |
| iSCSI | Maximum RSS Processor Number   | 63                          | *RssMaxProcN... {63}   |               |
| iSCSI | RSS Profile                    | NUMA Scaling Static         | *RSSProfile {4}        |               |
| iSCSI | TCP Checksum Offload (IPv4)    | Rx & Tx Enabled             | *TCPChecksum... {3}    |               |
| iSCSI | TCP Checksum Offload (IPv6)    | Rx & Tx Enabled             | *TCPChecksum... {3}    |               |
| iSCSI | UDP Checksum Offload (IPv4)    | Rx & Tx Enabled             | *UDPChecksum... {3}    |               |
| iSCSI | UDP Checksum Offload (IPv6)    | Rx & Tx Enabled             | *UDPChecksum... {3}    |               |
| iSCSI | Forwarding Optimization        | Disabled                    | ForwardingOp... {0}    |               |
| iSCSI | Hyper-V Network Adapter Name   |                             | HyperNetwor... {--}    |               |
| iSCSI | Network Address                | --                          | NetworkAddress {--}    |               |
| iSCSI | Receive Buffer Size            | 8MB                         | ReceiveBuffe... {8192} |               |
| iSCSI | Send Buffer Size               | 1MB                         | SendBufferSize {1024}  |               |
| iSCSI | VLAN ID                        | 0                           | VlanID {0}             |               |

- Look for the property related to Jumbo Frames or Jumbo Packet and use the exact DisplayName as it appears:

○ **Set-NetAdapterAdvancedProperty -Name "iSCSI" -DisplayName "Jumbo Packet" -DisplayValue "9014 Bytes"**

| 063-SAN on STEVE-PC - Virtual Machine Connection  |                                |                             |                        |               |
|---------------------------------------------------|--------------------------------|-----------------------------|------------------------|---------------|
| File                                              | Action                         | Media                       | View                   | Help          |
| <b>Administrator: C:\Windows\system32\cmd.exe</b> |                                |                             |                        |               |
| Name                                              | DisplayName                    | DisplayValue                | RegistryKeyword        | RegistryValue |
| iSCSI                                             | IPv4 Checksum Offload          | Rx & Tx Enabled             | *IPChecksumO... {3}    |               |
| iSCSI                                             | TBSeC Offload                  | Auth Header and ESP Enabled | *IPsecOffloadV2 {3}    |               |
| iSCSI                                             | Jumbo Packet                   | 9014 Bytes                  | *JumboPacket {9014}    |               |
| iSCSI                                             | Large Send Offload Version ... | Enabled                     | *LsoV2IPv4 {1}         |               |
| iSCSI                                             | Large Send Offload Version ... | Enabled                     | *LsoV2IPv6 {1}         |               |
| iSCSI                                             | Max Number of RSS Processors   | 16                          | *MaxRssProce... {16}   |               |
| iSCSI                                             | Network Direct (RDMA)          | Disabled                    | *NetworkDirect {0}     |               |
| iSCSI                                             | Maximum Number of RSS Queues   | 16                          | *NumRssQueues {16}     |               |
| iSCSI                                             | Packet Direct                  | Disabled                    | *PacketDirect {0}      |               |
| iSCSI                                             | Recv Segment Coalescing (IPv4) | Enabled                     | *RscIPv4 {1}           |               |
| iSCSI                                             | Recv Segment Coalescing (IPv6) | Enabled                     | *RscIPv6 {1}           |               |
| iSCSI                                             | Receive Side Scaling           | Enabled                     | *RSS {1}               |               |
| iSCSI                                             | RSS Base Processor Number      | 0                           | *RssBaseProc... {0}    |               |
| iSCSI                                             | Maximum RSS Processor Number   | 63                          | *RssMaxProcN... {63}   |               |
| iSCSI                                             | RSS Profile                    | NUMA Scaling Static         | *RSSProfile {4}        |               |
| iSCSI                                             | TCP Checksum Offload (IPv4)    | Rx & Tx Enabled             | *TCPChecksum... {3}    |               |
| iSCSI                                             | TCP Checksum Offload (IPv6)    | Rx & Tx Enabled             | *TCPChecksum... {3}    |               |
| iSCSI                                             | UDP Checksum Offload (IPv4)    | Rx & Tx Enabled             | *UDPChecksum... {3}    |               |
| iSCSI                                             | UDP Checksum Offload (IPv6)    | Rx & Tx Enabled             | *UDPChecksum... {3}    |               |
| iSCSI                                             | Forwarding Optimization        | Disabled                    | ForwardingOp... {0}    |               |
| iSCSI                                             | Hyper-V Network Adapter Name   |                             | HyperNetwor... {--}    |               |
| iSCSI                                             | Network Address                | --                          | NetworkAddress {--}    |               |
| iSCSI                                             | Receive Buffer Size            | 8MB                         | ReceiveBuffe... {8192} |               |
| iSCSI                                             | Send Buffer Size               | 1MB                         | SendBufferSize {1024}  |               |
| iSCSI                                             | VLAN ID                        | 0                           | VlanID {0}             |               |

- After applying these settings, you may need to restart the network adapter for the changes to take effect. You can disable and then re-enable the adapter like so:

○ **Disable-NetAdapter -Name "iSCSI" -Confirm:\$false**  
 ○ **Enable-NetAdapter -Name "iSCSI"**

```
PS C:\Users\Administrator> Disable-NetAdapter -Name "iSCSI" -Confirm:$false
>> Enable-NetAdapter -Name "iSCSI"
>>
PS C:\Users\Administrator>
```

## Create a Nested Hyper-V Server (063-HV1):

### First Level Guest Virtual Machine HV1:

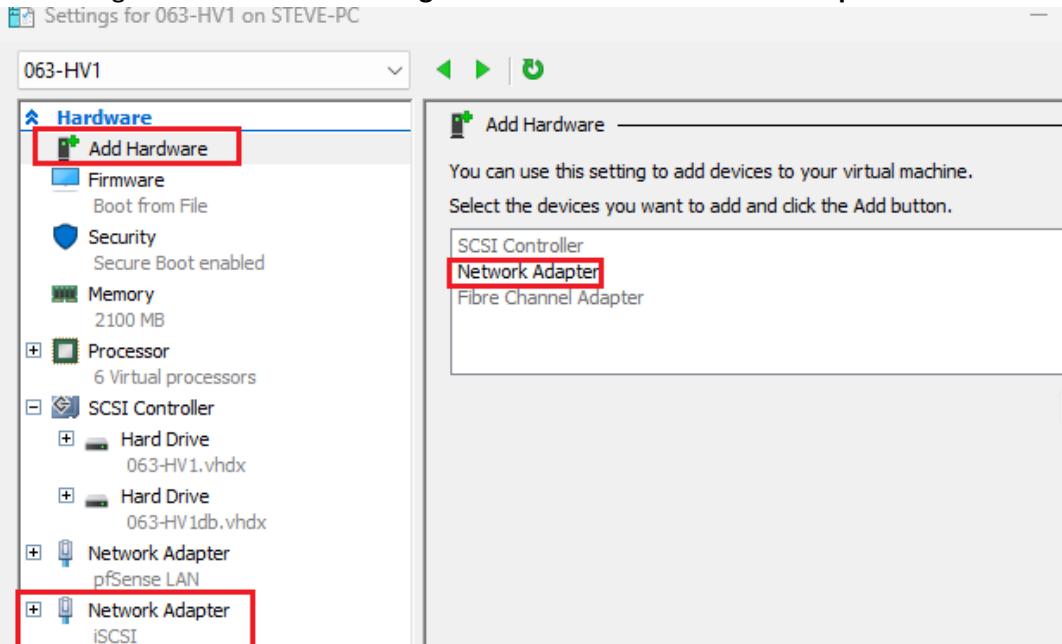
- This will be configured as the first level VM which the Nested Hypervisor will be installed on
- Opening Hyper-V Manager on Windows host machine

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Install Windows Server Core 2022 – Differencing Disk
  - **Create a New Virtual Machine**
    - Actions > New > Virtual Machine – This will launch the Wizard
  - Specify Name and Location
    - **063-HV1**
    - Create VM in designated VHDX folder on a separate partition
  - Assign Memory
    - Choose Generation 2 (Gen 2 supports UEFI and Secure Boot)
    - Allocate **3100MB** for the RAM
      - We need sufficient memory to run a nested VM
    - Uncheck Dynamic Memory to provide stable performance
  - Configure Networking
    - In this instance we will select the **pfSense LAN** that was created earlier
  - Connect Virtual Hard Disk
    - **30GB**
- Following best practices, we will **disable automatic checkpoints in Settings and enable guest services**

### Create iSCSI Network Switch (063-HV1):

- In Hyper-V Manager on the host machine”
  - Right click **063-HV1** > **Settings** > **Add Hardware** > **Network Adapter** > **iSCSI**



- Navigate to **063-HV1**
- Rename the Network Switch
  - Use command **Get-NetAdapter** to select the appropriate Network Adapter-
  - **Rename-NetAdapter -Name "Ethernet" -NewName "iSCSI"**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

```
PS C:\> get-netadapter
Name           InterfaceDescription          ifIndex Status     MacAddress      LinkSpeed
----           -----                   -----   -----   -----
vFSense LAN    Microsoft Hyper-V Network Adapter       7 Up      00-15-5D-01-85-CA  10 Gbps
iSCSI          Microsoft Hyper-V Network Adapter #2      4 Up      00-15-5D-01-85-CC  10 Gbps

PS C:\>
```

- Set a static IP for iSCSI vSwitch

- `New-NetIPAddress -InterfaceAlias "iSCSI" -IPAddress 192.168.10.2 -PrefixLength 29`

```
=====
Network adapter settings
=====

NIC index: 3
Description: Microsoft Hyper-V Network Adapter #
IP address: 192.168.10.2,
fe80::8b38:a222:165f:813f
Subnet mask: 255.255.255.248
DHCP enabled: False

Default gateway:
Preferred DNS server:
Alternate DNS server:

1) Set network adapter address
2) Set DNS servers
3) Clear DNS server settings

Enter selection (Blank=Cancel): -
```

Enable Jumbo Frames:

- On **063-HV1** from the console run option 15 for PowerShell
- Enter the command: **Get-NetAdapterAdvancedProperty -Name "iSCSI"**
- This will tell us if Jumbo Packets are enabled or not, if not we need to run the command:
  - **Set-NetAdapterAdvancedProperty -Name "iSCSI" -DisplayName "Jumbo Packet" -DisplayValue "9014 Bytes"**
- **Jumbo Packet (9014)**

```
Administrator: C:\Windows\system32\cmd.exe
-----
iSCSI          IPv4 Checksum Offload      Rx & Tx Enabled      *IPChecksumOffload {3}
iSCSI          TPsec Offload            Auth Header and ESP Enabled  *TPsecOffloadV2 {3}
iSCSI          Jumbo Packet             9014 Bytes          *JumboPacket {9014}
iSCSI          Large Send Offload Version ... Enabled      *Lsov2IPv4 {1}
iSCSI          Large Send Offload Version ... Enabled      *Lsov2IPv6 {1}
iSCSI          Max Number of RSS Processors 16          *MaxRssProcessors {16}
iSCSI          Network Direct (RDMA)        Disabled        *NetworkDirect {0}
iSCSI          Maximum Number of RSS Queues 16          *NumRssQueues {16}
iSCSI          Packet Direct             Disabled        *PacketDirect {0}
iSCSI          Recv Segment Coalescing (IPv4) Enabled      *RscIPv4 {1}
iSCSI          Recv Segment Coalescing (IPv6) Enabled      *RscIPv6 {1}
iSCSI          Receive Side Scaling       Enabled        *RSS {1}
iSCSI          RSS Base Processor Number 0           *RssBaseProcessor {0}
iSCSI          Maximum RSS Processor Number 63          *RssMaxProcessor {63}
iSCSI          RSS Profile               NUMA Scaling Static  *RSSProfile {4}
iSCSI          TCP Checksum Offload (IPv4) Rx & Tx Enabled  *TCPChecksumOffload {3}
iSCSI          TCP Checksum Offload (IPv6) Rx & Tx Enabled  *TCPchecksumOffload {3}
```

Disable the Firewall on (063-HV1):

- **Set-NetFirewallProfile -Profile Domain -Enabled False**
- **Set-NetFirewallProfile -Profile Private -Enabled False**
- **Set-NetFirewallProfile -Profile Public -Enabled False**

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### Enabling Nested Virtualization (063-HV1):

- To enable nested virtualization in Hyper-V, you must expose the host's virtualization extensions, such as VT-x for Intel and AMD-V for AMD
- To enable the virtualization extension, invoke the **Set-VMProcessor** cmdlet:
  - o Open PowerShell as admin on the Hyper-V host machine (Windows 11 Lenovo)
  - o First, we must find the name of the VM we wish to enable nested virtualization on which is **063-HV1**:
    - Run the command **Get-VM**

```
PS C:\Users\Steve> Get-VM

Name      State    CPUUsage(%) MemoryAssigned(M) Uptime          Status      Version
----      ----    %           MB           -----          -----
063-DC1   Running  0            700          04:42:05.0690000 Operating normally 11.0
063-FW    Running  0            500          04:42:57.1130000 Operating normally 11.0
063-HV1   Running  0            4096         00:06:40.8720000 Operating normally 11.0
063-LinDHCP Running  0            500          04:40:27.9840000 Operating normally 11.0
063-SAN   Running  0            500          04:39:38.8450000 Operating normally 11.0
Test      Off      0            0             00:00:00          Operating normally 11.0

PS C:\Users\Steve>
```

- Once that has been identified we can run the command to enable virtualization extensions on the VM's virtual processor:
  - o **Set-VMProcessor -VMName 063-HV1 -ExposeVirtualizationExtensions \$true**
  - o Click Enter

```
PS C:\Users\Steve> Set-VMProcessor -VMName 063-HV1 -ExposeVirtualizationExtensions $true
PS C:\Users\Steve>
```

- To test and confirm that the command was successful, run the command:
  - o **(Get-VMProcessor -VMName 063-HV1).ExposeVirtualizationExtensions**
- Click Enter

```
PS C:\Users\Steve> (Get-VMProcessor -VMName 063-HV1).ExposeVirtualizationExtensions
True
PS C:\Users\Steve>
```

### Create a Secondary Disk for (063-HV1):

- We will create a secondary storage disk to hold all Database files
  - o Run script on Host (Windows 11 Lenovo) using **PowerShell ISE Administrator**
- **\$VHDXname = Read-Host -Prompt 'Input VHDX name'**
- **\$SizeInGB = Read-Host -Prompt 'Input the size in GB. Ex 5, 10'**
- **\$VMName = Read-Host -Prompt 'Input target VM name'**
- **\$VHDPath = "V:\VMs\VHDX\" + \$VHDXname + ".vhdx"**
- **\$SizeBytes = (\$SizeInGB/1 \* 1073741824)**

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- \$alreadyExists = Test-Path -Path \$VHDPath
- 
- if (\$alreadyExists) {  
    Write-Error "Error. The VHDX already exists"  
    return  
}
- New-VHD -Path \$VHDPath -Dynamic -SizeBytes \$SizeBytes | Mount-VHD -Passthru | Initialize-Disk -Passthru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS -Confirm:\$false -Force
- Dismount-VHD -Path \$VHDPath
- # Optimize-VHD -Path \$VHDPath -Mode Full
- Add-VMHardDiskDrive -VMName \$VMName -Path \$VHDPath
- VHDX name: **063-HV1db.vhdx**
- Size of Disk: **30GB**
- Target VM name: **063-HV1**

```
PS C:\Windows\system32> C:\Users\Steve\Desktop\Secondary Disk Script.ps1
Input VHDX name: 063-HV1db
Input the size in GB. Ex 5, 10, 30
Input target VM name: 063-HV1

DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining     Size
-----   -----
E          NTFS      Fixed       Healthy      OK           29.92 GB 29.98 GB

PS C:\Windows\system32>
```

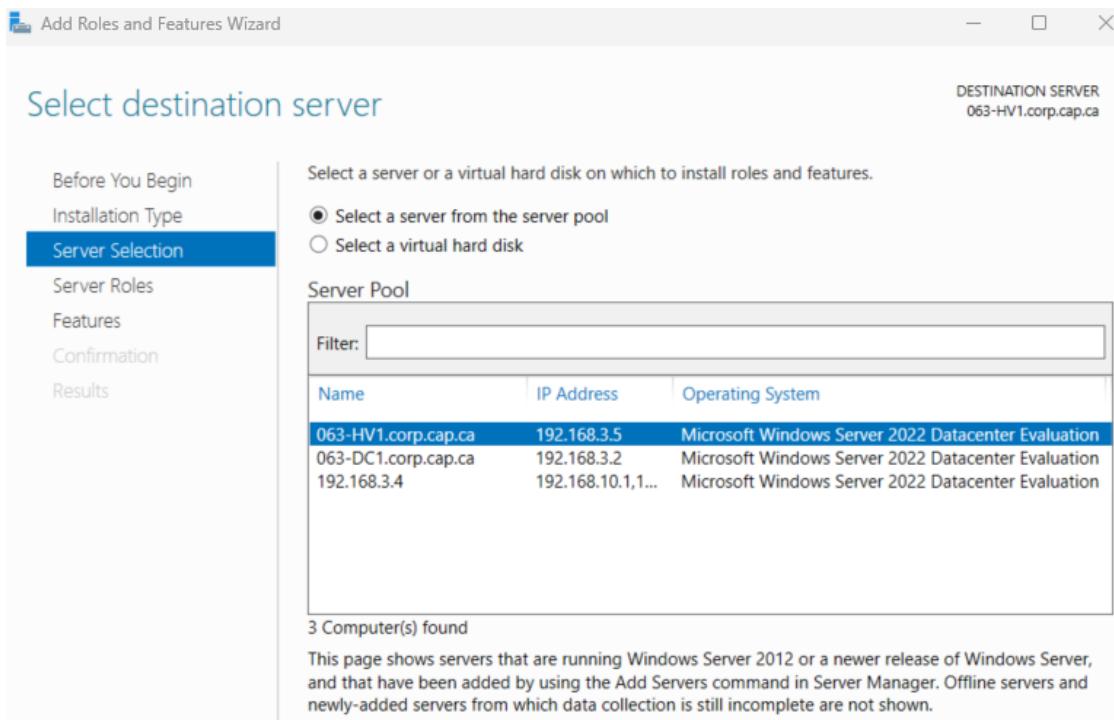
- Bring the Disk Online using Server Manager on Host:
  - o Refresh Server Manager
    - File and Storage Services > Volumes > Disks > Right Click > Bring Online
- The Disk is located on the **D: Drive**

| DISKS               |              |            |          |             |           |           |           |                           |                   |      |
|---------------------|--------------|------------|----------|-------------|-----------|-----------|-----------|---------------------------|-------------------|------|
| All disks   6 total |              |            |          |             |           |           |           |                           |                   |      |
| Number              | Virtual Disk | Status     | Capacity | Unallocated | Partition | Read Only | Clustered | Subsystem                 | Bus Type          | Name |
| 0                   | 063-DC1 (2)  | Online     | 30.0 GB  | 1.00 MB     | GPT       |           |           | SAS                       | Msft Virtual Disk |      |
| 1                   | 1            | Online     | 30.0 GB  | 0.00 B      | GPT       |           |           | SAS                       | Msft Virtual Disk |      |
| 0                   | 063-HV1 (2)  | Online     | 30.0 GB  | 1.00 MB     | GPT       |           |           | SAS                       | Msft Virtual Disk |      |
| 1                   | 1            | Online     | 30.0 GB  | 0.00 B      | GPT       |           |           | SAS                       | Msft Virtual Disk |      |
| 0                   | 063-SAN (2)  | Online     | 30.0 GB  | 1.00 MB     | GPT       |           |           | SAS                       | Msft Virtual Disk |      |
| 9                   | 9            | Production | 200 GB   | 0.00 B      | GPT       |           |           | Windows S... Storage S... | Production        |      |

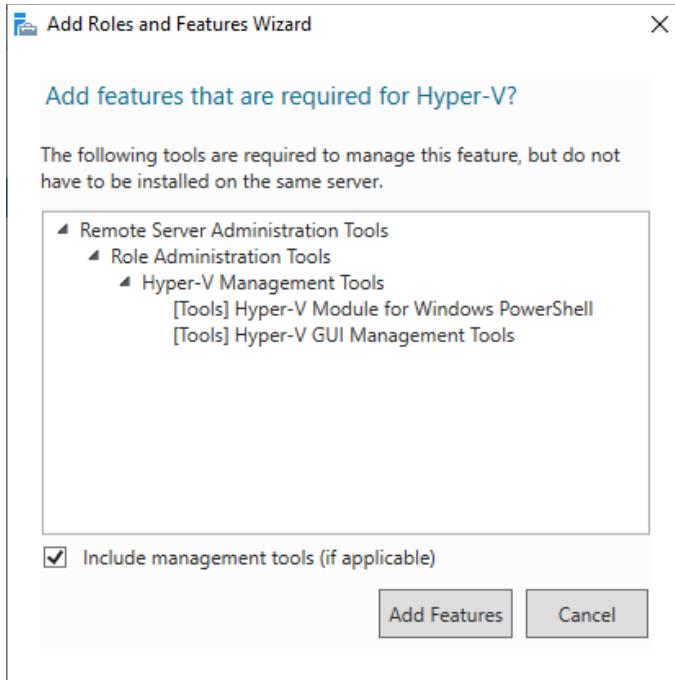
### Installing Hyper-V on (063-HV1) (The first level VM):

- Open Server Manager, click Add role and Features
  - o Choose Role-based or feature-based installation
- Select destination server: **063-HV1**

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- Check the Hyper-V role
- Add Features:



- Click Next

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

Hyper-V allows you to virtualize your server workloads by running those workloads on virtual machines. You can use virtual machines to consolidate multiple workloads on one physical server, to improve server availability, and to increase efficiency in developing and testing software.

Things to note:

- Before you install this role, you should identify which network connections on this server you want to use for setting up virtual switches.
- After you install Hyper-V, you can use Hyper-V Manager to create and configure your virtual machines.

- Create Virtual Switches:
  - o Skip this page, leave the Ethernet option unchecked because we will create an external vSwitch after

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 type="checkbox"/> Ethernet | Microsoft Hyper-V Network Adapter |

*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.*

- Virtual Machine Migration:
  - o Leave as Default

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

Hyper-V can be configured to send and receive live migrations of virtual machines on this server. Configuring Hyper-V now enables any available network on this server to be used for live migrations. If you want to dedicate specific networks for live migration, use Hyper-V settings after you install the role.

Allow this server to send and receive live migrations of virtual machines

Authentication protocol

Select the protocol you want to use to authenticate live migrations.

Use Credential Security Support Provider (CredSSP)  
This protocol is less secure than Kerberos, but does not require you to set up constrained delegation. To perform a live migration, you must be logged on to the source server.

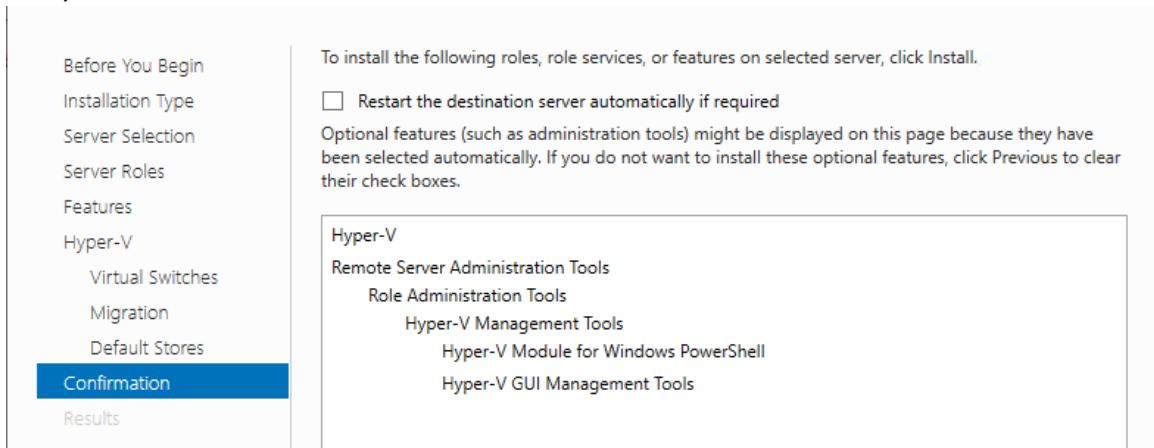
Use Kerberos  
This protocol is more secure but requires you to set up constrained delegation in your environment to perform tasks such as live migration when managing this server remotely.

**⚠️** If this server will be part of a cluster, do not enable migration now. Instead, you will configure the server for live migration, including specifying networks, when you create the cluster.

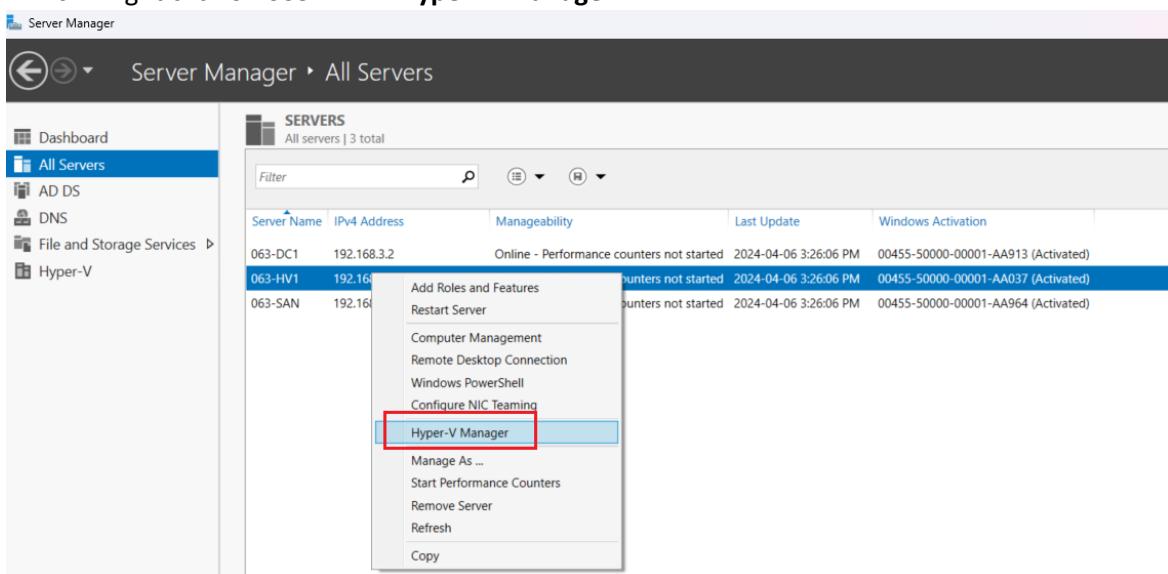
- Default Stores:

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- Set the default storage location for virtual machines and virtual hard disks
- For this setting we will use the root of D: Drive (Secondary Disk)
  - Default location for virtual hard disk files:
    - **D:\VHDX Files**
  - Default location for virtual machine configuration files:
    - **D:\Virtual Machines**
- The final screen allows you to review the basic options that you chose and optionally export them. It also allows you to enable an automatic reboot to enable Hyper-V. Click Install when ready:

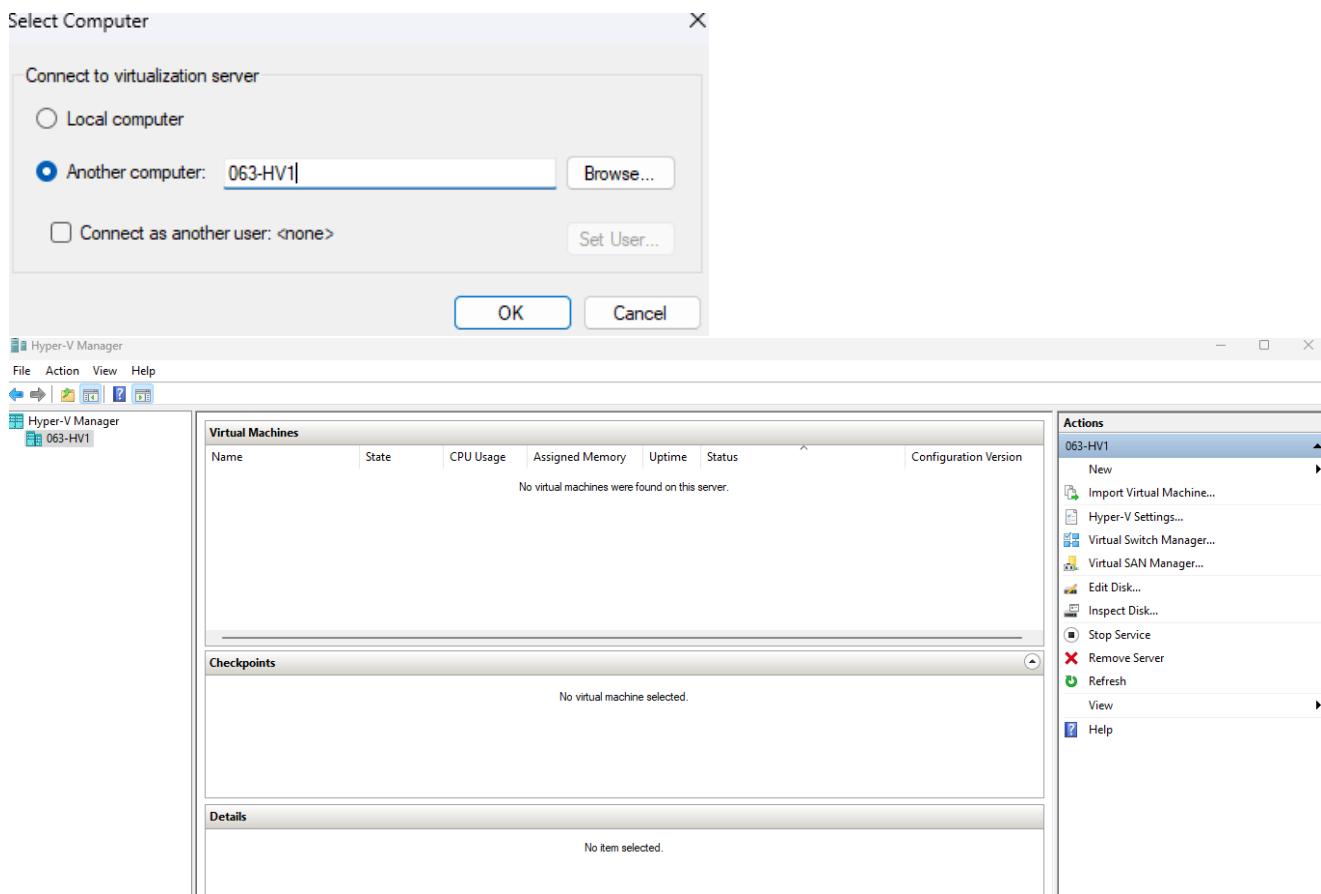


- To access Hyper-V on **063-HV1**:
  - Navigate to the Host
  - Right click on **063-HV1 > Hyper-V Manager**



- Connect to Server:

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### Create a Nested Hyper-V Server (063-HV2):

#### First Level Guest Virtual Machine HV2:

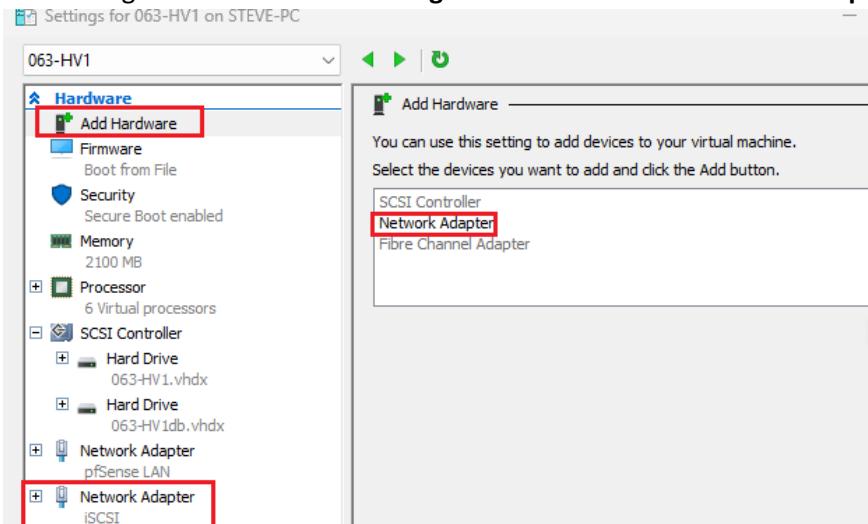
- This will be configured as the first level VM which the Nested Hypervisor will be installed on
- Opening Hyper-V Manager on Windows host machine
  - o **Create a New Virtual Machine**
    - **Actions > New > Virtual Machine** – This will launch the Wizard
  - o Specify Name and Location
    - **063-HV2**
    - Create VM in designated VHDX folder on a separate partition
  - o Assign Memory
    - Choose **Generation 2** (Gen 2 supports UEFI and Secure Boot)
    - Allocate **3096MB** for the RAM
      - We need sufficient memory to run a nested VM
      - Uncheck Dynamic Memory to provide stable performance
  - o Configure Networking
    - In this instance we will select the **pfSense LAN** that was created earlier
  - o Connect Virtual Hard Disk
    - **30GB**

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- Following best practices, we will **disable automatic checkpoints in Settings and enable guest services**

### Create iSCSI Network Switch (063-HV2):

- In Hyper-V Manager on the host machine"
  - o Right click **063-HV2 > Settings > Add Hardware > Network Adapter > iSCSI**



- Navigate to **063-HV2**
- Rename the Network Switch
  - o Use command **Get-NetAdapter** to select the appropriate Network Adapter-
  - o **Rename-NetAdapter -Name "Ethernet" -NewName "iSCSI"**

```
PS C:\> get-netadapter
Name           InterfaceDescription      ifIndex Status     MacAddress      LinkSpeed
--           --                         --       --       --           --
pfSense LAN    Microsoft Hyper-V Network Adapter      7 Up      00-15-5D-01-85-CA  10 Gbps
iSCSI          Microsoft Hyper-V Network Adapter #2      4 Up      00-15-5D-01-85-CC  10 Gbps
PS C:\>
```

- Set a static IP for iSCSI vSwitch
  - o **New-NetIPAddress -InterfaceAlias "iSCSI" -IPAddress 192.168.10.3 -PrefixLength 29**

```
C:\> Administrator: C:\Windows\system32\cmd.exe
=====
                           Network adapter settings
=====

NIC index:      3
Description:   Microsoft Hyper-V Network Adapter #2
IP address:   192.168.10.3,
              fe80::6c6c:96fd:d1dd:5a5d
Subnet mask:  255.255.255.248
DHCP enabled: False

Default gateway:
Preferred DNS server:
Alternate DNS server:

  1) Set network adapter address
  2) Set DNS servers
  3) Clear DNS server settings

Enter selection (Blank=Cancel):
```

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Enable Jumbo Frames:

- On **063-HV2** from the console run option 15 for PowerShell
- Enter the command: **Get-NetAdapterAdvancedProperty -Name "iSCSI"**
- This will tell us if Jumbo Packets are enabled or not, if not we need to run the command:
  - o **Set-NetAdapterAdvancedProperty -Name "iSCSI" -DisplayName "Jumbo Packet" -DisplayValue "9014 Bytes"**

### Jumbo Packet (9014)

| Administrator: C:\Windows\system32\cmd.exe |                                |                             |                             |
|--------------------------------------------|--------------------------------|-----------------------------|-----------------------------|
| iSCSI                                      | IPv4 Checksum Offload          | Rx & Tx Enabled             | *IPChecksumOffload {3}      |
| iSCSI                                      | TSPec Offload                  | Auth Header and ESP Enabled | *TPsecOffloadV2 {3}         |
| <b>iSCSI</b>                               | <b>Jumbo Packet</b>            | <b>9014 Bytes</b>           | <b>*JumboPacket {9014}</b>  |
| iSCSI                                      | Large Send Offload Version ... | Enabled                     | *LsoV2IPv4 {1}              |
| iSCSI                                      | Large Send Offload Version ... | Enabled                     | *LsoV2IPv6 {1}              |
| iSCSI                                      | Max Number of RSS Processors   | 16                          | *MaxRssProcessors {16}      |
| iSCSI                                      | Network Direct (RDMA)          | Disabled                    | *NetworkDirect {0}          |
| iSCSI                                      | Maximum Number of RSS Queues   | 16                          | *NumRssQueues {16}          |
| iSCSI                                      | Packet Direct                  | Disabled                    | *PacketDirect {0}           |
| iSCSI                                      | Recv Segment Coalescing (IPv4) | Enabled                     | *RscIPv4 {1}                |
| iSCSI                                      | Recv Segment Coalescing (IPv6) | Enabled                     | *RscIPv6 {1}                |
| iSCSI                                      | Receive Side Scaling           | Enabled                     | *RSS {1}                    |
| iSCSI                                      | RSS Base Processor Number      | 0                           | *RssBaseProcessorNumber {0} |
| iSCSI                                      | Maximum RSS Processor Number   | 63                          | *RssMaxProcNumber {63}      |
| iSCSI                                      | RSS Profile                    | NUMA Scaling Static         | *RSSProfile {4}             |
| iSCSI                                      | TCP Checksum Offload (IPv4)    | Rx & Tx Enabled             | *TCPChecksumOffload {3}     |
| iSCSI                                      | TCP Checksum Offload (IPv6)    | Rx & Tx Enabled             | *TCPChecksumOffload {3}     |

Disable the Firewall on (063-HV2):

- **Set-NetFirewallProfile -Profile Domain -Enabled False**
- **Set-NetFirewallProfile -Profile Private -Enabled False**
- **Set-NetFirewallProfile -Profile Public -Enabled False**

Enabling Nested Virtualization (063-HV2):

- To enable nested virtualization in Hyper-V, you must expose the host's virtualization extensions, such as VT-x for Intel and AMD-V for AMD
- To enable the virtualization extension, invoke the **Set-VMProcessor** cmdlet:
  - o Open PowerShell as admin on the Hyper-V host machine (Windows 11 Lenovo)
  - o First, we must find the name of the VM we wish to enable nested virtualization on which is **063-HV2**:

- Run the command **Get-VM**

| Windows PowerShell                                                                                                               |                |             |                   |                         |                           |             |
|----------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|-------------------|-------------------------|---------------------------|-------------|
| Copyright (C) Microsoft Corporation. All rights reserved.                                                                        |                |             |                   |                         |                           |             |
| Install the latest PowerShell for new features and improvements! <a href="https://aka.ms/PSWindows">https://aka.ms/PSWindows</a> |                |             |                   |                         |                           |             |
| PS C:\Users\Steve> Get-VM                                                                                                        |                |             |                   |                         |                           |             |
| Name                                                                                                                             | State          | CPUUsage(%) | MemoryAssigned(M) | Uptime                  | Status                    | Version     |
| 063-DC1                                                                                                                          | Running        | 0           | 700               | 03:27:32.1310000        | Operating normally        | 11.0        |
| 063-FW                                                                                                                           | Running        | 0           | 500               | 03:28:24.1260000        | Operating normally        | 11.0        |
| 063-HV1                                                                                                                          | Running        | 0           | 2100              | 03:25:31.5310000        | Operating normally        | 11.0        |
| <b>063-HV2</b>                                                                                                                   | <b>Running</b> | <b>0</b>    | <b>2100</b>       | <b>03:24:59.9850000</b> | <b>Operating normally</b> | <b>11.0</b> |
| 063-LinDHCP                                                                                                                      | Running        | 0           | 500               | 03:24:23.5230000        | Operating normally        | 11.0        |
| 063-SAN                                                                                                                          | Running        | 0           | 500               | 03:26:13.8400000        | Operating normally        | 11.0        |
| 063-Test                                                                                                                         | Off            | 0           | 0                 | 00:00:00                | Operating normally        | 11.0        |

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- Once that has been identified we can run the command to enable virtualization extensions on the VM's virtual processor:
  - o Set-VMProcessor -VMName 063-HV2 -ExposeVirtualizationExtensions \$true
  - o Click Enter

```
PS C:\Users\Steve> Set-VMProcessor -VMName 063-HV2 -ExposeVirtualizationExtensions $true
```

- To test and confirm that the command was successful, run the command:
  - o (Get-VMProcessor -VMName 063-HV1).ExposeVirtualizationExtensions

- Click Enter

```
PS C:\Users\Steve> (Get-VMProcessor -VMName 063-HV2).ExposeVirtualizationExtensions  
True  
PS C:\Users\Steve>
```

### Create a Secondary Disk for (063-HV2):

- We will create a secondary storage disk to hold all Database files
  - o Run script on Host (Windows 11 Lenovo) using **PowerShell ISE Administrator**
- ```
$VHDXname = Read-Host -Prompt 'Input VHDX name'  
$SizeInGB = Read-Host -Prompt 'Input the size in GB. Ex 5, 10'  
$VMName = Read-Host -Prompt 'Input target VM name'  
$VHDPATH = "V:\VMs\VHDX\" + $VHDXname + ".vhdx"  
$SizeBytes = ($SizeInGB/1 * 1073741824)  
$alreadyExists = Test-Path -Path $VHDPATH  
  
if ($alreadyExists) {  
    Write-Error "Error. The VHDX already exists"  
    return  
}  
  
New-VHD -Path $VHDPATH -Dynamic -SizeBytes $SizeBytes | Mount-VHD -Passthru | Initialize-Disk -Passthru  
| New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS -Confirm:$false -Force  
Dismount-VHD -Path $VHDPATH  
# Optimize-VHD -Path $VHDPATH -Mode Full  
Add-VMHardDiskDrive -VMName $VMName -Path $VHDPATH
```
- VHDX name: **063-HV2db.vhdx**
- Size of Disk: **30GB**
- Target VM name: **063-HV2**

```
PS C:\Windows\system32> C:\Users\Steve\Desktop\Secondary Disk Script.ps1  
Input VHDX name: 063-HV1db  
Input the size in GB. Ex 5, 10: 30  
Input target VM name: 063-HV1  
  
DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining Size  
----- ----- ----- ----- ----- ----- -----  
E NTFS Fixed Healthy OK 29.92 GB 29.98 GB  
  
PS C:\Windows\system32>
```

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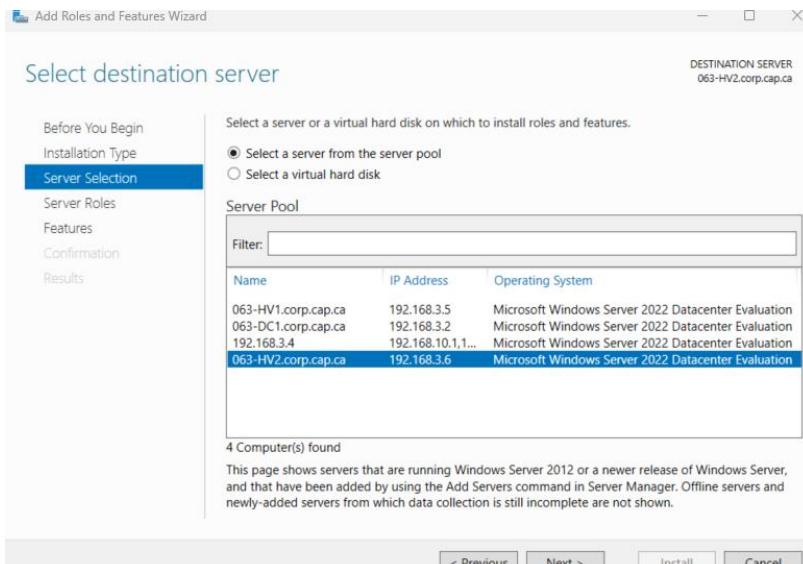
- Bring the Disk Online using Server Manager on Host:
  - o Refresh Server Manager
    - File and Storage Services > Volumes > Disks > Right Click > Bring Online

- The Disk is located on the D:

	1	Online	30.0 GB	0.00 B	GPT	SAS	MSIT VIRTUAL DISK
	063-HV2 (2)	Online	30.0 GB	1.00 MB	GPT	SAS	Msft Virtual Disk
	1	Online	30.0 GB	0.00 B	GPT	SAS	Msft Virtual Disk

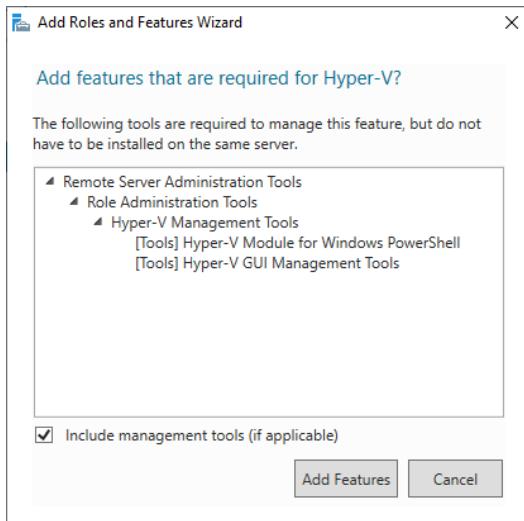
### Installing Hyper-V on (063-HV2) (The first level VM):

- Open Server Manager > click Add role and Features
- Choose Role-based or feature-based installation
- Select destination server:



- Check the Hyper-V role
- Add Features:

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- Click Next

The screenshot shows the 'Before You Begin' step of the Hyper-V setup wizard. The 'Hyper-V' tab is selected. On the right, it says: 'Hyper-V allows you to virtualize your server workloads by running those workloads on virtual machines. You can use virtual machines to consolidate multiple workloads on one physical server, to improve server availability, and to increase efficiency in developing and testing software.' Below that, it says: 'Things to note:' followed by two bullet points: 'Before you install this role, you should identify which network connections on this server you want to use for setting up virtual switches.' and 'After you install Hyper-V, you can use Hyper-V Manager to create and configure your virtual machines.' A sidebar on the left lists the following steps: Before You Begin, Installation Type, Server Selection, Server Roles, Features, Hyper-V, Virtual Switches, Migration, Default Stores, Confirmation, and Results.

- Create Virtual Switches:

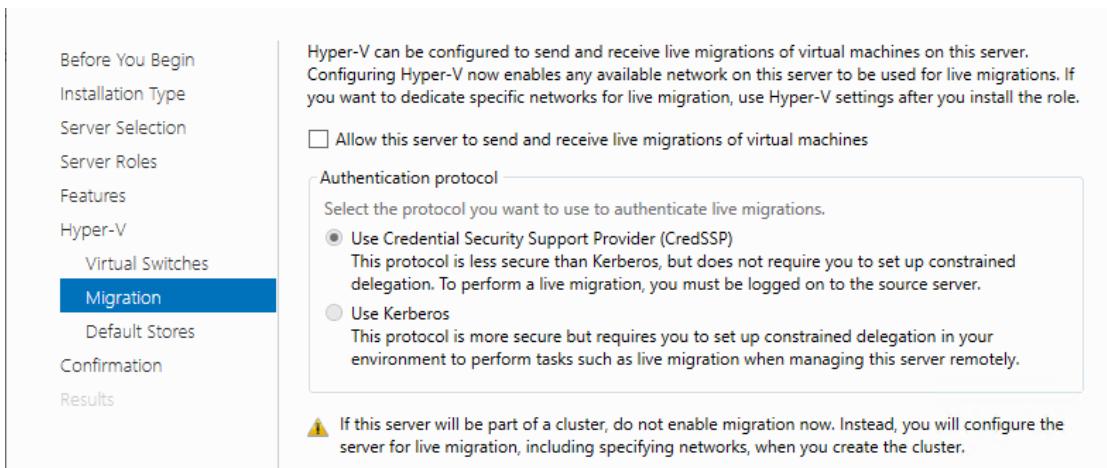
- o Skip this page, leave the Ethernet option unchecked because we will create an external vSwitch after

The screenshot shows the 'Virtual Switches' step of the Hyper-V setup wizard. The 'Virtual Switches' tab is selected. On the right, it says: '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.' Below that, it says: '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.' A sidebar on the left lists the following steps: Before You Begin, Installation Type, Server Selection, Server Roles, Features, Hyper-V, Virtual Switches, Migration, Default Stores, Confirmation, and Results. On the right, there is a table titled 'Network adapters:' with one entry: Name: Ethernet, Description: Microsoft Hyper-V Network Adapter. There is also a note: '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.'

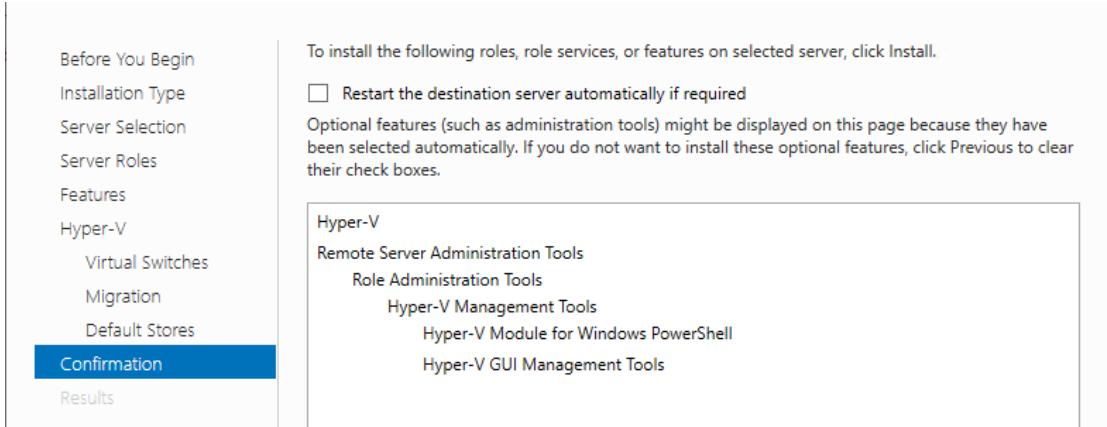
- Virtual Machine Migration:

- o Leave as default

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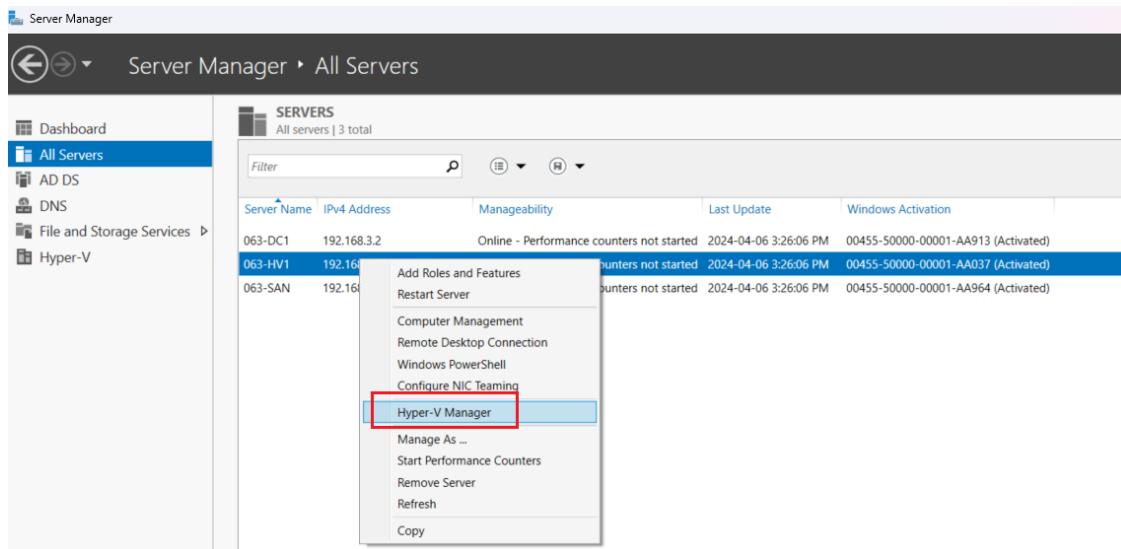


- Default Stores:
  - o Set the default storage location for virtual machines and virtual hard disks
  - o For this setting we will use the root of D: Drive (Secondary Disk)
    - Default location for virtual hard disk files:
      - D:\VHDX Files
    - Default location for virtual machine configuration files:
      - D:\Virtual Machines
- The final screen allows you to review the basic options that you chose and optionally export them. It also allows you to enable an automatic reboot to enable Hyper-V. Click Install when ready:

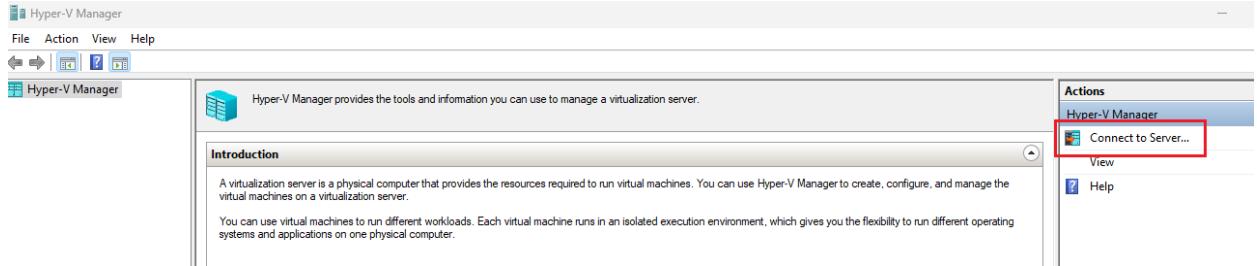


- To access Hyper-V on 063-HV2:
  - o Navigate to the Host
  - o Right click on 063-HV2 > Hyper-V Manager

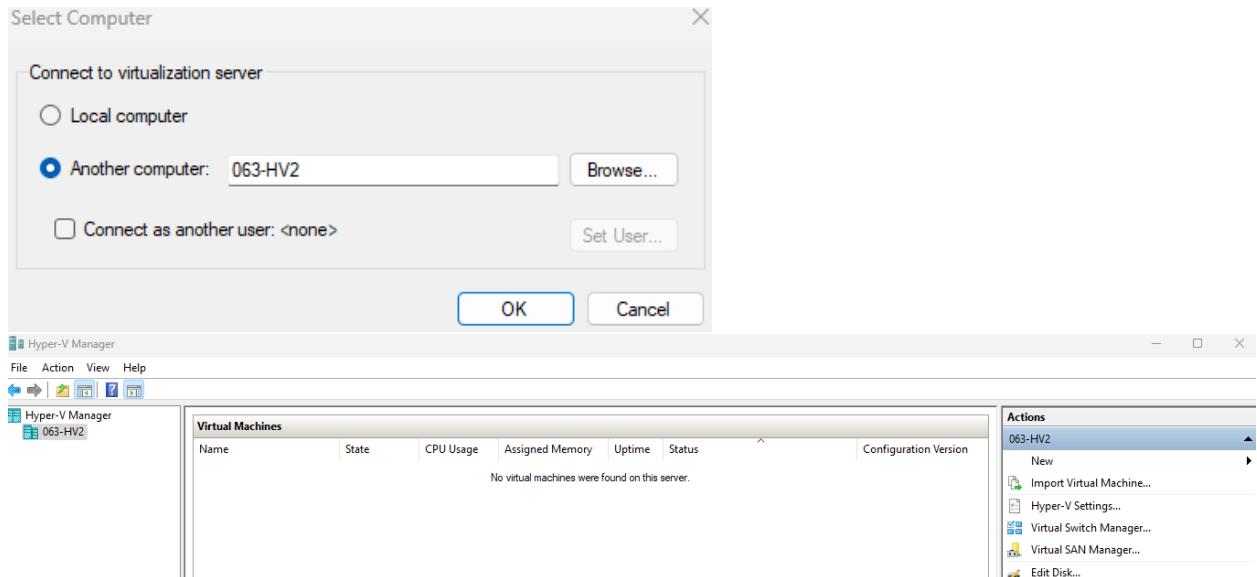
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- Connect to Server:



- Enter 063-HV2

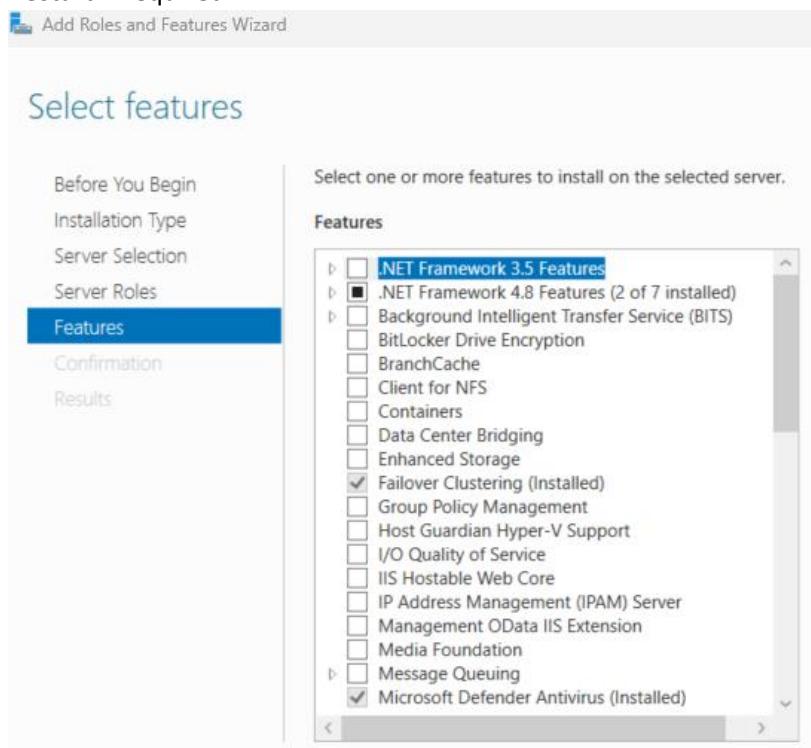


## Create a Hyper-V Failover Cluster in GUI:

- Step 1: Prepare the Nodes

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- Join to the Domain **corp.cap.ca**
  - o Both nodes **063-HV1** and **063-HV2** should be joined to the same domain
- Both should have static IPs on the same subnet
- Run Windows update on both nodes to ensure they have the latest patches
- Step 2: Install Failover Clustering Feature
  - o On **Both Nodes**:
  - o Open **Server Manager > Manage > Add Roles and Features**
- Select the appropriate server VM
  - o Either **063-HV1** or **063 HV2**
- Select “**Features**”
- Choose “**Failover Clustering**” and install
- Restart if required



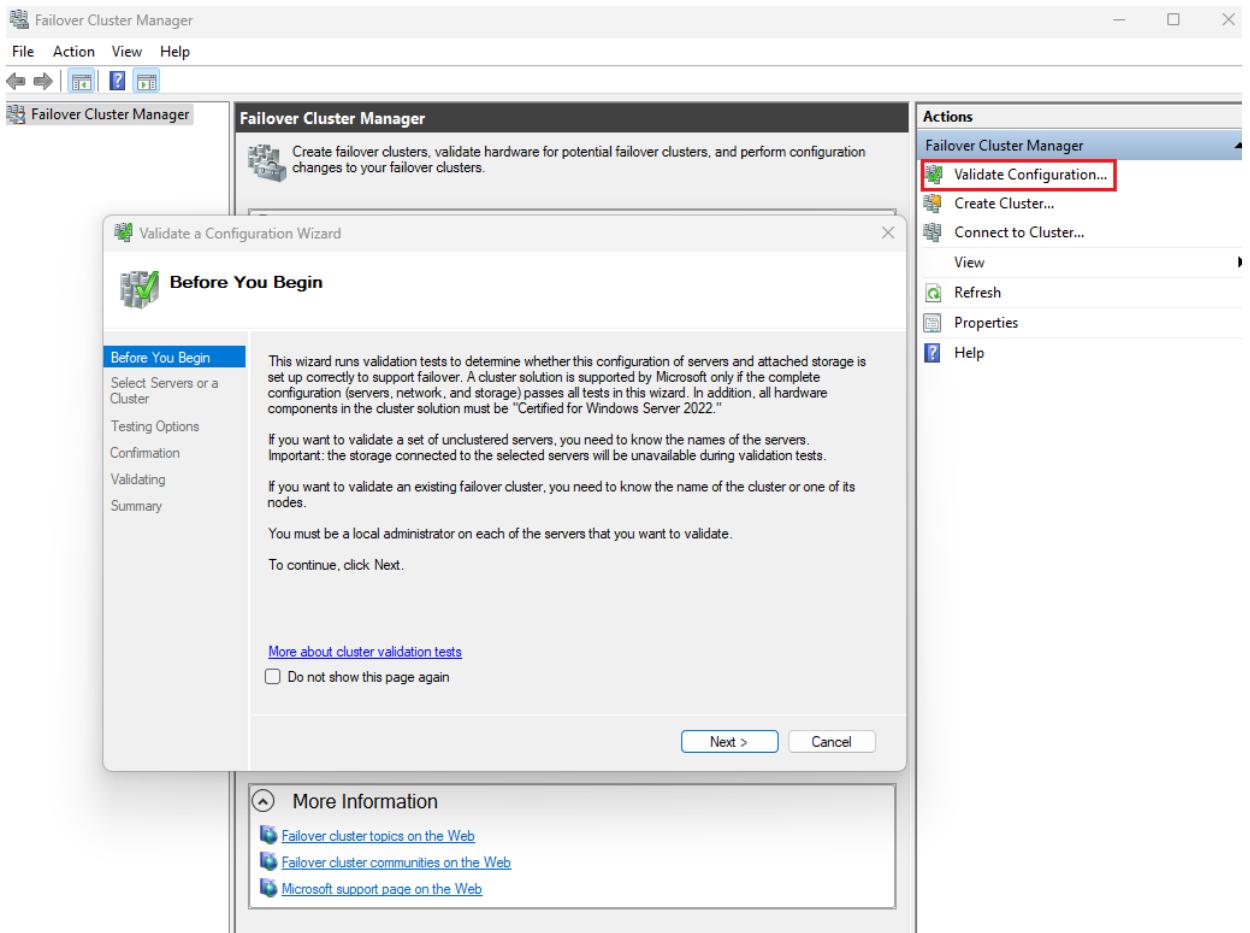
- Step 3: Validate Cluster Configuration
- Open Failover Cluster Manager: On one of the nodes, launch the **Failover Cluster Manager**

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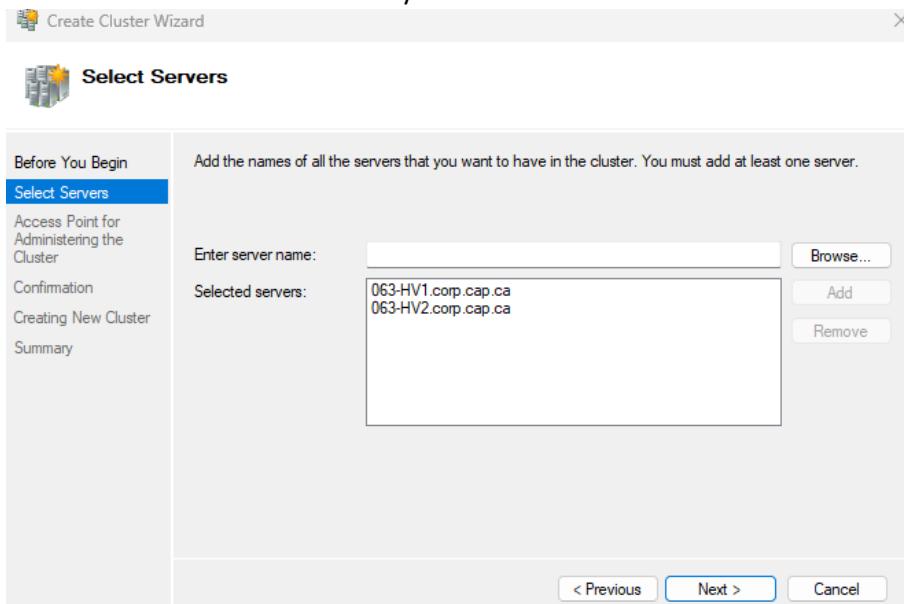
The screenshot shows the Windows Server Manager interface. The left navigation pane is open, showing 'All Servers' as the selected item. The main content area displays a table of servers with columns for 'Server Name', 'IPv4 Address', 'Manageability', 'Last Update', and 'Windows Activation'. Five servers are listed: 063-DC1, 063-HV1, 063-HV2, 063-SAN, and HyperVCluster. The 'HyperVCluster' row is currently selected. An actions pane is open on the right, listing several management options: 'Add Roles and Features', 'Restart Server', 'Computer Management', 'Remote Desktop Connection', 'Windows PowerShell', 'Configure NIC Teaming', 'Add other servers in the cluster to the server pool', 'Update Cluster', 'Failover Cluster Manager' (which is highlighted with a red box), 'Hyper-V Manager' (which is highlighted with a blue box), 'Manage As ...', 'Start Performance Counters', 'Remove This Server and Remote Servers in This Cluster', 'Refresh', and 'Copy'. Below the table, there is another section labeled 'EVENTS'.

- Validate Configuration:
- In the Actions pane, click “**Validate Configuration**”

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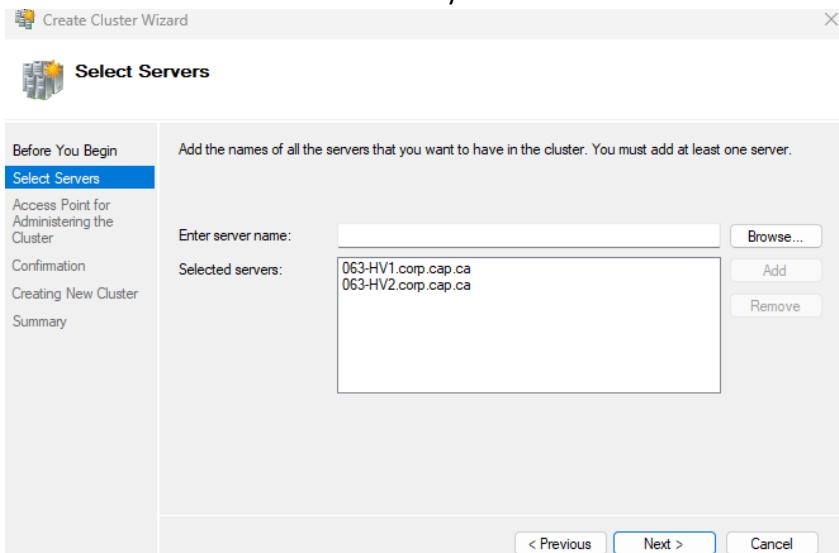
- Select Servers: Add **both nodes** by their names and click Next



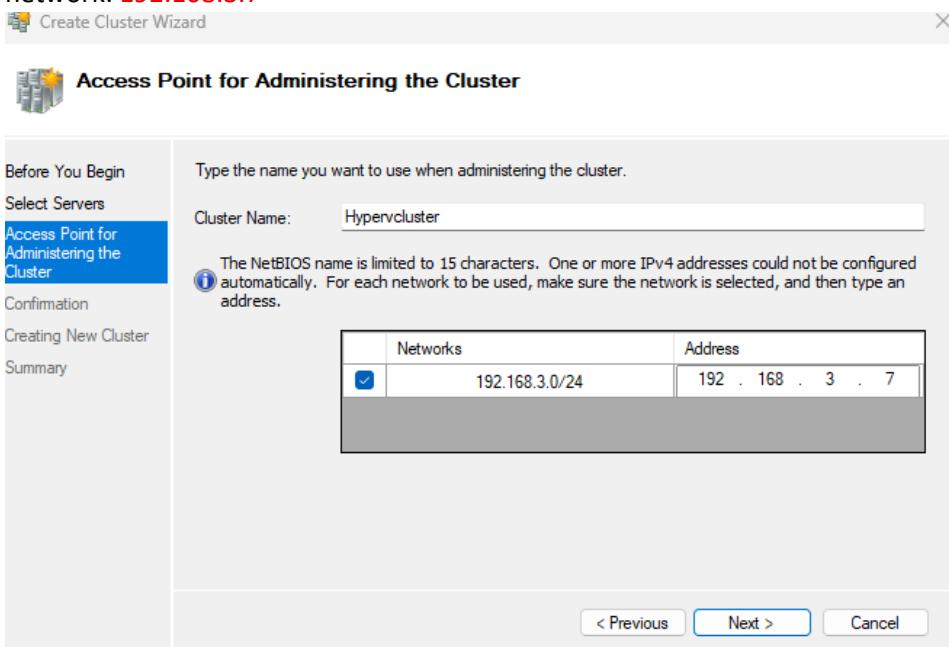
- Run all tests: Choose to run all tests, which is recommended for a first time setup

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- View Report: Once the tests complete, review the report for any warnings or errors and rectify them before proceeding
- Step 4: Create the Cluster
- Open **Failover Cluster Manager**:
  - o Create the Cluster: In the Actions pane, click “Create Cluster”
- Cluster Nodes: Add both VM nodes by name and click Next

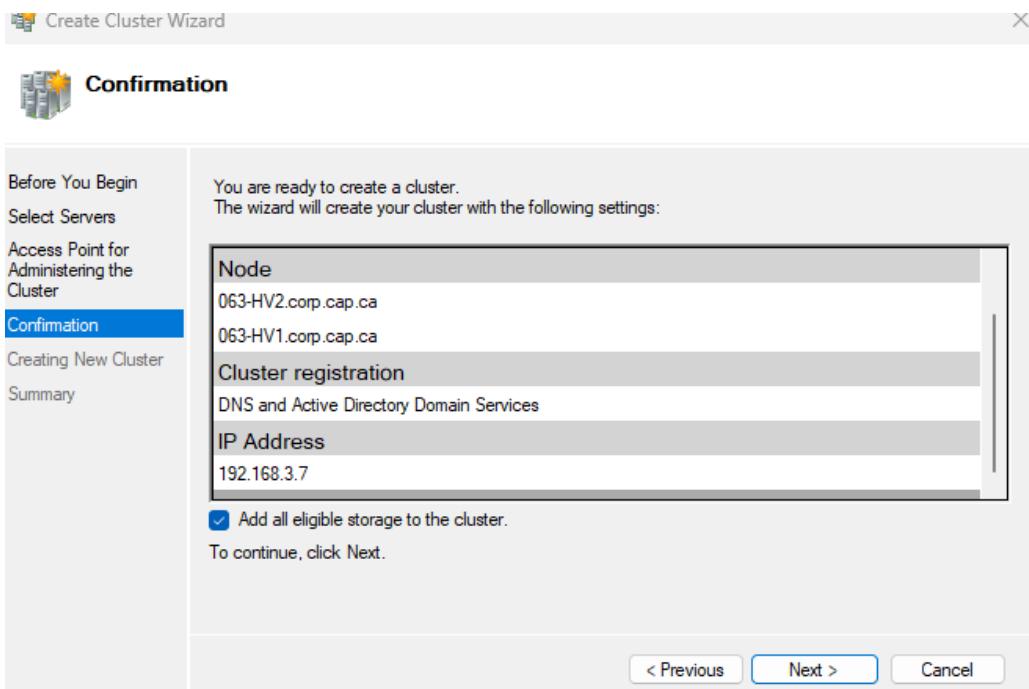


- Access Point: Provide a name for the cluster and an IP address that is not currently in use on the network: **192.168.3.7**



- Confirmation: Review settings then click Next to create the cluster

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- Wait for Completion

### Creating the Cluster in PowerShell:

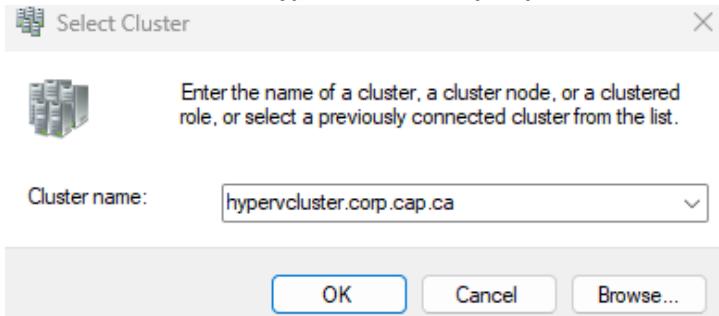
- Run the command on one of the nodes in this case **063-HV1**
  - o `New-Cluster -Name HyperVCluster -Node 063-HV1.corp.cap.ca, 063-HV2.corp.cap.ca -StaticAddress 192.168.3.7`

```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\_sysadmin> New-Cluster -Name HyperVCluster -Node 063-HV1.corp.cap.ca, 063-HV2.corp.cap.ca -StaticAddress 192.168.3.7
Name
-----
HyperVCluster

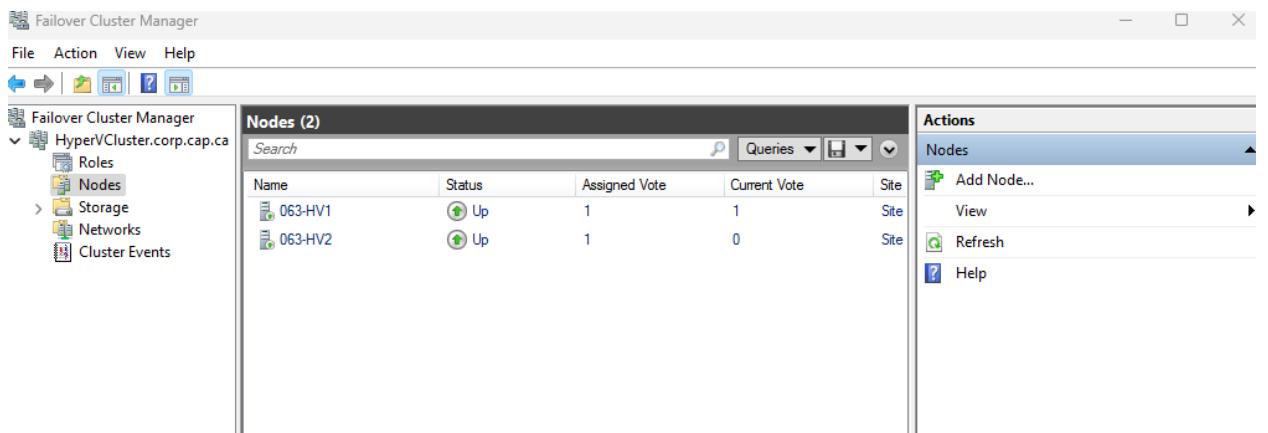
PS C:\Users\_sysadmin>
```

### Connecting to the Cluster in Failover Cluster Manager:

- Open **Server Manager** on the Host > Right click on **063-HV1** > Open **Failover Cluster Manager**
- Connect to a Cluster: **hypervcluster.corp.cap.ca**



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### Install the iSCSI Target Server Role on the Storage Server (063-SAN)

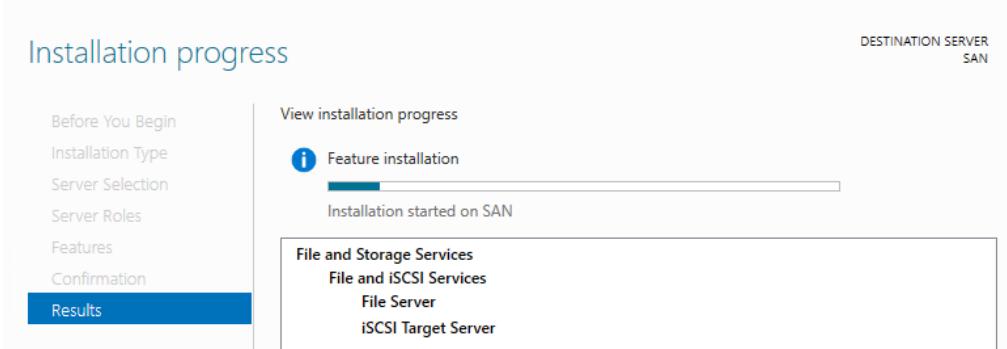
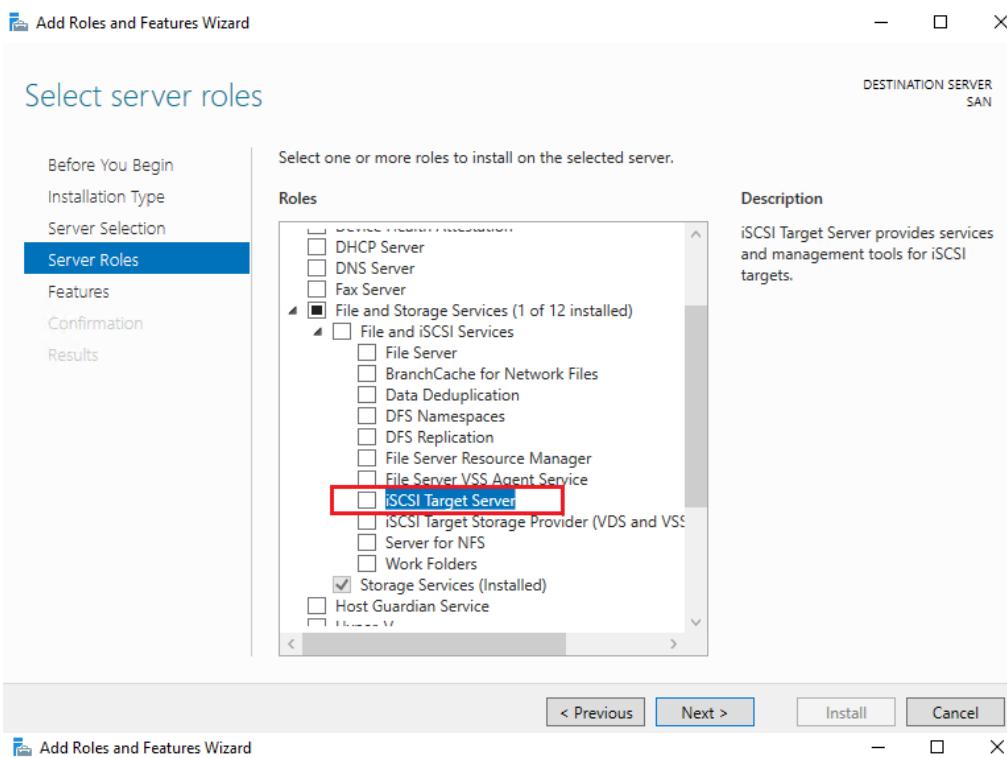
- Open Server Manager on the Host and select install a New Role
  - o Access the **063-SAN** Server
    - Server Manager > Manage > Add Roles and Features
- Select the destination server:

The screenshot shows the 'Select destination server' step of the 'Add Roles and Features Wizard'. The left sidebar shows steps: 'Before You Begin', 'Installation Type', 'Server Selection' (selected), 'Server Roles', 'Features', 'Confirmation', and 'Results'. The main area shows 'Select a server or a virtual hard disk on which to install roles and features.' with a radio button selected for 'Select a server from the server pool'. Below is a 'Server Pool' table with a filter field. The table lists four servers: 063-HV1.corp.cap.ca, 063-DC1.corp.cap.ca, 192.168.3.4, and 063-HV2.corp.cap.ca. The row for 192.168.3.4 is highlighted. The right side of the screen shows 'DESTINATION SERVER 192.168.3.4'.

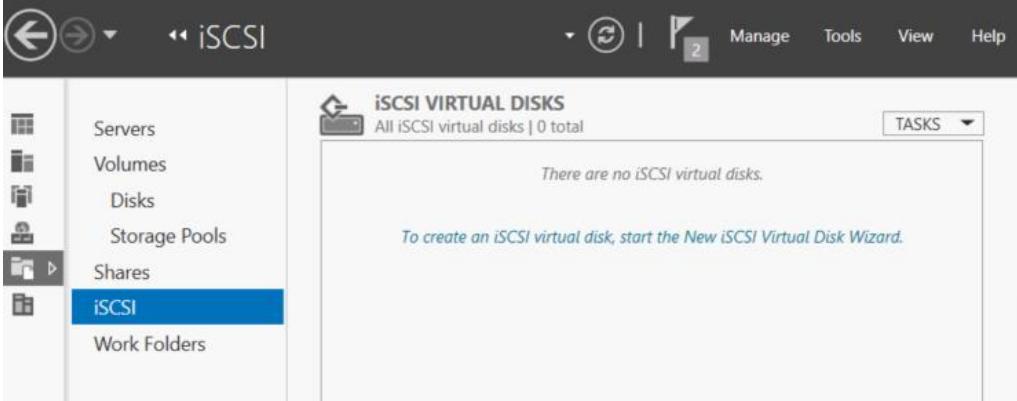
Name	IP Address	Operating System
063-HV1.corp.cap.ca	192.168.3.5	Microsoft Windows Server 2022 Datacenter Evaluation
063-DC1.corp.cap.ca	192.168.3.2	Microsoft Windows Server 2022 Datacenter Evaluation
<b>192.168.3.4</b>	<b>192.168.10.1,1...</b>	<b>Microsoft Windows Server 2022 Datacenter Evaluation</b>
063-HV2.corp.cap.ca	192.168.3.6,19...	Microsoft Windows Server 2022 Datacenter Evaluation

- o Locate **iSCSI Target Server**

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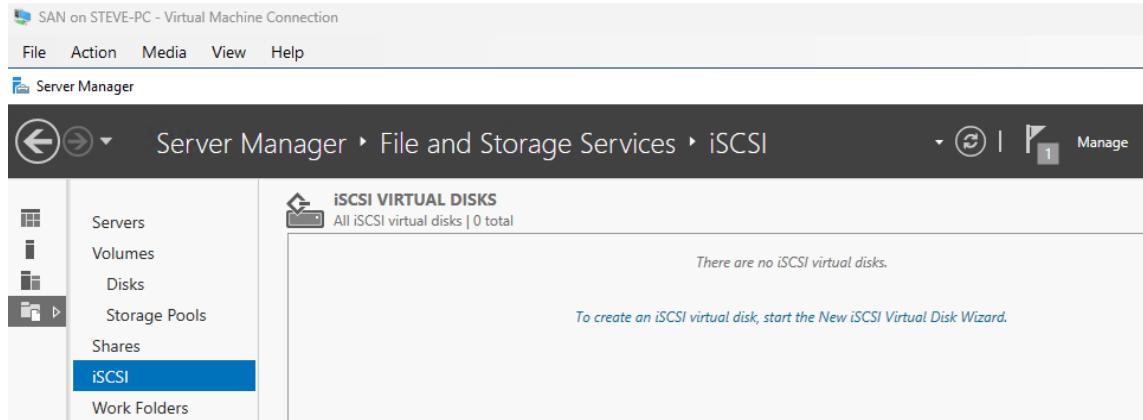
- iSCSI will appear as a heading under File and Storage Services



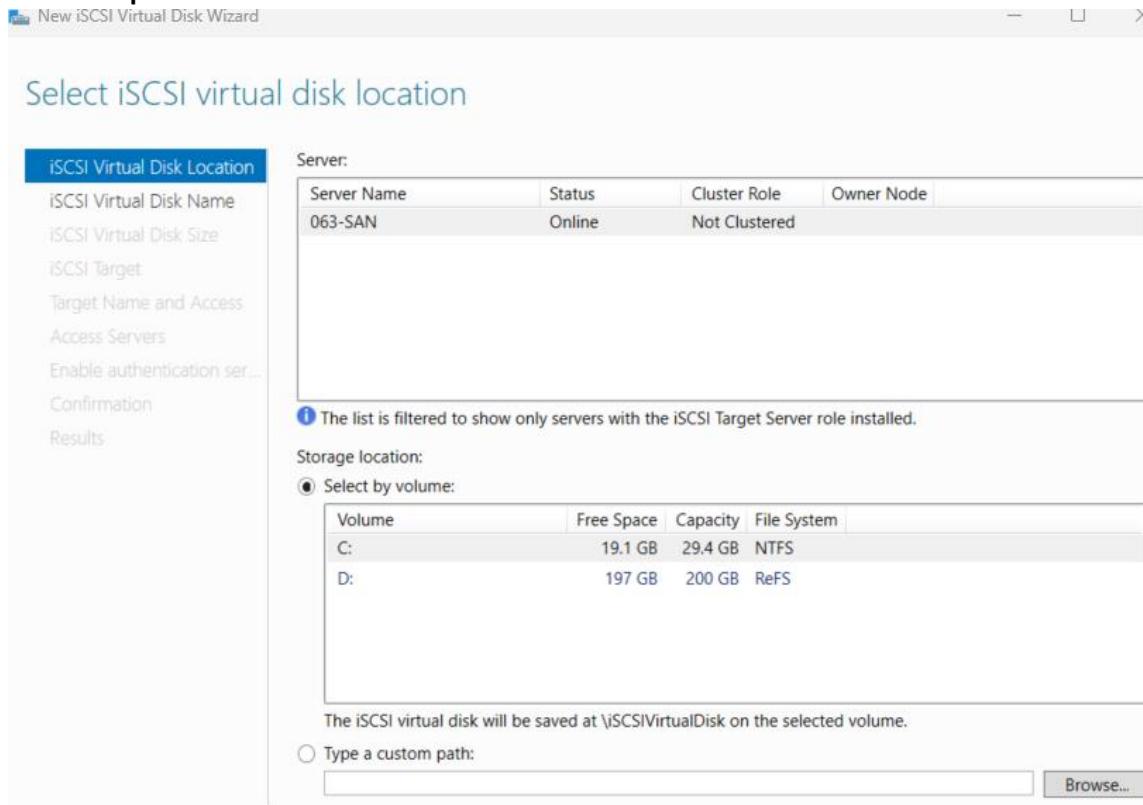
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### Create an iSCSI Virtual Disk:

- Open **Server Manager > File and Storage Services > iSCSI**
- Click “To create an iSCSI virtual disk”



- This will open the iSCSI Virtual Disk Wizard:



- Name the Disk “**FileData**”

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## Specify iSCSI virtual disk name

iSCSI Virtual Disk Location

**iSCSI Virtual Disk Name**

iSCSI Virtual Disk Size

iSCSI Target

Target Name and Access

Access Servers

Enable authentication ser...

Confirmation

Results

Name:

Description:

Path: D:\iSCSIVirtualDisks\FileData.vhdx

- Specify iSCSI virtual disk size:



## Specify iSCSI virtual disk size

iSCSI Virtual Disk Location

iSCSI Virtual Disk Name

**iSCSI Virtual Disk Size**

iSCSI Target

Target Name and Access

Access Servers

Enable authentication ser...

Confirmation

Results

Free space: 197 GB

Size:  GB

Fixed size

This type of disk provides better performance and is recommended for servers running applications with a high level of disk activity. The virtual hard disk is created using the size of the fixed virtual hard disk. It does not change when data is added or deleted.

Clear the virtual disk on allocation

Note: Un-selecting is NOT RECOMMENDED. Clearing a disk to zero will remove any fragments of data that remained on underlying storage, thus protecting from information leaks.

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 .vhdx file is small when the disk is created and grows as data is written to it.

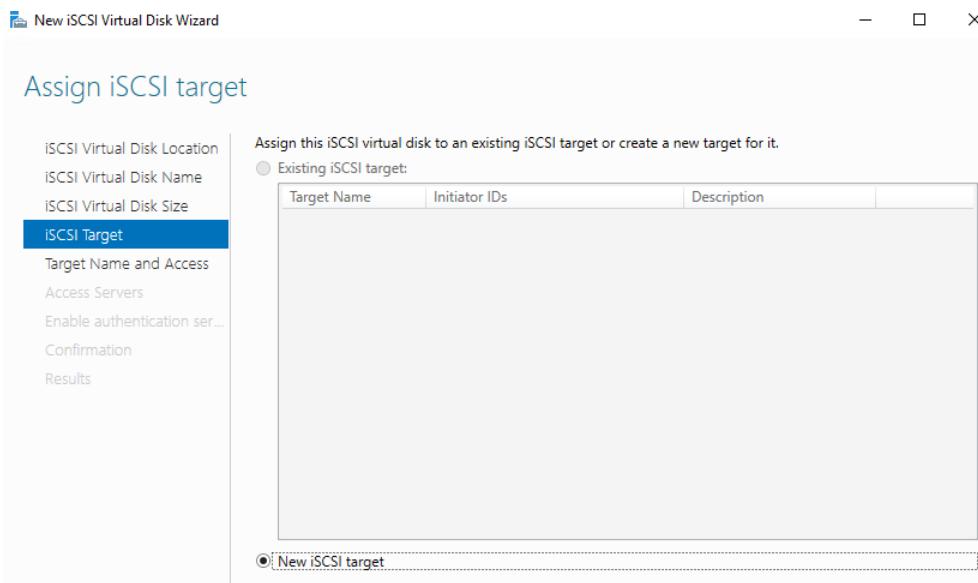
Differencing

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 this virtual hard disk without affecting the parent disk and easily revert the changes later.

Parent virtual disk path:

- Assign iSCSI target:

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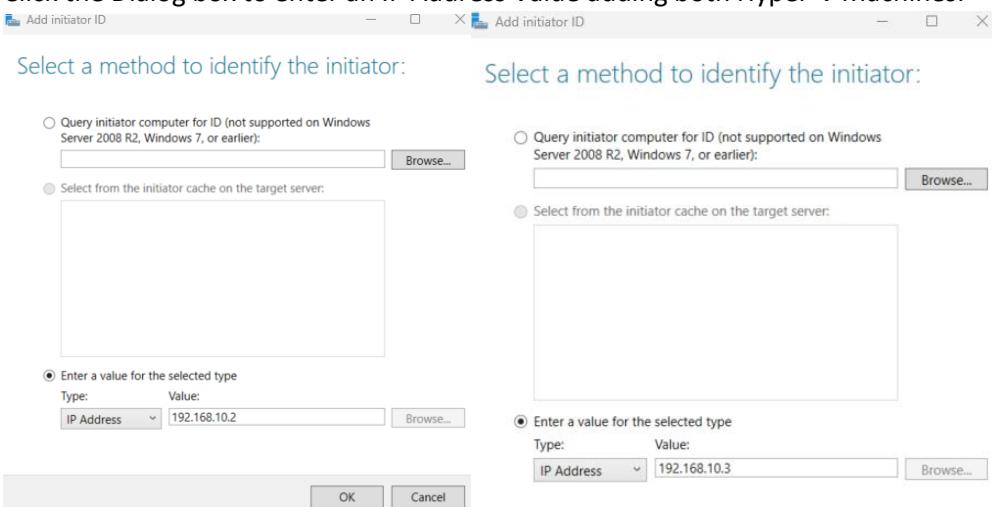


- Specify target name:

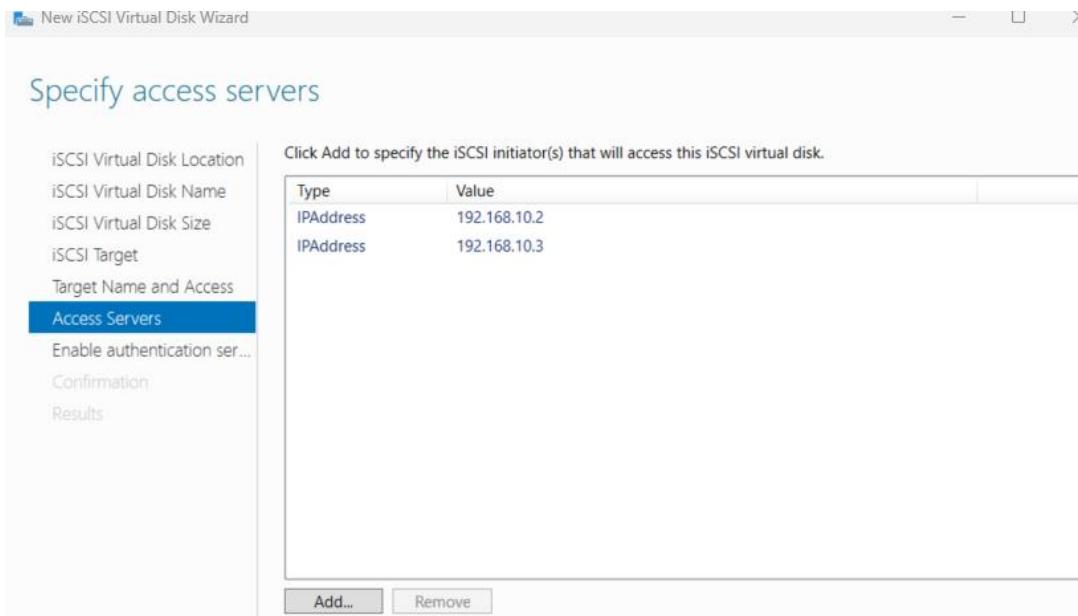
## Specify target name



- Add IP of the Nested Hypervisors
- Click the Dialog box to enter an IP Address Value adding both Hyper-V Machines:

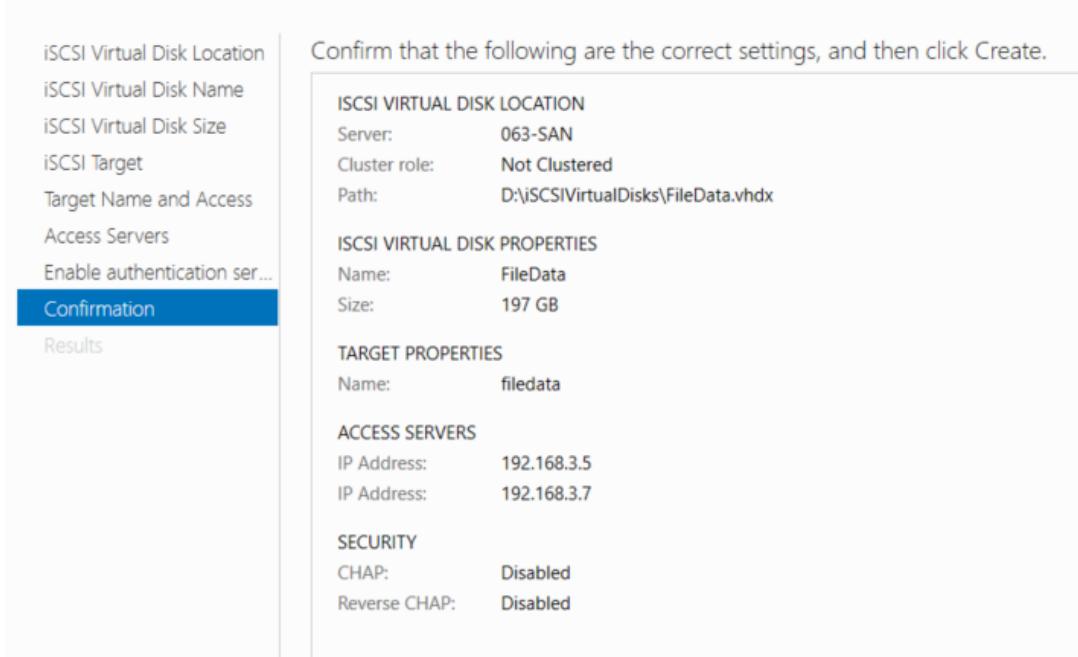


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- 063-HV1: **192.168.10.2**
- 063-HV2: **192.168.10.3**

### Confirm selections



- Confirm Settings and Create

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View results

iSCSI Virtual Disk Location  
iSCSI Virtual Disk Name  
iSCSI Virtual Disk Size  
iSCSI Target  
Target Name and Access  
Access Servers  
Enable authentication ser...  
Confirmation

Results

Task	Progress	Status
Create iSCSI virtual disk	Running	
Create iSCSI target	Pending	
Set target access	Pending	
Assign iSCSI virtual disk to target	Pending	

### Connect (063-HV1) to the SAN in iSCSI Initiator Properties:

- To achieve successful communication to the Initiators we must run iSCSI Initiator Properties from PowerShell on 063-HV1
- Launch PowerShell using Option 15 in SConfig Console Menu
- Enter the command: **iscsicpl**

The screenshot shows a PowerShell window titled "063-HV1 on STEVE-PC - Virtual Machine Connection" and an "iSCSI Initiator Properties" dialog box.

In the PowerShell window, the command **iscsicpl** is entered, showing the output:

```
Administrator: C:\Windows\system32\cmd.ps1
PS C:\Users\_sysadmin> iscsicpl
PS C:\Users\_sysadmin>
```

The "iSCSI Initiator Properties" dialog box has the "Targets" tab selected. It displays a table of target portals:

Address	Port	Adapter	IP address
192.168.10.1	3260	Microsoft iSCSI Initiator	192.168.10.2

Below the table, there are buttons for "Discover Portal..." and "Remove".

- Upon launch it may prompt you with a message to run the service, click Yes

Microsoft iSCSI

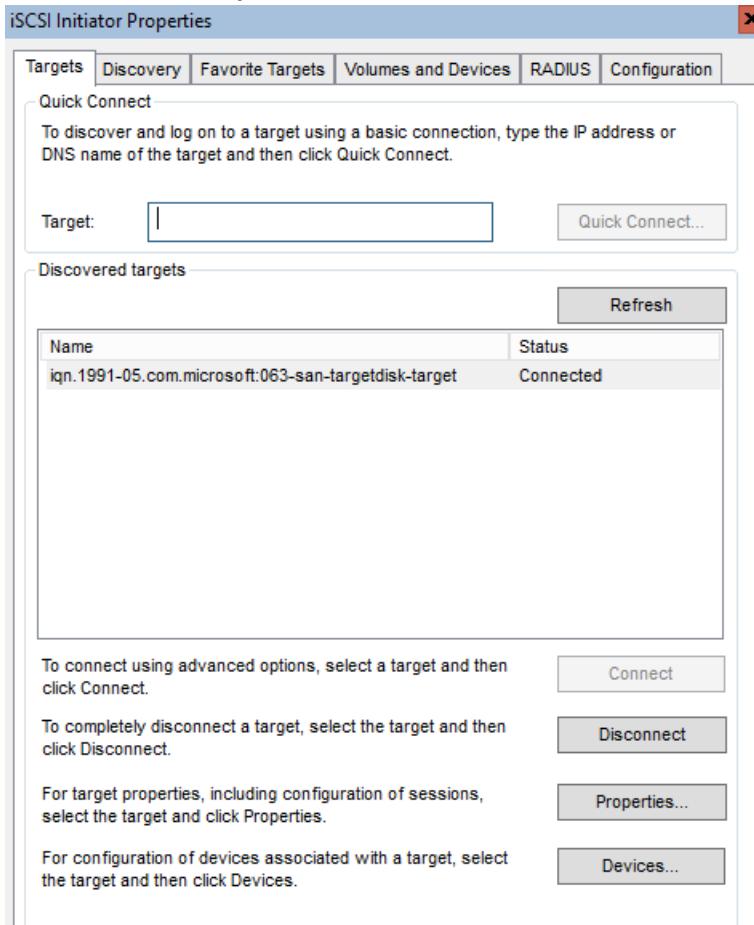


The Microsoft iSCSI service is not running. The service is required to be started for iSCSI to function correctly. To start the service now and have the service start automatically each time the computer restarts, click the Yes button.

Yes      No

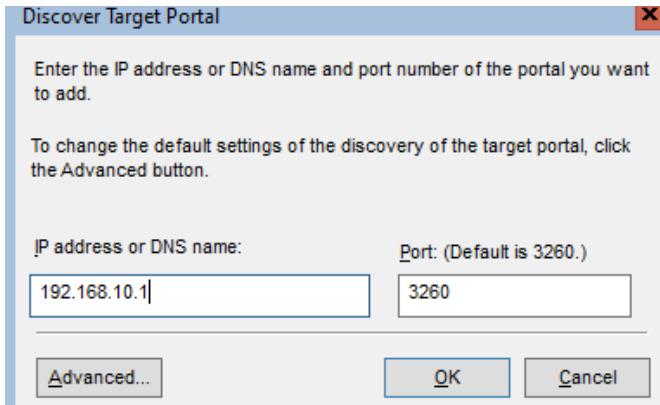
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Select the **Discovery Tab:**



- Click on the **Discovery Portal:**

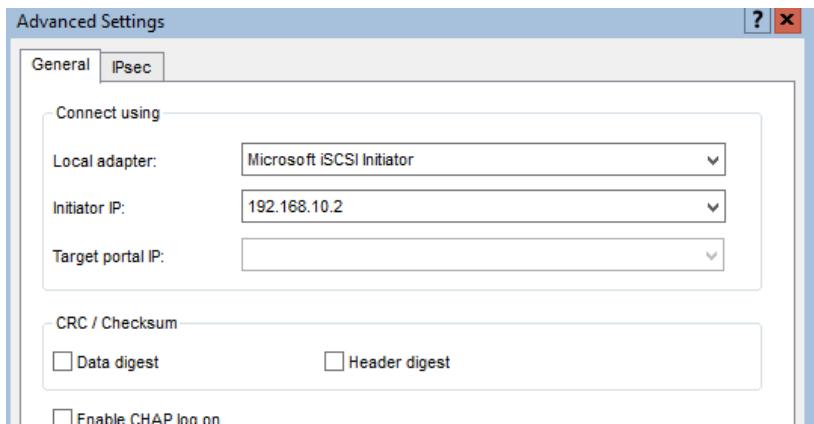
- Enter the IP Address of the SAN Server 063-SAN: **192.168.10.1**



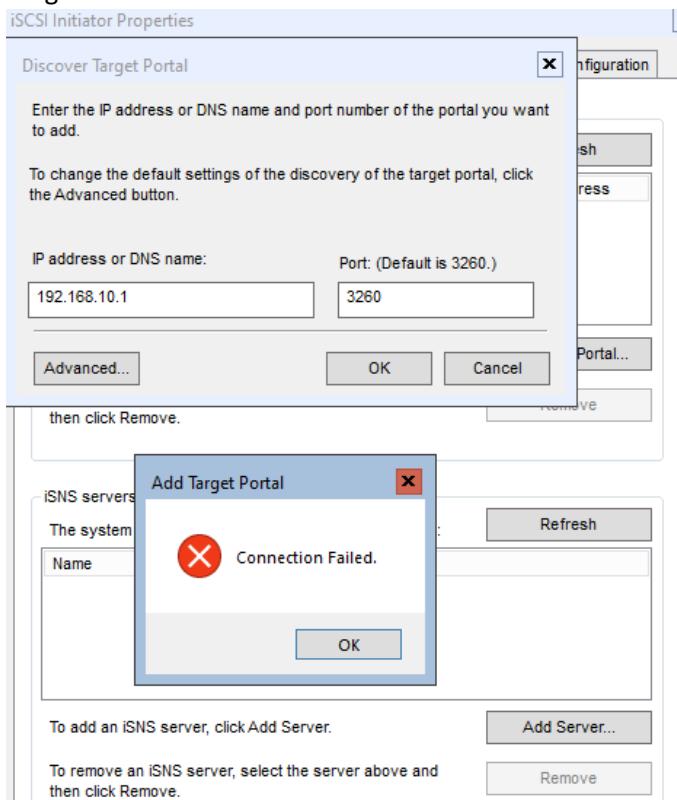
- Click on Advanced right after

- o Select Microsoft iSCSI Initiator
  - o Initiator IP: **192.168.10.2 (063-HV1)**

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- Target should Connect:



- I had an issue where I could not connect
- I used the command: **restart-service wintarget**
  - o Run this command on the SAN Server **063-SAN**
  - o **Select Option 15 PowerShell in SConfig Console**

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```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> restart-service wintarget
PS C:\Users\Administrator>
```

- Attempt to reconnect again back on 063-HV1

- Targets should connect:

Name	Server Name	Target IQN	Target Status	Initiator ID	Last Logon	Idle Duration
targetdisk	063-SAN	iqn.1991-05.com.microsoft:063-san-targetdisk-target	Connected	IPAddress:192.168.10.2, IPAddress:192.168.10.3	2024-04-07 5:52:17 PM	00:00:00

### Connect (063-HV2) to the SAN in iSCSI Initiator Properties:

- Launch PowerShell using Option 15 in SConfig Console Menu
- Enter the command: **iscsicpl**

Address	Port	Adapter	IP address
192.168.10.1	3260	Microsoft iSCSI Initiator	192.168.10.3

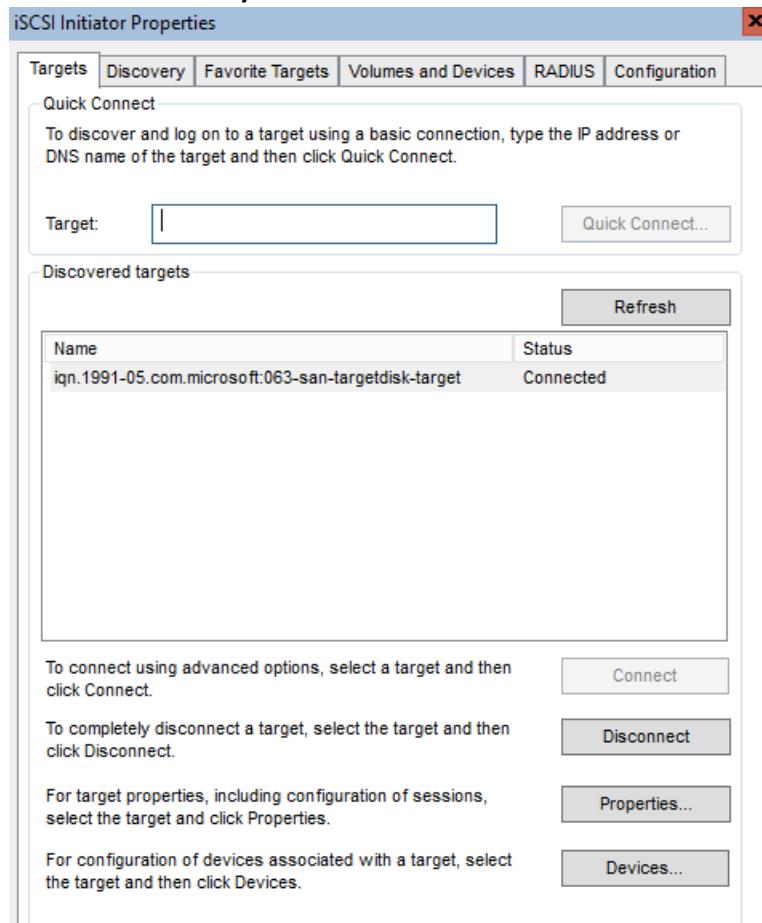
- Upon launch it may prompt you with a message to run the service, click Yes

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## Microsoft iSCSI

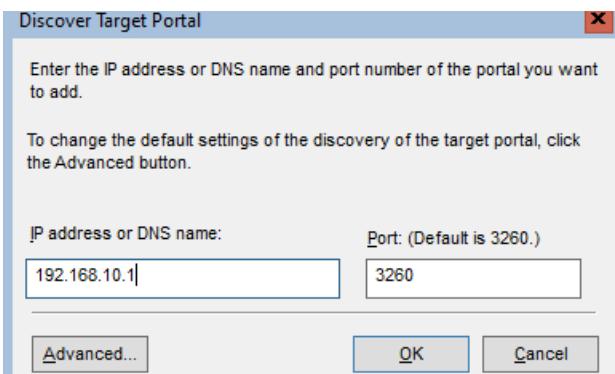
The Microsoft iSCSI service is not running. The service is required to be started for iSCSI to function correctly. To start the service now and have the service start automatically each time the computer restarts, click the Yes button.

- Select the **Discovery Tab:**

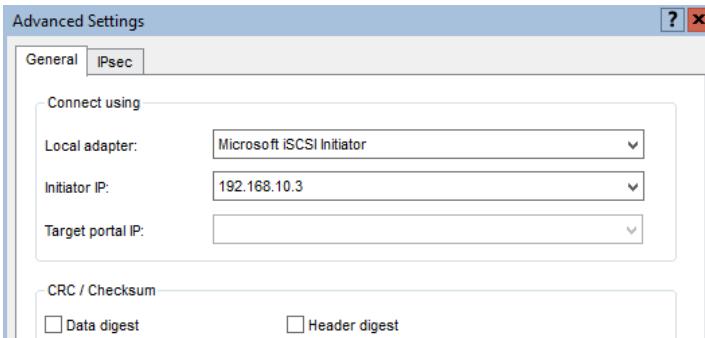


- Click on the **Discovery Portal:**
- Enter the IP Address of the SAN Server 063-SAN: **192.168.10.1**

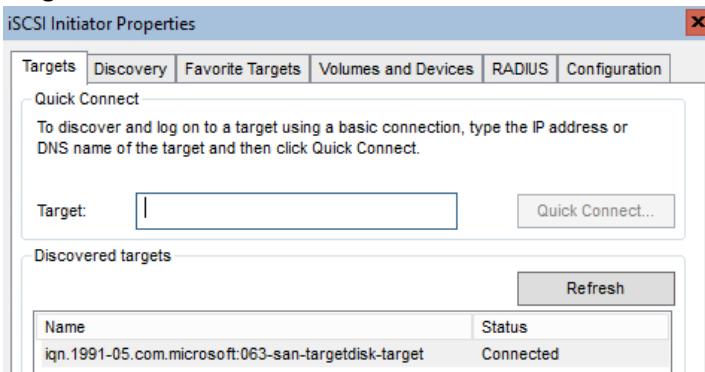
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



- Click on Advanced right after
  - o Select Microsoft iSCSI Initiator
  - o Initiator IP: **192.168.10.3 (063-HV2)**



- Target should Connect:



- We do not need to initialize and format the disk from **063-HV2**. By design only one Server can write to a volume at a time. The disks only need to be attached
- Bring the Disk online in **DISKMGMT**:

### Disk Initialization:

- From **063-HV1**
- **We need to initialize and format disks before they can be used in a cluster. This can be done using the Disk Management snap-in or using PowerShell with the Initialize-Disk, New-Partition, and Format-Volume cmdlets**

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- 1. Get-Disk
  - o Identifies the Disk
  - o 2 is shown as Offline

```
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\sysadmin> iscsicpl
PS C:\Users\sysadmin> iscsicpl
PS C:\Users\sysadmin> Get-Disk

Number Friendly Name Serial Number          HealthStatus   OperationalStatus   Total Size Partition
                                         Style

-----
0   Msft Virtu...                         Healthy        Online           30 GB GPT
1   Msft Virtu...                         Healthy        Online           30 GB GPT
2   Msft Virtu...                         Healthy        Online           30 GB GPT
2   MSFT Virtu... 29542256-A5E3-433F-B867-F162C... Healthy      Offline          197 GB RAW

PS C:\Users\sysadmin>
```

- 2. Initialize the Disk
  - o **Initialize-Disk -Number 2 -PartitionStyle GPT**
- 3. Create a new Partition
  - o **\$partition = New-Partition -DiskNumber 2 -UseMaximumSize -AssignDriveLetter**
- 4. Format Disk: NTFS
  - o **Format-Volume -Partition \$partition -FileSystem NTFS -Confirm:\$false**

```
PS C:\Users\sysadmin> Initialize-Disk -Number 2 -PartitionStyle GPT
>>
PS C:\Users\sysadmin> Get-Disk

Number Friendly Name Serial Number          HealthStatus   OperationalStatus   Total Size Partition
                                         Style

-----
0   Msft Virtu...                         Healthy        Online           30 GB GPT
1   Msft Virtu...                         Healthy        Online           30 GB GPT
2   Msft Virtu...                         Healthy        Online           30 GB GPT
2   MSFT Virtu... 29542256-A5E3-433F-B867-F162C... Healthy      Offline          197 GB RAW

PS C:\Users\sysadmin> $partition = New-Partition -DiskNumber 2 -UseMaximumSize -AssignDriveLetter
PS C:\Users\sysadmin> Format-Volume -Partition $partition -FileSystem NTFS -Confirm:$false

DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining     Size
----- -----------
E          NTFS       Fixed      Healthy      OK                  196.89 GB 196.98 GB

PS C:\Users\sysadmin> Get-Disk

Number Friendly Name Serial Number          HealthStatus   OperationalStatus   Total Size Partition
                                         Style

-----
0   Msft Virtu...                         Healthy        Online           30 GB GPT
1   Msft Virtu...                         Healthy        Online           30 GB GPT
2   Msft Virtu...                         Healthy        Online           30 GB GPT
2   MSFT Virtu... 29542256-A5E3-433F-B867-F162C... Healthy      Online          197 GB GPT
```

### Creating Permissions for Cluster Name Object (CNO):

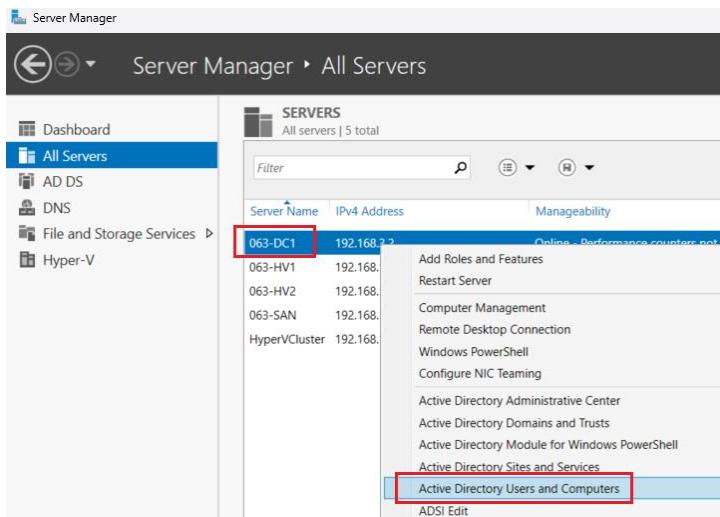
- \* The cluster is not configured with a quorum witness. As a best practice, configure a quorum witness to help achieve the highest availability of the cluster.
- \* The cluster network name HYPERVCLUSTER does not have Create Computer Objects permissions on the Organizational Unit OU=HYPERV,OU=Servers,DC=corp,DC=cap,DC=ca. This can result in issues during the creation of additional network names in this OU.

- o *The Cluster Name Object (CNO) named 'HYPERVCLUSTER' does not have permissions to create computer objects in the specified Organizational Unit (OU) within Active Directory (AD)*

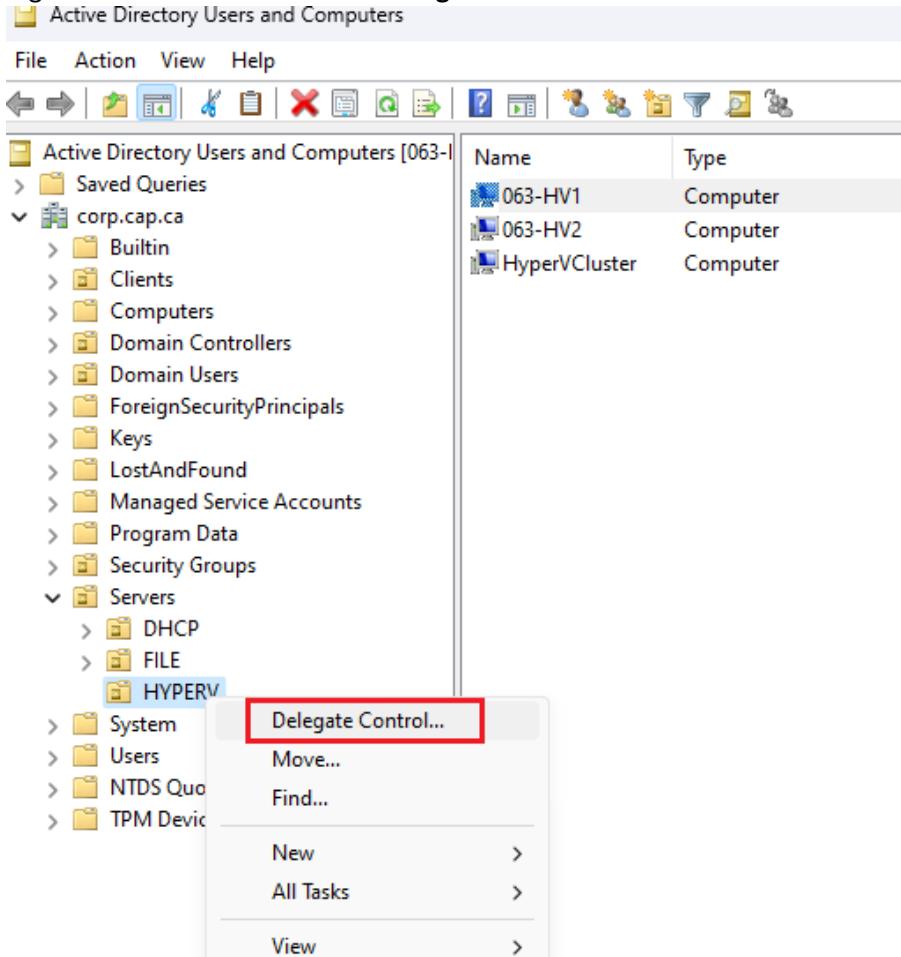
To gran the necessary permissions:

- Open "Active Directory Users and Computers" from Server Manger on the Host Lenovo Machine

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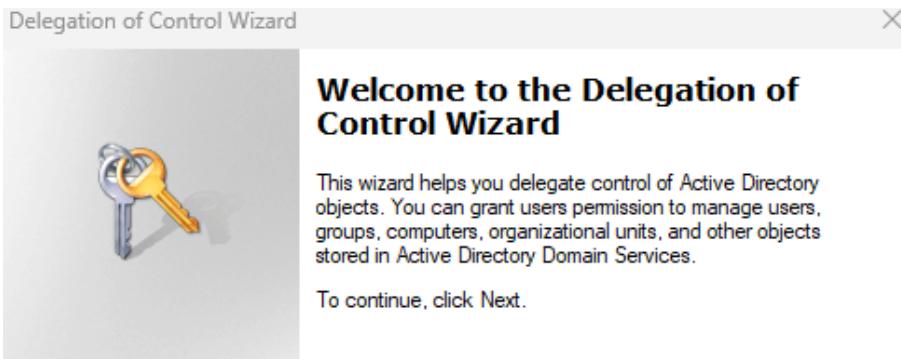


- Navigate to the OU in question:
  - o **OU=HYPERV,OU=Servers,DC=comp,DC=cap,DC=ca**
- Right-click the OU and choose "Delegate Control"

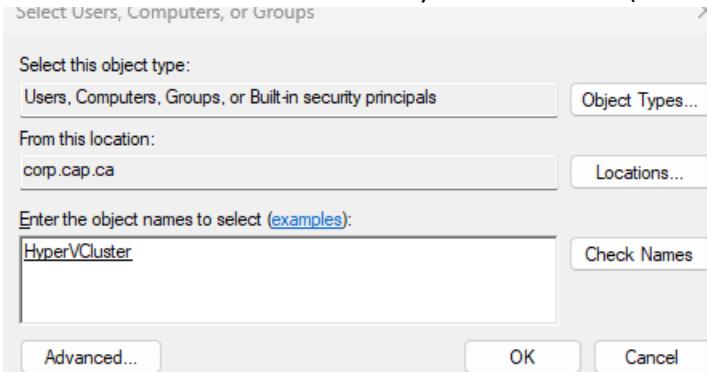


- Click "Next" on the welcome screen

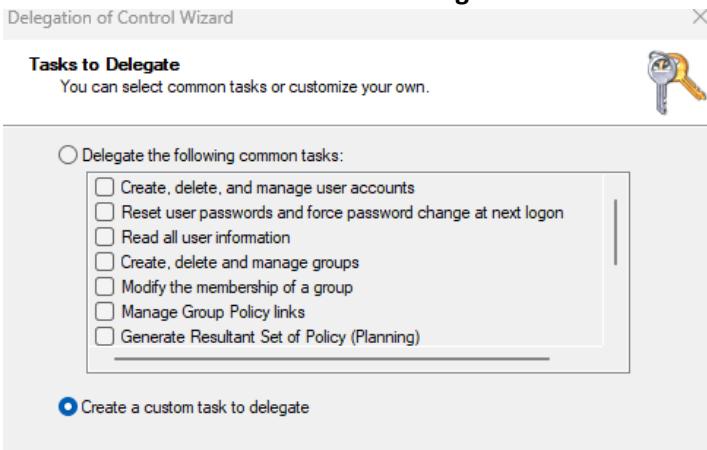
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



- Click "Add" and enter the name of your cluster CNO (HYPERVCLUSTER), then click "Next"

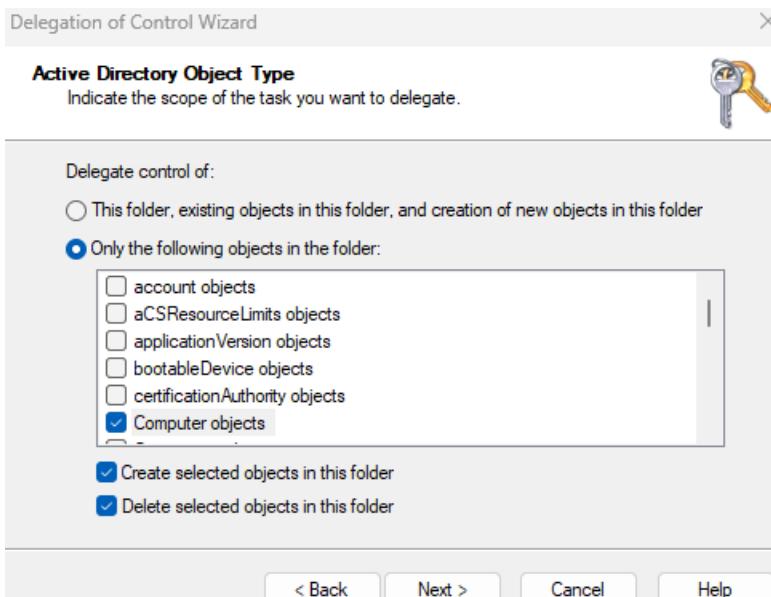


- Choose "Create a custom task to delegate" and click "Next"

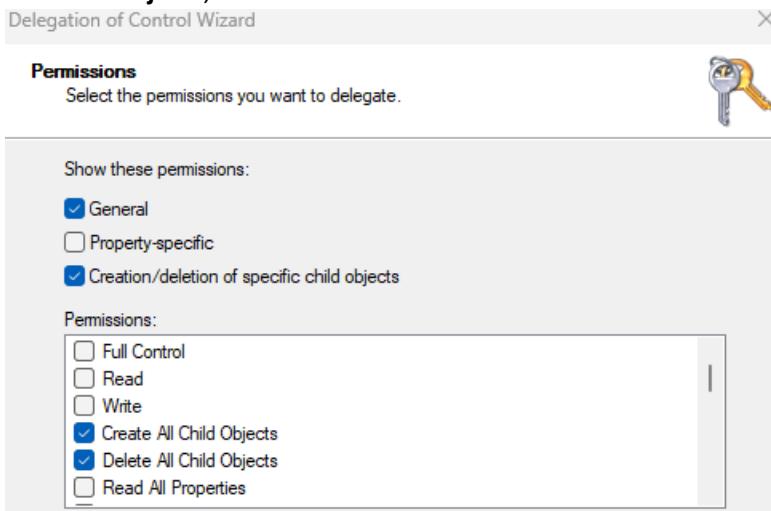


- Select "Only the following objects in the folder," check "Computer objects," and check the boxes for "Create selected objects in this folder" and "Delete selected objects in this folder"

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- In the Permissions page, give the CNO the permissions "Create All Child Objects" and "Delete All Child Objects," then click "Next" and "Finish"



- After performing these actions, the cluster should have the necessary permissions to function correctly, and we will have improved the overall high availability of your cluster by configuring a quorum witness

### Convert Cluster Disk1 to a Cluster Shared Volume (CSV):

- **Step 1: Validate Storage**
  - o Before you can use a disk in a cluster, it must be validated. When adding new storage, ensure the following:
    - It's not currently in use by another server or service outside the cluster
    - It's visible to all nodes in the cluster. If you're using iSCSI, for example, ensure all nodes are connected to the iSCSI target
    - **Server Manager > File and Storage Services > iSCSI**

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- Ensure that the iSCSI disks are connected

The screenshot shows the Server Manager interface with the 'File and Storage Services' section selected. Under 'iSCSI', two tables are displayed:

- iSCSI VIRTUAL DISKS:** Shows one entry: '063-SAN (1)' with Path 'D:\iSCSIVirtualDisks\TargetDisk.vhdx'. Status: Connected. Target disk: targetdisk. Initiator ID: IP Address:192.168.10.2, IP Address:192.168.10.3. Size: 197 GB.
- iSCSI TARGETS:** Shows one entry: 'targetdisk' on '063-SAN' with Target IQN 'iqn.1991-05.com.microsoft:063-san-targetdisk-target'. Status: Connected. Initiator ID: IP Address:192.168.10.2, IP Address:192.168.10.3. Last Logon: 2024-04-07 5:52:17 PM. Idle Duration: 00:00:00.

- It does not contain any data you wish to keep, as the clustering process may format the disk

## - Step 2: Add Disk to Cluster Storage

- Assuming '**Cluster Disk 1**' is a new disk that you've just connected:
  - **Access Failover Cluster Manager:** Open the Failover Cluster Manager on any node in the cluster

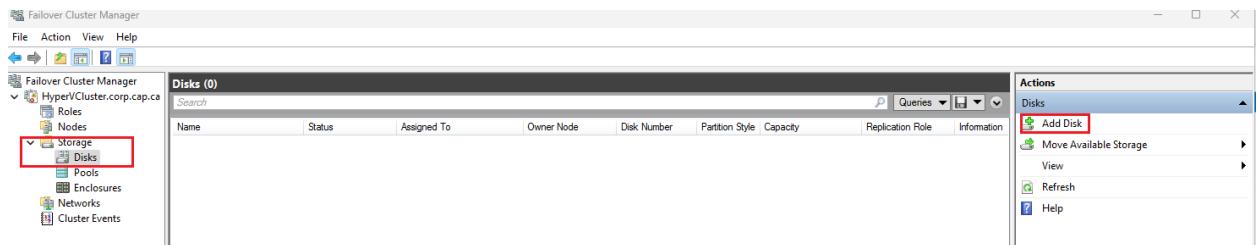
The screenshot shows the 'All Servers' view in Server Manager. The left navigation pane has 'All Servers' selected. In the main area, a list of servers is shown with '063-HV1' highlighted. A context menu is open over '063-HV1' with the following options:
 

- Add Roles and Features
- Restart Server
- Computer Management
- Remote Desktop Connection
- Windows PowerShell
- Configure NIC Teaming
- Add other servers in the cluster to the server pool
- Update Cluster
- Failover Cluster Manager** (this option is highlighted with a blue box)
- Hyper-V Manager
- Manage As ...
- Start Performance Counters
- Remove This Server and Remote Servers in This Cluster
- Refresh
- Copy

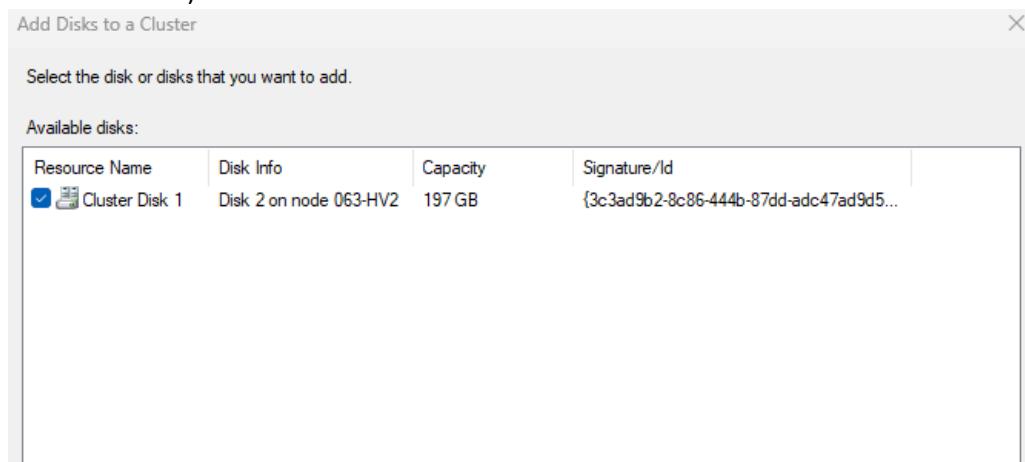
- **Navigate to Storage:** In the console tree, select '**Storage**'

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- **Add Disk:** In the Actions pane, click on '**Add Disk**'. The Add Disk wizard will scan for available storage that's not currently used by the cluster

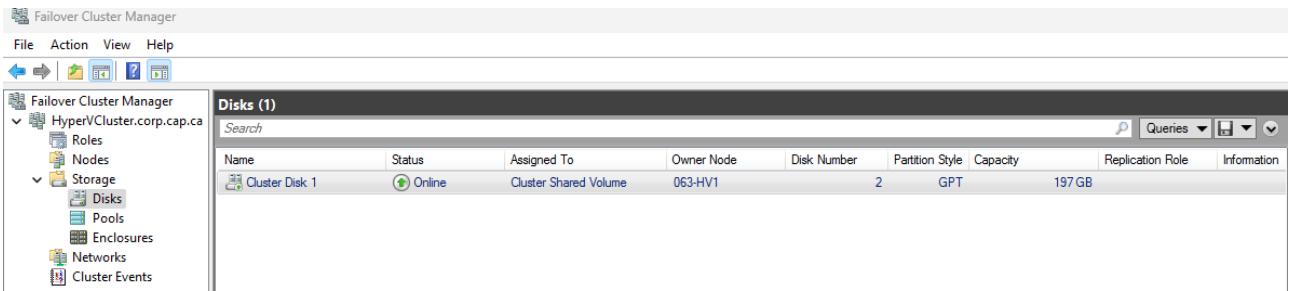


- **Select the Disk:** Check the disk(s) you want to add (here, it would be the disk you wish to be '**Cluster Disk 1**') and click OK

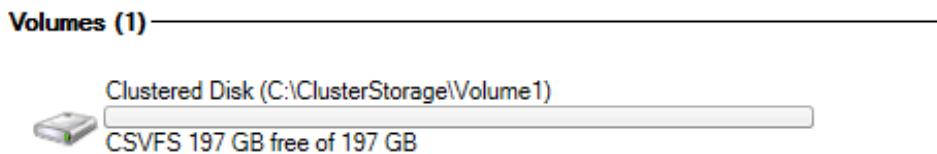


- **Format the Disk** (if not done):
  - Right-click on the disk and select '**Format**'. If the disk is already formatted and recognized as '**Cluster Disk 1**', we can skip this step
- **Step 3: Convert to CSV**
- After the cluster disk is added, you can convert it to a CSV for shared access by multiple nodes:
  - **Select Cluster Disk:** In the Failover Cluster Manager, click on '**Storage**', then click on '**Disks**'
  - **Identify the Disk:** In the list of disks, right-click on 'Cluster Disk 1'.
  - **Convert to CSV:** Select '**Add to Cluster Shared Volumes**'. *This will convert the standard cluster disk into a CSV*
- **Step 4: Verify CSV Creation**
  - Once you've added the disk to CSVs:
    - **Navigate to CSV:** In the console tree under '**Storage**', you should see a new section called '**Cluster Shared Volumes**'

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

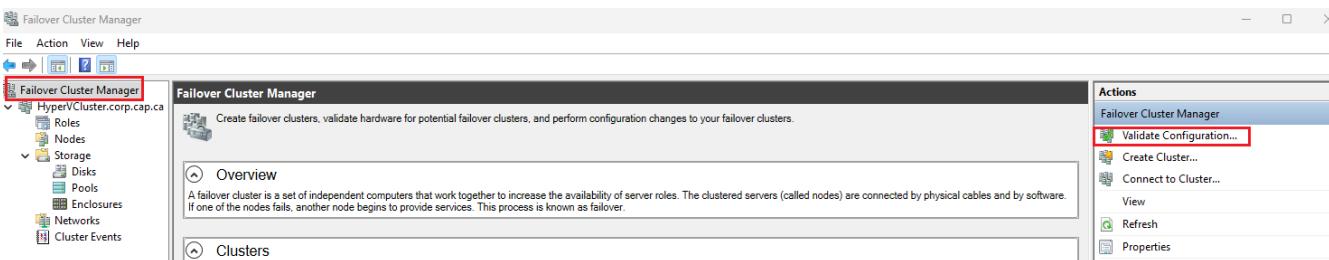


- **Check CSV:** The disk you've just added should be listed there. The CSV will be accessible by all nodes simultaneously and will be found at a path like **C:\ClusterStorage\Volume1** on each node



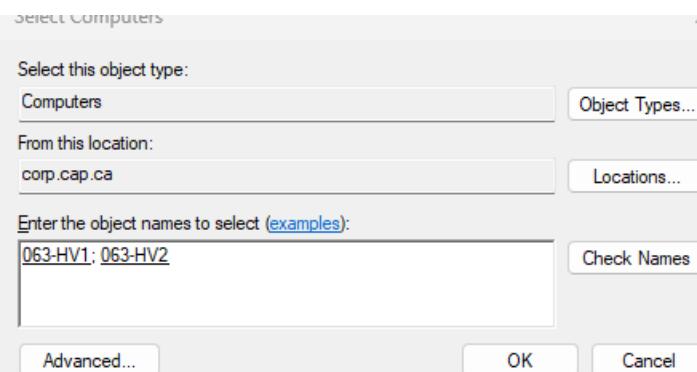
## Step 5: Monitor and Validate

- Finally, after converting to CSV:
  - **Monitor Health:** Monitor the health and status of the CSV through the Failover Cluster Manager to ensure it's functioning as expected
  - **Validate Configuration:** Optionally, you can run the Validate a Configuration wizard to ensure that the storage meets all requirements for failover clustering:

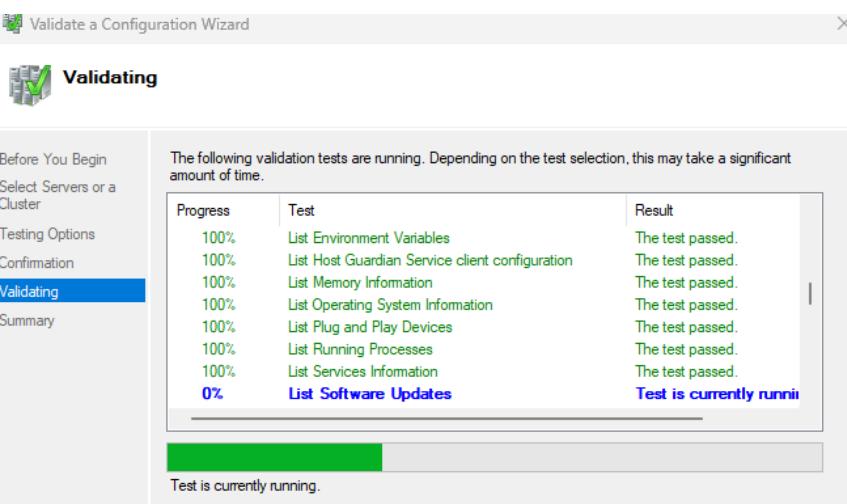
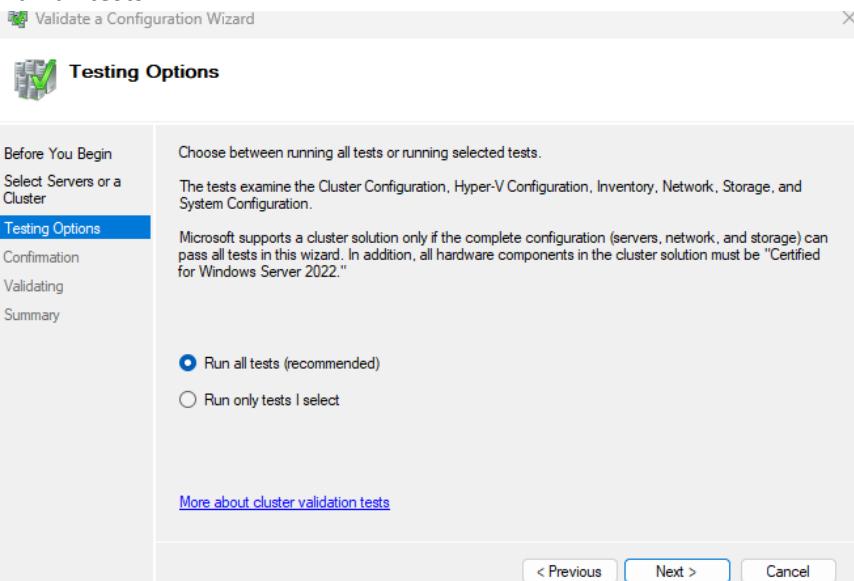


- Add the Computer names of the nodes attached to the Cluster:

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- Run all tests:



- A successful test will show that the test has passed, view report for more detail

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

### Transferring an .ISO onto (063-HV1) & (063-HV2):

- Create a VHDX on the Host and Format it:

```
$VHDXname = Read-Host -Prompt 'Input VHDX name'  
$SizeInGB = Read-Host -Prompt 'Input the size in GB. Ex 5, 10'  
$VHDPath = "V:\VMs\VHDX\" + $VHDXname + ".vhdx"  
$SizeBytes = ($SizeInGB/1 * 1073741824)  
$alreadyExists = Test-Path -Path $VHDPath  
New-VHD -Path $VHDPath -Dynamic -SizeBytes $SizeBytes | Mount-VHD -Passthru | Initialize-Disk -Passthru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS -Confirm:$false -Force
```

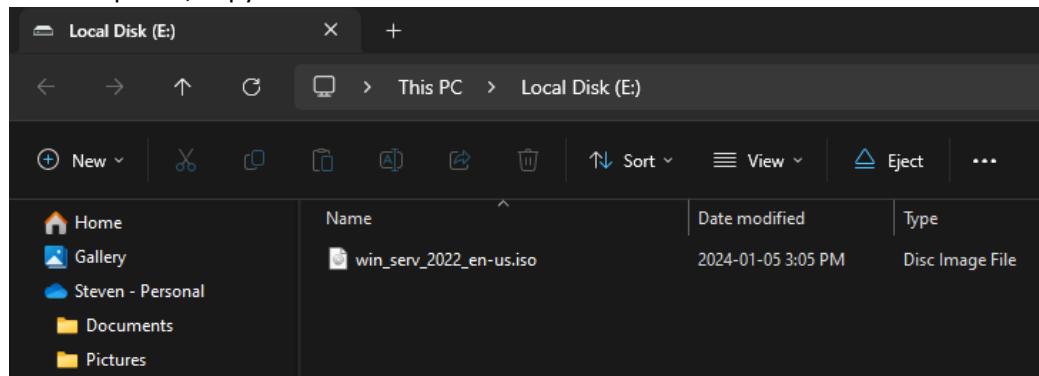
- Name: filetransfer (*filetransfer2 for 063-HV2*)
- Size: 10GB
- Drive Letter: E:

```
PS C:\Windows\system32> $VHDXname = Read-Host -Prompt 'Input VHDX name'  
$SizeInGB = Read-Host -Prompt 'Input the size in GB. Ex 5, 10'  
$VHDPath = "V:\VMs\VHDX\" + $VHDXname + ".vhdx"  
$SizeBytes = ($SizeInGB/1 * 1073741824)  
$alreadyExists = Test-Path -Path $VHDPath  
New-VHD -Path $VHDPath -Dynamic -SizeBytes $SizeBytes | Mount-VHD -Passthru | Initialize-Disk -Passthru  
  
Input VHDX name: filetransfer  
Input the size in GB. Ex 5, 10: 10  


| DriveLetter | FriendlyName | FileSystemType | DriveType | HealthStatus | OperationalStatus | SizeRemaining | Size    |
|-------------|--------------|----------------|-----------|--------------|-------------------|---------------|---------|
| E           |              | NTFS           | Fixed     | Healthy      | OK                | 9.95 GB       | 9.98 GB |

  
PS C:\Windows\system32>
```

- In File Explorer, copy the Windows Server 2022 iso to the root of the drive:



- Dismount the Drive and connect it to **063-HV1**
  - o We will achieve this using this script:

```
$VHDPath = "V:\VMs\VHDX\filetransfer.vhdx"  
Dismount-VHD -Path $VHDPath
```

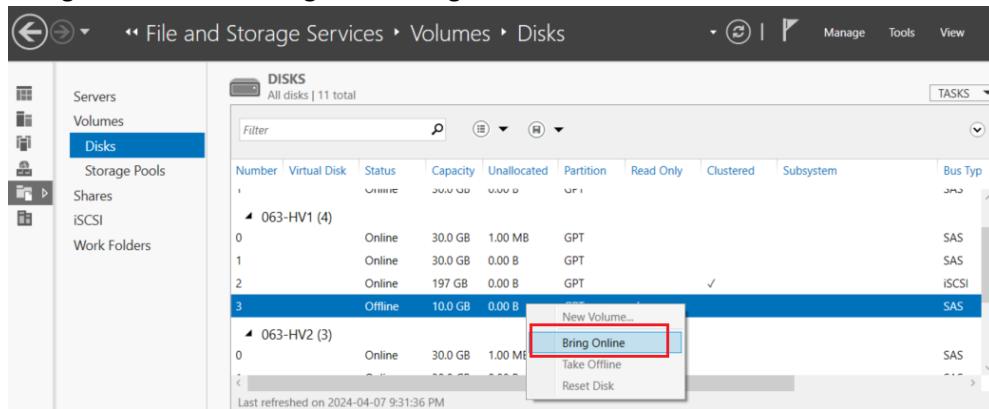
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

Add-VMHardDiskDrive -VMName 063-HV1 -Path \$VHDPath

```
PS C:\Windows\system32> $VHDPath = "V:\VMs\vhdx\filetransfer.vhdx"
Dismount-VHD -Path $VHDPath
Add-VMHardDiskDrive -VMName 063-HV1 -Path $VHDPath

PS C:\Windows\system32>
```

- Navigate to Server Manager and bring the disk Online:



- Repeat the process for 063-HV2

Create Folders within the ClusterStorage to store (063-FS1) & (063-FS2) Files:

- On 063-HV1 > Go to PowerShell
- Create Two New Folders in the Volume 1 directory of “ClusterStorage”
  - o New-Item -Path "C:\ClusterStorage\Volume1\vhdx" -ItemType Directory
  - o New-Item -Path "C:\ClusterStorage\Volume1\virtual machine files" -ItemType Directory

```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\_sysadmin> New-Item -Path "C:\ClusterStorage\Volume1\Virtual Machine Files" -ItemType Directory
>>

Directory: C:\ClusterStorage\Volume1

Mode                LastWriteTime          Length Name
----                -----          ---- 
d-----        4/8/2024  2:02 PM            Virtual Machine Files

PS C:\Users\_sysadmin> New-Item -Path "C:\ClusterStorage\Volume1\VHDX" -ItemType Directory
>>

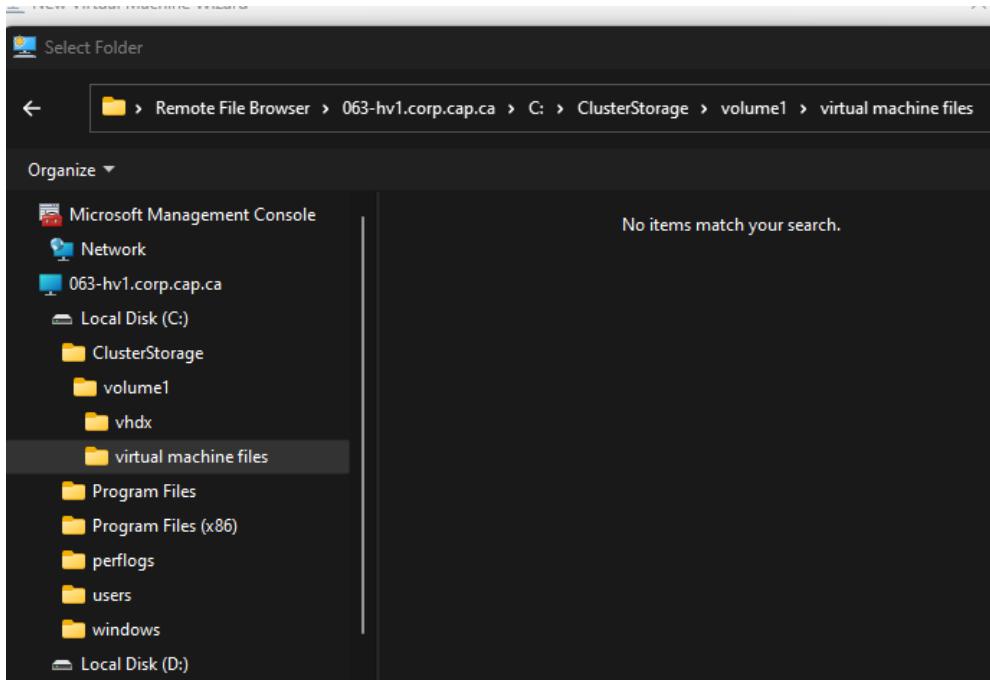
Directory: C:\ClusterStorage\Volume1

Mode                LastWriteTime          Length Name
----                -----          ---- 
d-----        4/8/2024  2:03 PM            VHDX

PS C:\Users\_sysadmin>
```

- Click the checkmark to “Store the virtual machine in a different location”
- Browse to the folder directory for “virtual machine files” in Volume 1

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Attach Storage Folders to the New Directories:

From within Hyper-V Settings for 063-HV1 change the paths:

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

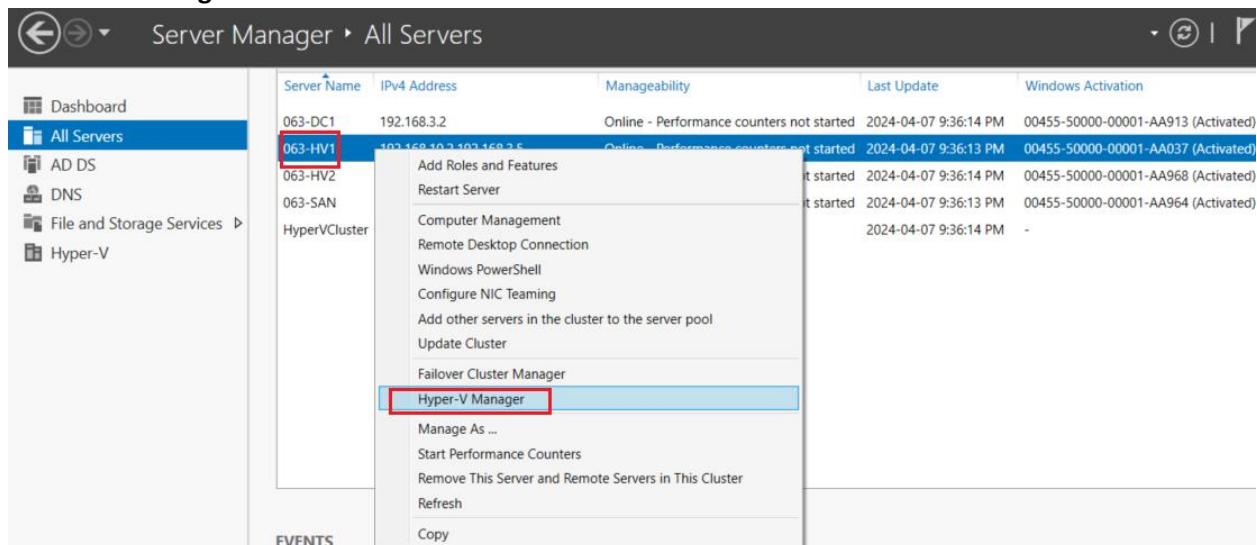
### Create the File Server (063-FS1) on Cluster Shared Volume:

- **Step 1: Configure the Cluster Shared Volume:**
- Make sure your CSV is correctly configured:
  - o Open Failover Cluster Manager
  - o Go to Storage > Disks
  - o Ensure the CSV is in the list and online

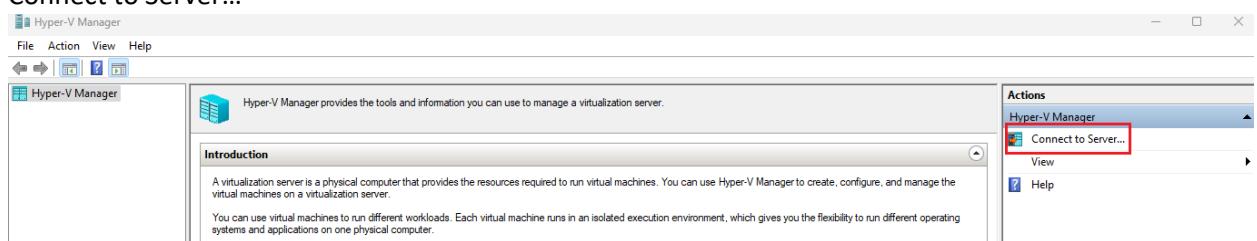


### Access Hyper-V Manager on (063-HV1):

- **Step 2: Open the Hyper-V Manager:**
  - o You can access this through Server Manager > All Servers > Right click 063-HV1 > Hyper-V Manager

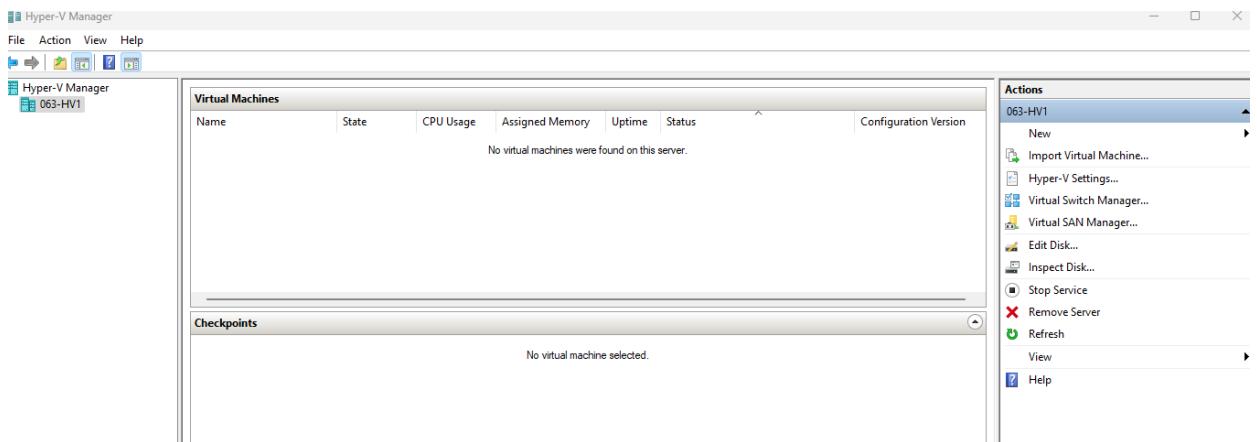
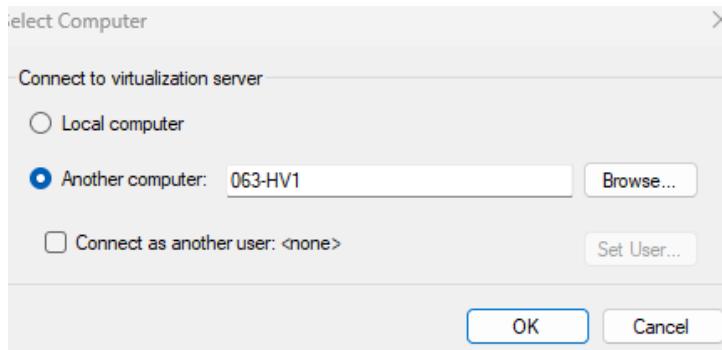


- Connect to Server...



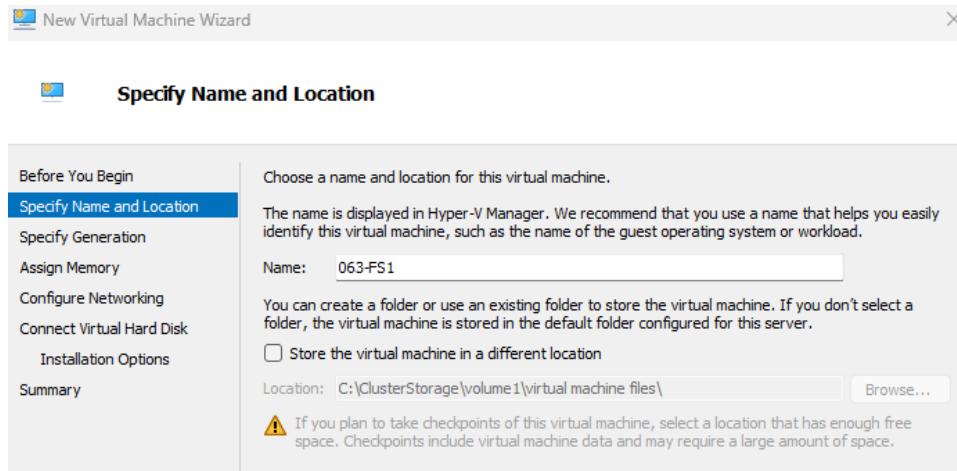
- Enter 063-HV1

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



## Create the Virtual Machine (063-FS1):

- In Hyper-V Manager, create the new VMs that will be used as file servers:
  - o In Hyper-V Manager, right-click on the Hyper-V server and select 'New' > 'Virtual Machine'
- Follow the New Virtual Machine Wizard to configure the VM:
  - o Assign a name to the VM (**063-FS1**)



### - Specify Generation 2

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- Assign memory: **800MB**
- When asked to connect a virtual hard disk, choose to create a new virtual hard disk, and place it on the CSV path **C:\ClusterStorage\volume1\virtual machine files\**

 **Connect Virtual Hard Disk**

Before You Begin  
Specify Name and Location  
Specify Generation  
Assign Memory  
Configure Networking  
**Connect Virtual Hard Disk**  
Installation Options  
Summary

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: 063-FS1.vhdx  
Location: C:\ClusterStorage\volume1\vhdx\   
Size: 30 GB (Maximum: 64 TB)

- o Install an operating system from a bootable CD/DVD or an ISO image
- o Location path: **C:\ClusterStorage\volume1\vhdx\**

 **Installation Options**

Before You Begin  
Specify Name and Location  
Specify Generation  
Assign Memory  
Configure Networking  
Connect Virtual Hard Disk  
**Installation Options**  
Summary

You can install an operating system now if you have access to the setup media, or you can install it later.

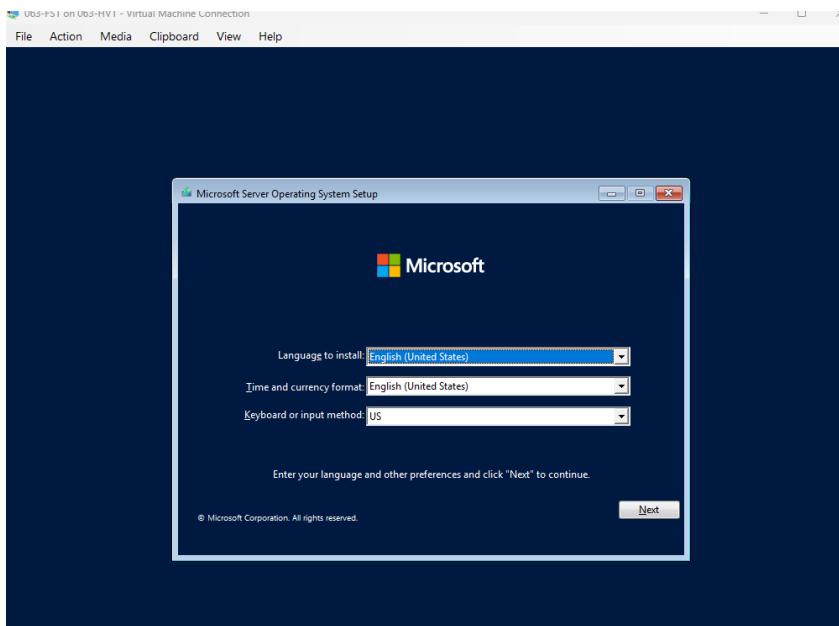
Install an operating system later  
 Install an operating system from a bootable image file

Media  
Image file (.iso): E:\win\_serv\_2022\_en-us.iso

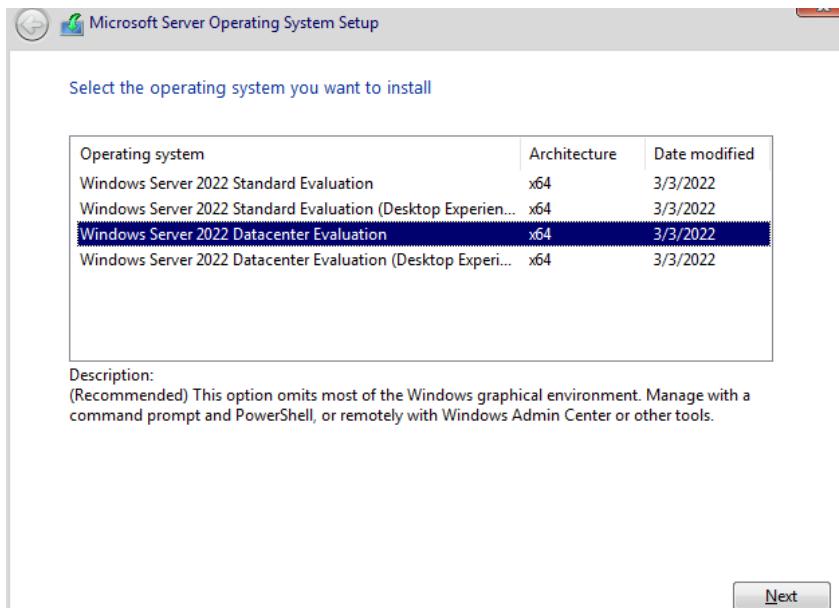
Install an operating system from a network-based installation server

 Your network adapter is disconnected. To perform a network-based installation, return to the Configure Networking page and connect the network adapter.

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- Choose Core \*Datacenter Evaluation\*

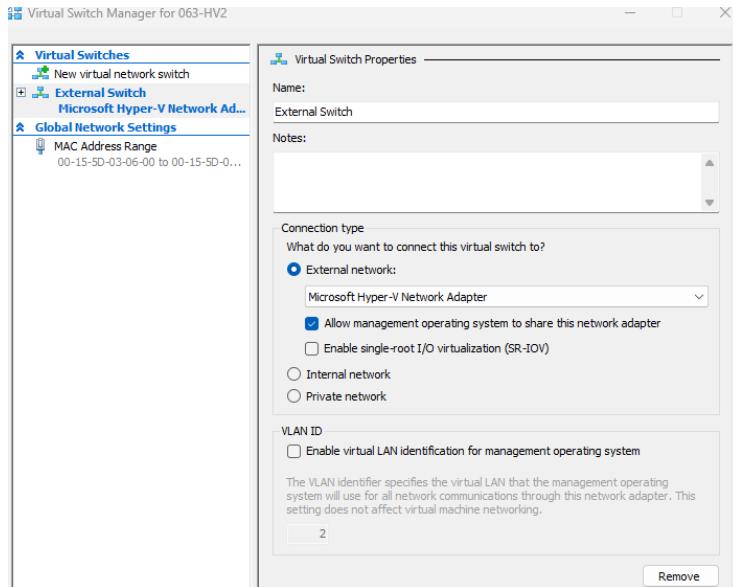


### Create a Virtual vSwitch for (063-FS1):

- Open Hyper-V Manager for (**063-HV1**)
- Navigate to “Virtual Switch Manager”
- Create “New Virtual Switch”
  - o External
- External Network: Choose the network adapter you wish to bind the virtual switch to. This is the physical network adapter in your host computer that connects to your external network
  - o “Microsoft Hyper-V Network Adapter”

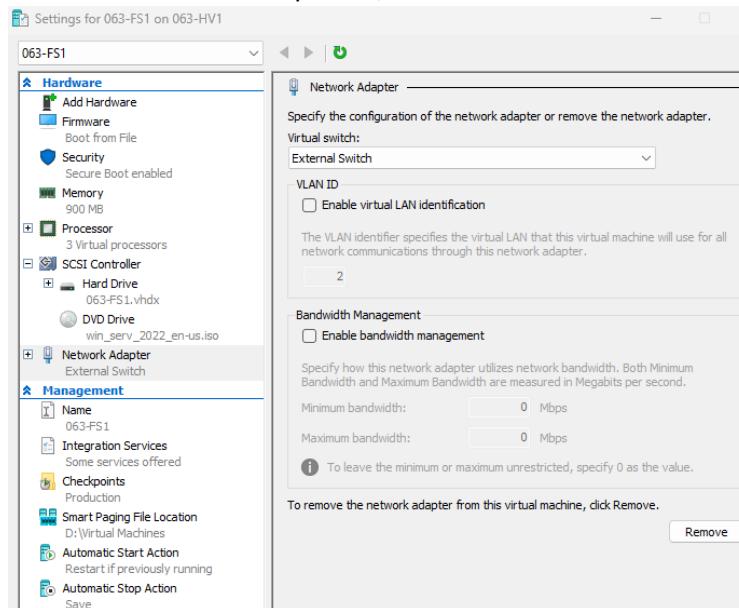
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Name it “External Switch”



## Assign the Virtual Switch to a Virtual Machine:

- To use the newly created external virtual switch with a virtual machine, right-click on **063-FS1** within Hyper-V Manager and select **Settings**
- Under the Hardware section, find and click on **Network Adapter**
- In the Virtual switch dropdown, select the external virtual switch you just created



- Allow management operating system to share this network adapter (optional but recommended): Check this option if you want the host operating system to have access to the network through this adapter. If you're unsure, leave it checked
- Check to see .iso image (**win\_serv\_2022\_en-us.iso**) file is selected
- Set Memory to **800MB**

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Adjust boot order if necessary
- Click Apply, then OK to save the changes

## Change Network Adapter Name for (063-FS1):

- From PowerShell run command:

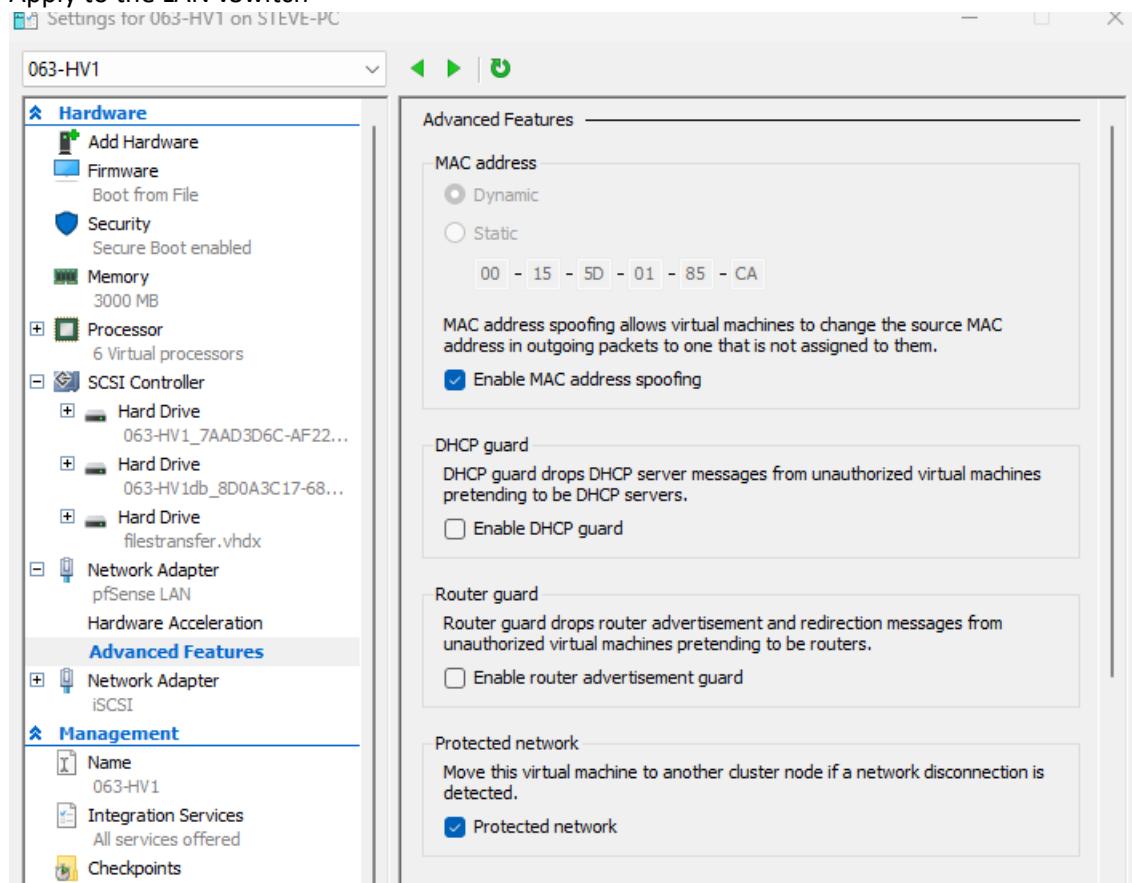
```
PS C:\Users\Administrator> Rename-NetAdapter -Name "Ethernet 3" -NewName "pfSense LAN"
```

- Enter “Get-NetAdapter”

Name	InterfaceDescription	ifIndex	Status	MacAddress	LinkSpeed
pfSense LAN	Microsoft Hyper-V Network Adapter #3	8	Up	00-15-5D-03-05-03	10 Gbps

## Enable MAC Spoofing on (063-HV1)

- Apply to the LAN vSwitch



## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

Configure Network Settings for (063-FS1):

- **SConfig Option 8**

```
=====
          Network adapter settings
=====

NIC index:      1
Description:   Microsoft Hyper-V Network Adapter
IP address:    192.168.3.8,
               fe80::b11d:2824:297d:485c
Subnet mask:   255.255.255.0
DHCP enabled: False

Default gateway:   192.168.3.254
Preferred DNS server: 192.168.3.2
Alternate DNS server:

  1) Set network adapter address
  2) Set DNS servers
  3) Clear DNS server settings

Enter selection (Blank=Cancel): -
```

Join (063-FS1) to the Domain:

```
=====
          Change domain/workgroup membership
=====

Current workgroup: WORKGROUP

Join (D)omain or (W)orkgroup? (Blank=Cancel): d
Name of domain to join (Blank=Cancel): corp.cap.ca
Specify an authorized domain\user (Blank=Cancel): _sysadmin@corp.cap.ca
Password for _sysadmin@corp.cap.ca: *****
Joining corp.cap.ca...
ARNING: The changes will take effect after you restart the computer 063-FS1.
Successfully joined domain.
Do you want to change the computer name before restarting? (Y)es or (N)o:
```

- In SConfig Console select Option 1
- Join **corp.cap.ca**
- **\_sysadmin@corp.cap.ca / Pa\$\$w0rd**

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## Add (063-FS1) to Trusted Hosts:

- Run command on Host machine:

```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

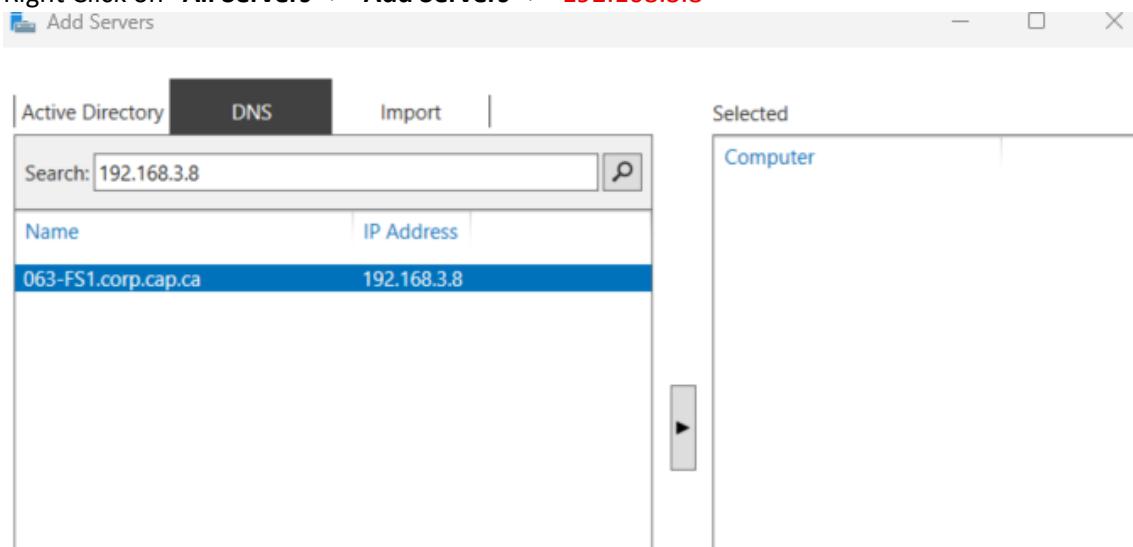
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\Steve> Set-Item WSMan:\localhost\Client\TrustedHosts -Value "063-FS1" -Concatenate

WinRM Security Configuration.
This command modifies the TrustedHosts list for the WinRM client. The computers in the TrustedHosts list might not be
authenticated. The client might send credential information to these computers. Are you sure that you want to modify this
list?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y
PS C:\Users\Steve>
```

## Add (063-FS1) to Server Manager:

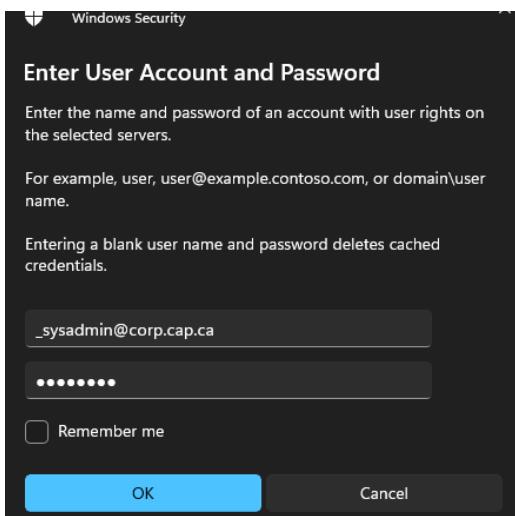
- Navigate to Server Manager on Host machine
- Right Click on “All Servers” > “Add Servers” > “**192.168.3.8**”



Server Name	IPv4 Address	Manageability	Last Update	Windows Activation
063-DC1	192.168.3.2	Online - Performance counters not started	2024-04-08 12:36:15 AM	00455-50000-00001-AA913 (Activated)
063-FS1	192.168.3.8	Online - Performance counters not started	2024-04-08 12:36:14 AM	00455-50000-00001-AA687 (Activated)
063-HV1	192.168.10.2,192.168.3.5	Online - Performance counters not started	2024-04-08 12:36:16 AM	00455-50000-00001-AA057 (Activated)
063-HV2	192.168.10.3,192.168.3.6,192.168.3.7	Online - Performance counters not started	2024-04-08 12:36:15 AM	00455-50000-00001-AA968 (Activated)
063-SAN	192.168.10.1,192.168.3.4	Online - Performance counters not started	2024-04-08 12:36:14 AM	00455-50000-00001-AA964 (Activated)
HyperVCluster	192.168.10.3,192.168.3.6,192.168.3.7	Online	2024-04-08 12:36:15 AM	-

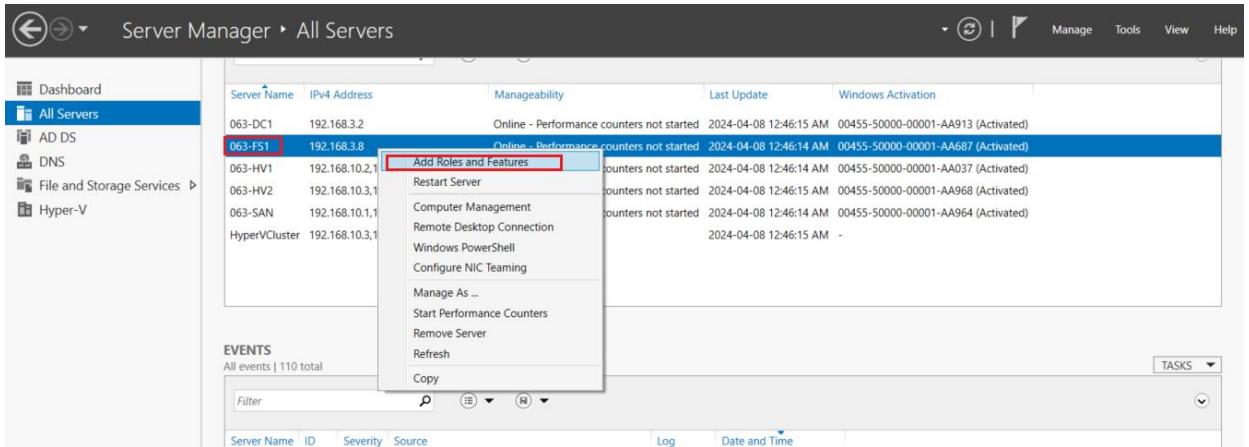
- Right click on **063-FS1** > “Manage as...”
- o [sysadmin@corp.cap.ca](#) / Pa\$\$w0rd

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



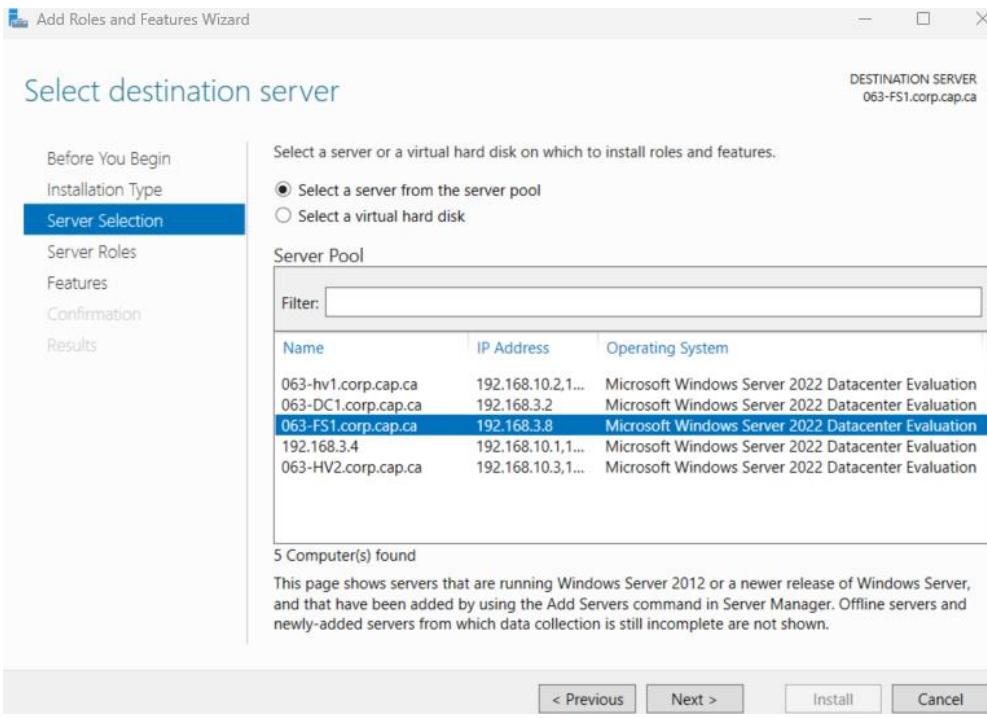
## Install the File Server Role inside (063-FS1):

- Access Server Manager on the Host Machine with the added **063-FS1** we can now manage the File Server using remote tools to add the File Server role

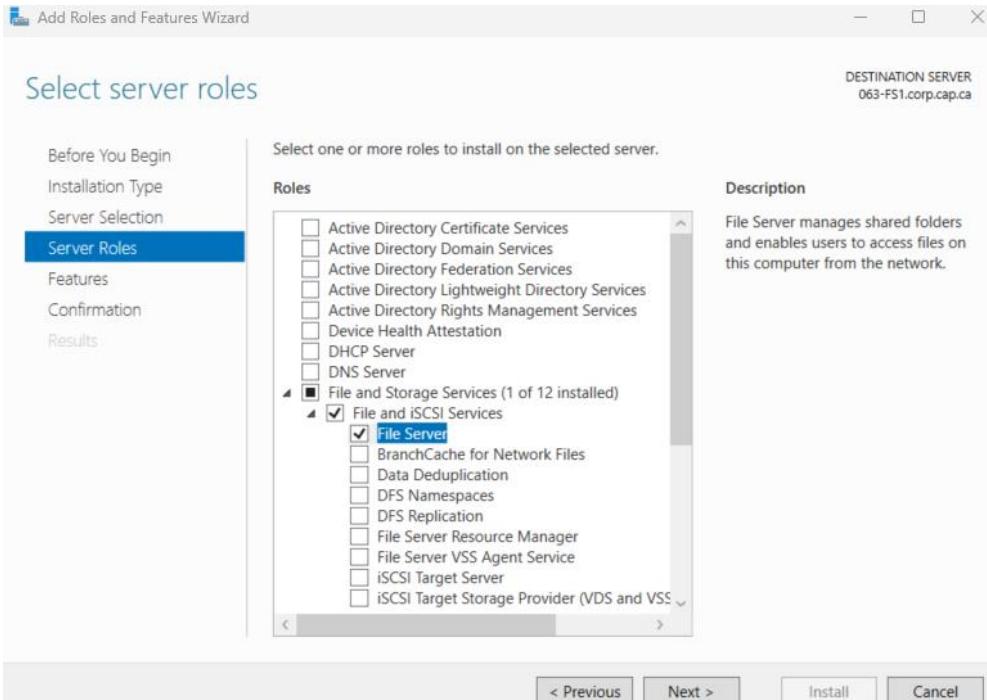


- Right click on **063-FS1** and select "**Add Roles and Features**"
- Select Role-Based or feature-based installation
- Server Selection: "**063-FS1.corp.cap.ca**"

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

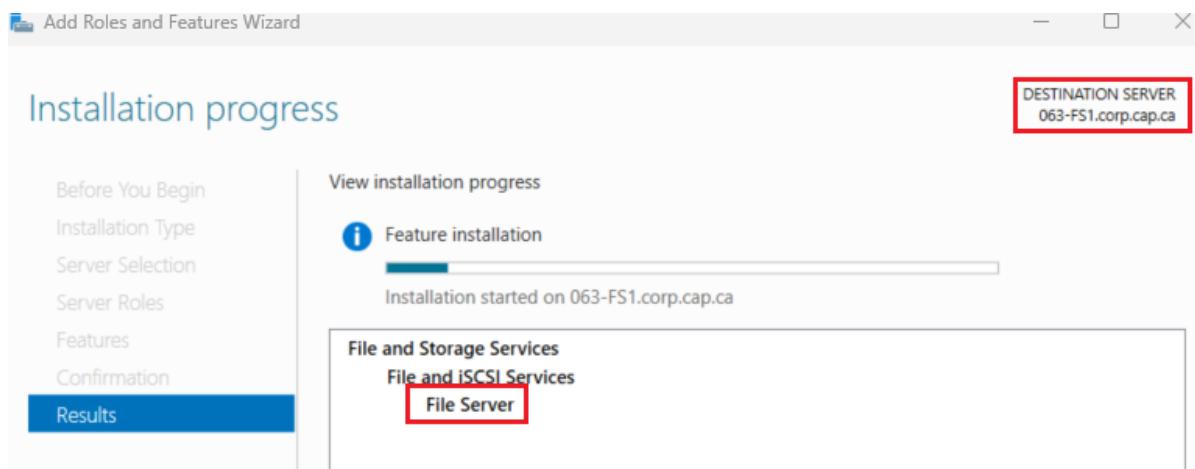


- Click Next
- For Server Roles we want to select “**File Server**”

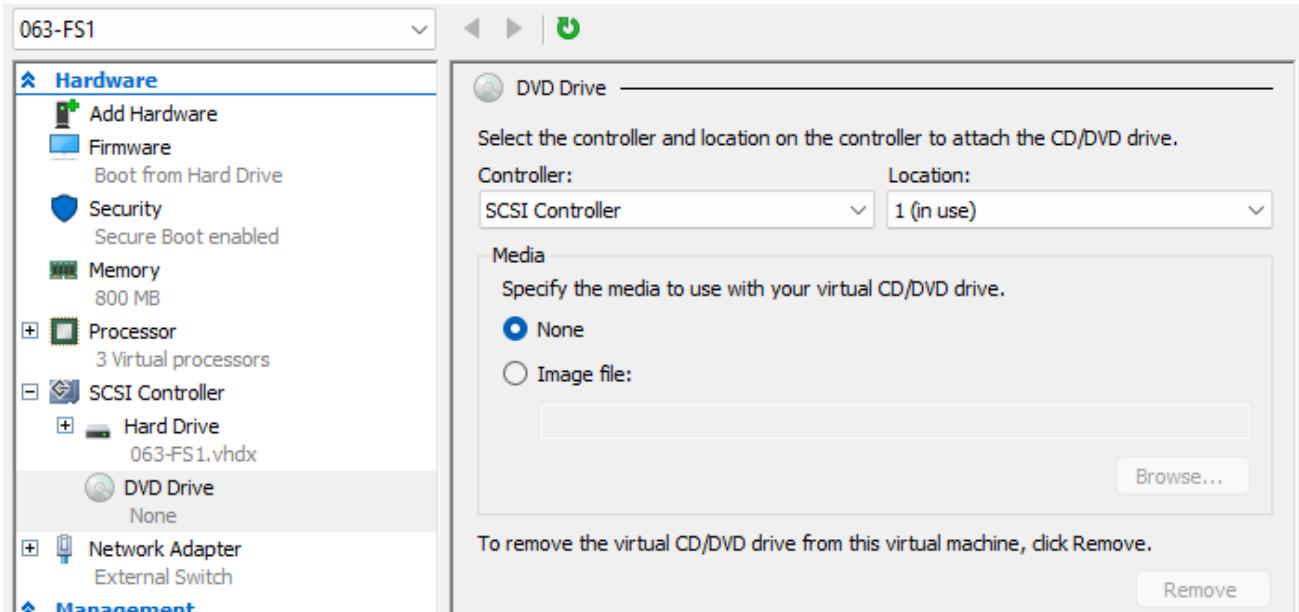


- Click Next > Install

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Remove .ISO File from Settings in both (063-FS1 & 063-FS2):



- Click on DVD Drive and select none, we will do this on both VMs

Create the File Server (063-FS2) on Cluster Shared Volume:

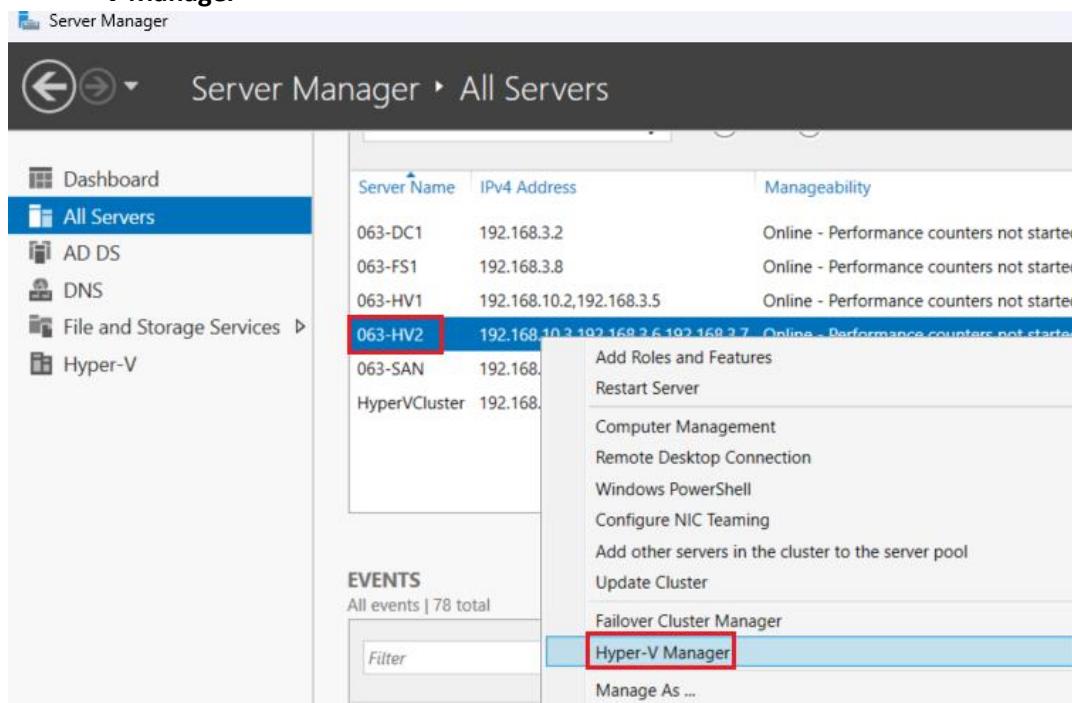
- **Step 1: Configure the Cluster Shared Volume:**
- Make sure your CSV is correctly configured:
  - o Open Failover Cluster Manager
  - o Go to **Storage > Disks**
  - o Ensure the CSV is in the list and online

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

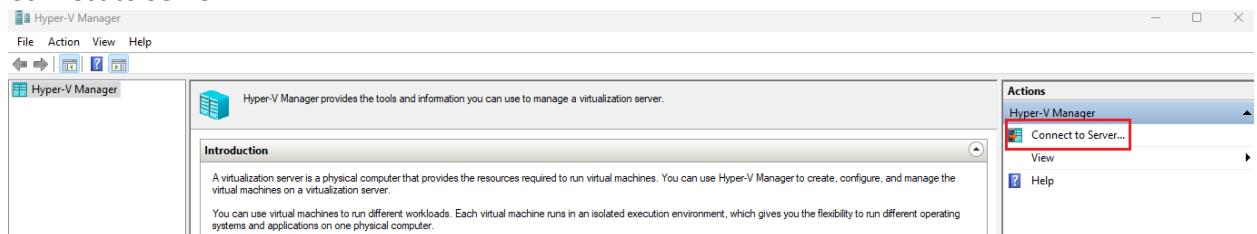


Access Hyper-V Manager on (063-HV2):

- **Step 2: Open the Hyper-V Manager:**
  - o You can access this through Server Manager > All Servers > Right click 063-HV2 > Hyper-V Manager

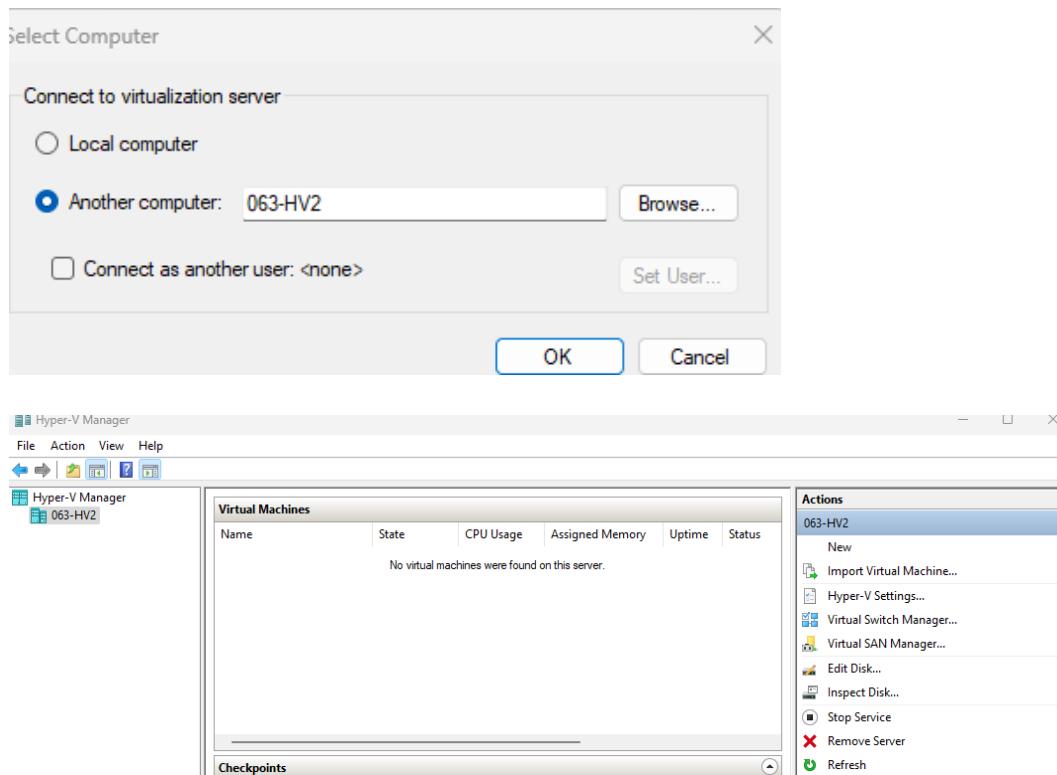


- Connect to Server...



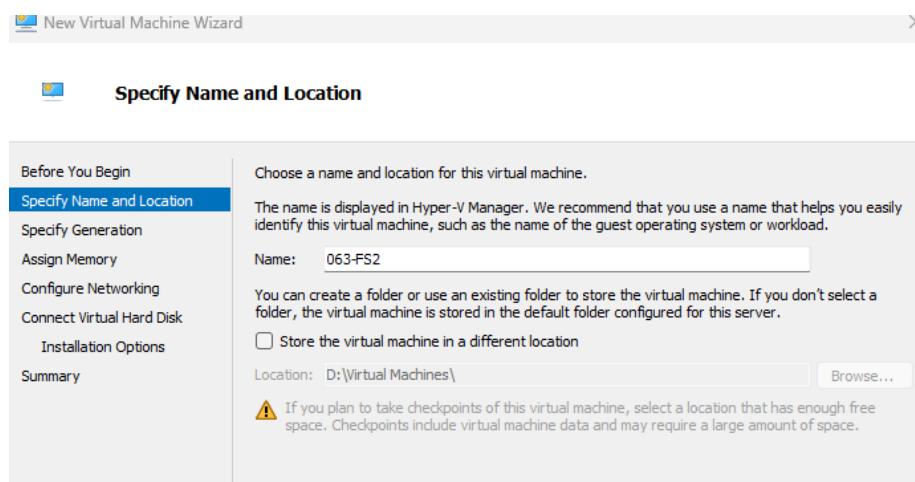
- Enter 063-HV2

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



## Create the Virtual Machine (063-FS2):

- In Hyper-V Manager, create the new VMs that will be used as file servers:
  - o In Hyper-V Manager, right-click on the Hyper-V server and select 'New' > 'Virtual Machine'
- Follow the New Virtual Machine Wizard to configure the VM:
  - o Assign a name to the VM (**063-FS2**)



- o Specify Generation 2
- o Assign memory: **900MB**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

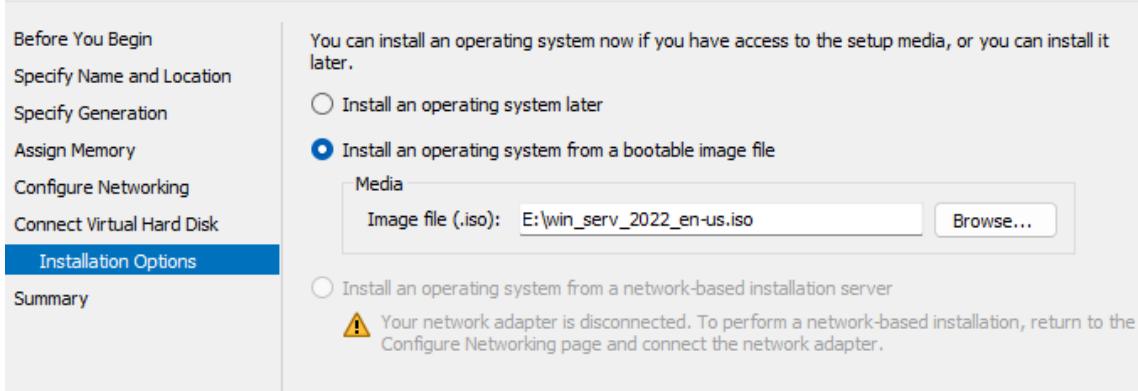
- When asked to connect a virtual hard disk, choose to create a new virtual hard disk, and place it on the CSV path **C:\ClusterStorage\volume1\virtual machine files\**



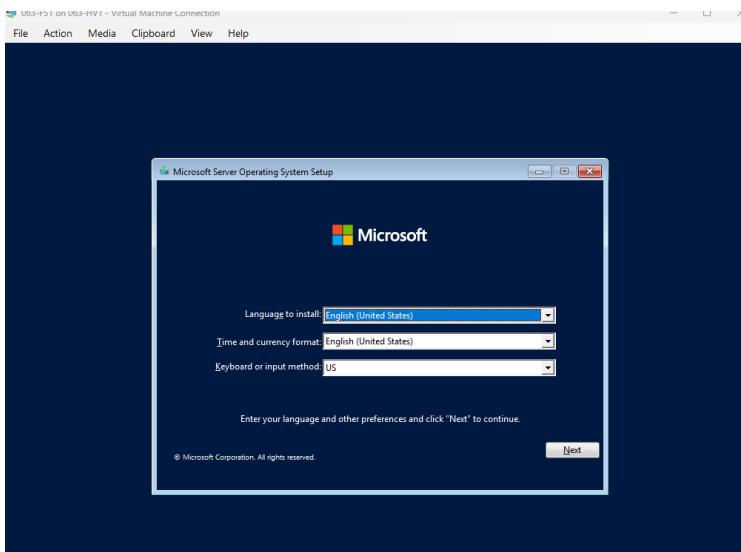
- Install an operating system from a bootable CD/DVD or an ISO image

- Browse to Folder Location: **C:\ClusterStorage\volume1\vhdx\**

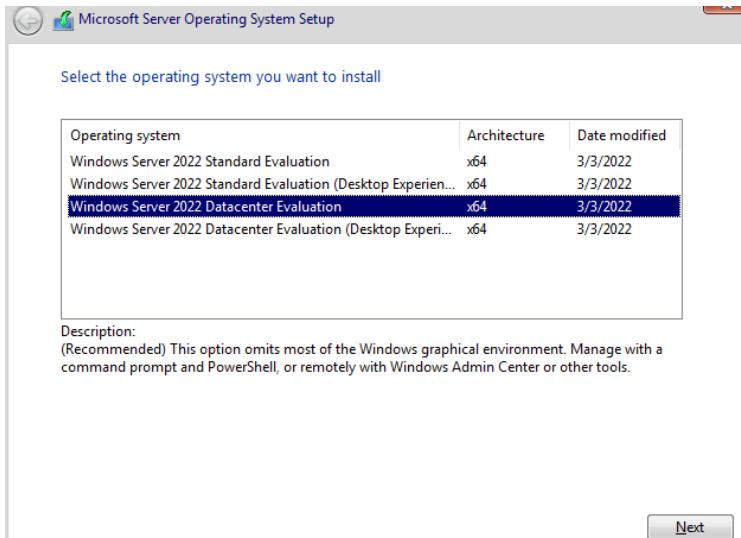
### Installation Options



# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



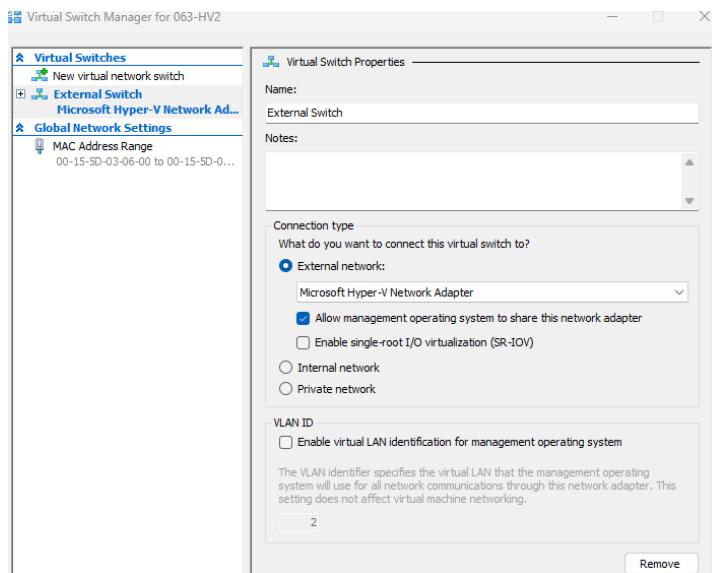
- Choose Core \*Datacenter Evaluation\*



## Create a Virtual vSwitch for (063-FS2):

- Open Hyper-V Manager for **(063-HV2)**
- Navigate to “Virtual Switch Manager”
- Create “New Virtual Switch”
  - o External
- External Network: Choose the network adapter you wish to bind the virtual switch to. This is the physical network adapter in your host computer that connects to your external network
  - o **“Microsoft Hyper-V Network Adapter”**
- Name it **“External Switch”**

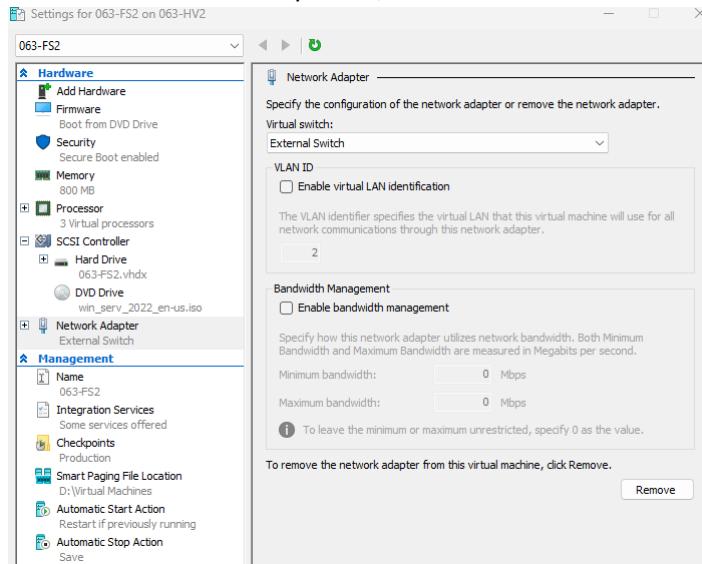
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



- Apply > OK

## Assign the Virtual Switch to a Virtual Machine:

- To use the newly created external virtual switch with a virtual machine, right-click on **063-FS2** within Hyper-V Manager and select **Settings**
- Under the **Hardware** section, find and click on **Network Adapter**
- In the **Virtual switch** dropdown, select the external virtual switch you just created



- Allow management operating system to share this network adapter (optional but recommended): Check this option if you want the host operating system to have access to the network through this adapter. If you're unsure, leave it checked
- Check to see .iso image (**win\_serv\_2022\_en-us.iso**) file is selected
- Set Memory to **900MB**

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Adjust boot order if necessary – HD to the top
- Click Apply, then OK to save the changes

## Change Network Adapter Name for (063-FS2):

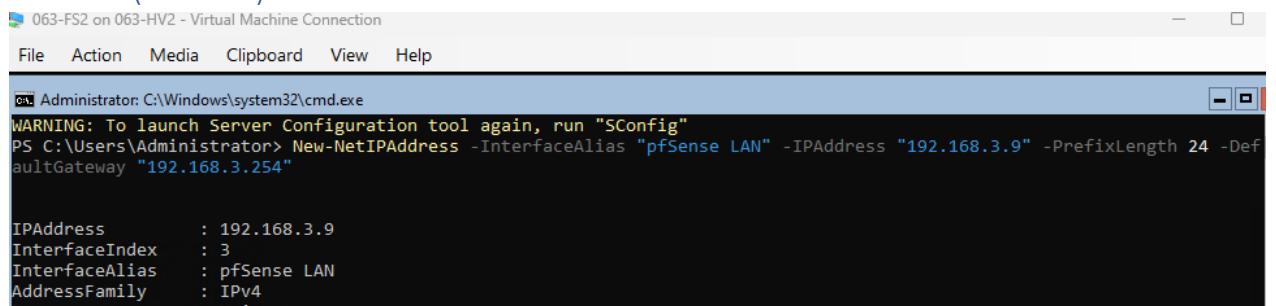
- From PowerShell run command:

```
PS C:\Users\Administrator> Rename-NetAdapter -Name "Ethernet 3" -NewName "pfSense LAN"
```

- Enter “Get-NetAdapter”

Name	InterfaceDescription	ifIndex	Status	MacAddress	LinkSpeed
pfSense LAN	Microsoft Hyper-V Network Adapter #3	8	Up	00-15-5D-03-05-03	10 Gbps

## Set Static IP for (063-FS2):

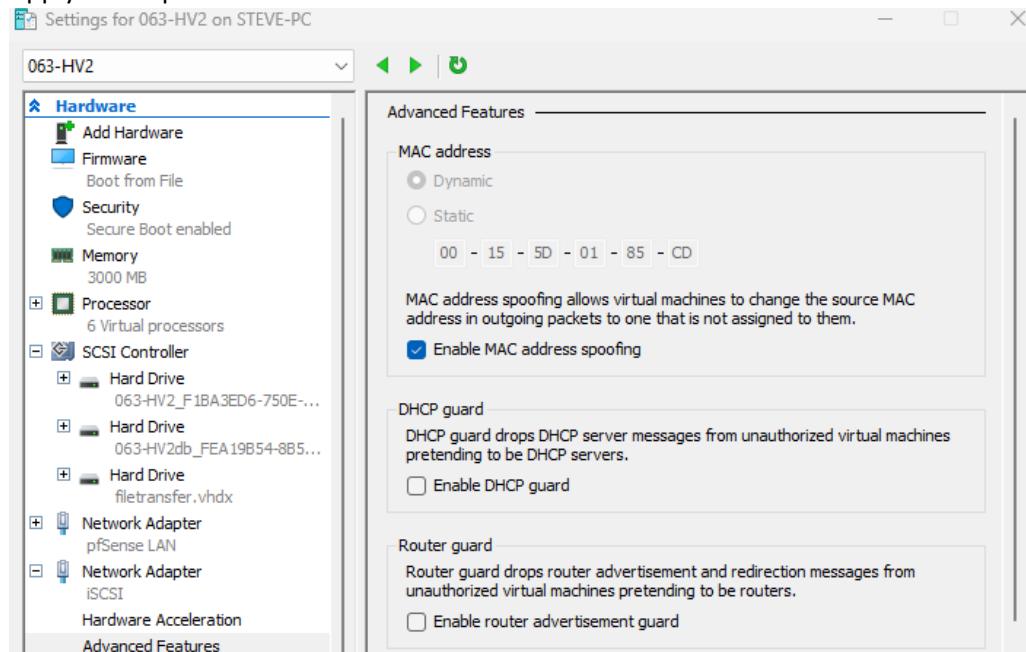


```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\Administrator> New-NetIPAddress -InterfaceAlias "pfSense LAN" -IPAddress "192.168.3.9" -PrefixLength 24 -DefaultGateway "192.168.3.254"

IPAddress      : 192.168.3.9
InterfaceIndex  : 3
InterfaceAlias  : pfSense LAN
AddressFamily   : IPv4
```

## Enable MAC Spoofing on (063-HV2):

- Apply to the pfSense LAN vSwitch



## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

Join (063-FS2) to the Domain:

```
=====
          Change domain/workgroup membership
=====

Current workgroup: WORKGROUP

Join (D)omain or (W)orkgroup? (Blank=Cancel): d
Name of domain to join (Blank=Cancel): corp.cap.ca
Specify an authorized domain\user (Blank=Cancel): _sysadmin@corp.cap.ca
Password for _sysadmin@corp.cap.ca: *****
Joining corp.cap.ca...
ARNING: The changes will take effect after you restart the computer 063-FS1.
Successfully joined domain.
Do you want to change the computer name before restarting? (Y)es or (N)o:
```

- In SConfig Console select Option 1
- Join **corp.cap.ca**
- **\_sysadmin@corp.cap.ca / Pa\$\$w0rd**

Add (063-FS2) to Trusted Hosts:

- Run command on Host machine:
  - o **Set-Item WSMan:\localhost\Client\TrustedHosts -Value "063-FS2" -Concatenate**

```
Windows PowerShell
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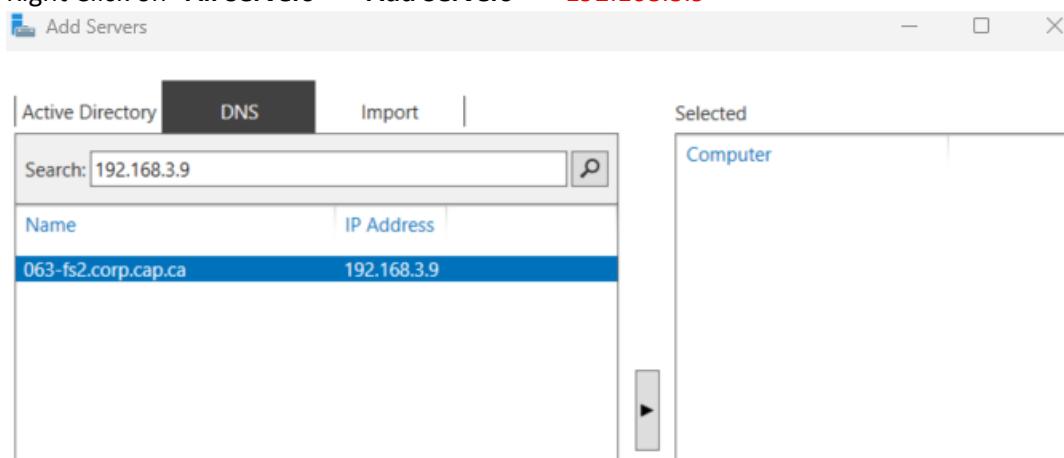
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\Steve> Set-Item WSMan:\localhost\Client\TrustedHosts -Value "063-FS2" -Concatenate

WinRM Security Configuration.
This command modifies the TrustedHosts list for the WinRM client. The computers in the TrustedHosts list might not be
authenticated. The client might send credential information to these computers. Are you sure that you want to modify this
list?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y
PS C:\Users\Steve>
```

Add (063-FS2) to Server Manager:

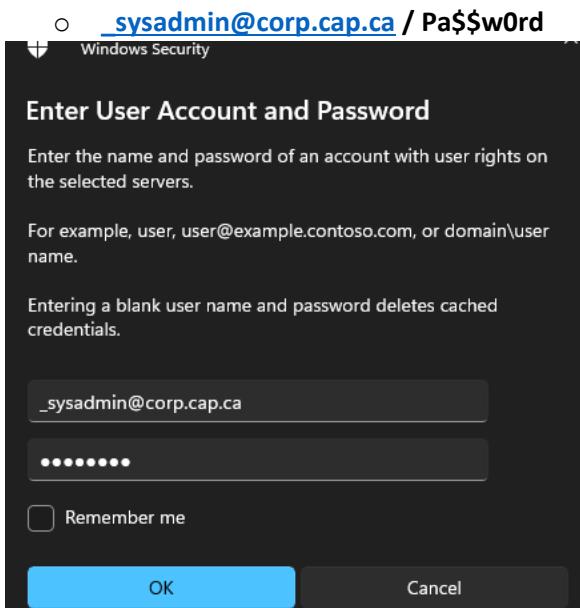
- Navigate to Server Manager on Host machine
- Right Click on “All Servers” > “Add Servers” > “**192.168.3.9**”



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Servers				
All servers   7 total				
Server Name	IPv4 Address	Manageability	Last Update	Windows Activation
063-DC1	192.168.3.2	Online - Performance counters not started	2024-04-08 11:08:12 AM	00455-50000-00001-AA913 (Activated)
063-FS1	192.168.3.8	Online - Performance counters not started	2024-04-08 11:08:11 AM	00455-50000-00001-AA687 (Activated)
063-FS2	192.168.3.9	Online - Performance counters not started	2024-04-08 11:08:11 AM	00455-50000-00001-AA918 (Activated)
063-HV1	192.168.10.2,192.168.3.5,192.168.3.7	Online - Performance counters not started	2024-04-08 11:08:11 AM	00455-50000-00001-AA037 (Activated)
063-HV2	192.168.10.3,192.168.3.6	Online - Performance counters not started	2024-04-08 11:08:11 AM	00455-50000-00001-AA968 (Activated)
063-SAN	192.168.10.1,192.168.3.4	Online - Performance counters not started	2024-04-08 11:08:10 AM	00455-50000-00001-AA964 (Activated)
HyperVCluster	192.168.10.2,192.168.3.5,192.168.3.7	Online	2024-04-08 11:08:11 AM	-

- Right click on **063-FS2** > “Manage as...”



Install the File Server Role inside (063-FS2):

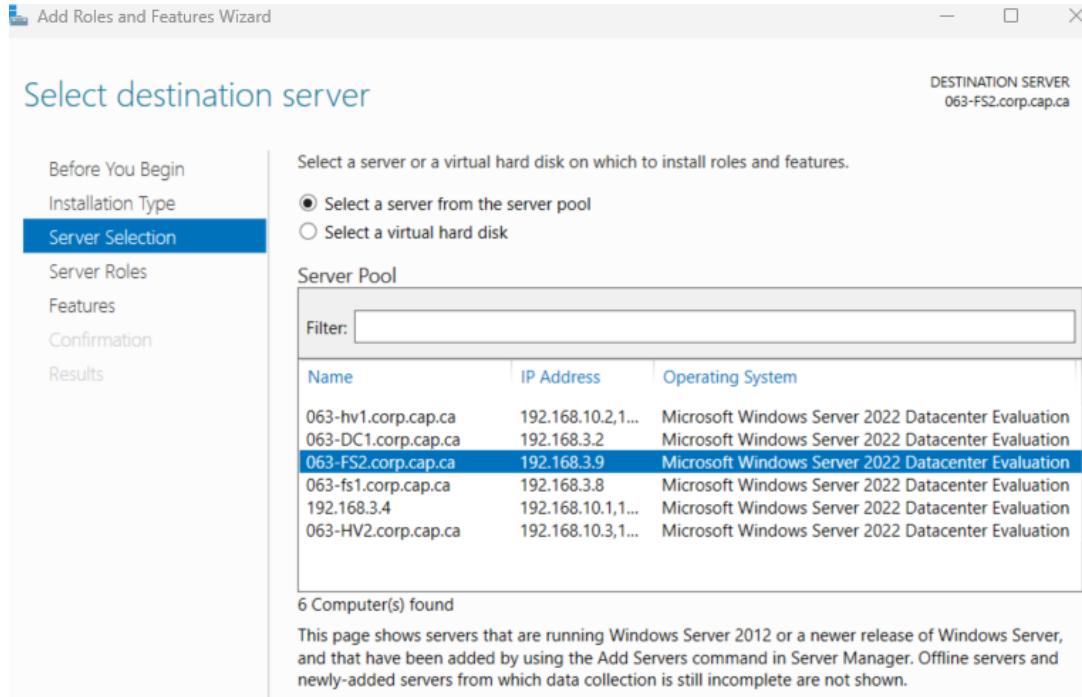
- Access Server Manager on the Host Machine with the added **063-FS2** we can now manage the File Server using remote tools to add the File Server role

The screenshot shows the Server Manager interface with the following details:

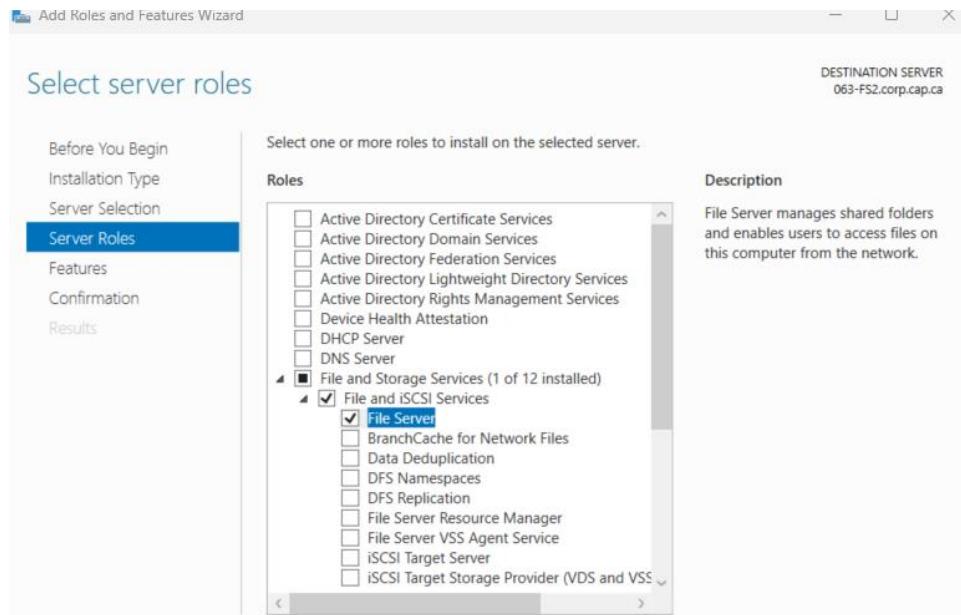
- Left sidebar: Dashboard, All Servers (selected), AD DS, DNS, File and Storage Services (expanded), Hyper-V.
- Center pane: A table of servers with columns: Server Name, IPv4 Address, Manageability, Last Update, Windows Activation.
- Right pane: Events section showing 110 total events.
- Bottom navigation: Filter, Log, Date and Time.
- Context menu for server 063-FS1 (highlighted with a red box):
  - Add Roles and Features (highlighted with a red box)
  - Restart Server
  - Computer Management
  - Remote Desktop Connection
  - Windows PowerShell
  - Configure NIC Teaming
  - Manage As ...
  - Start Performance Counters
  - Remove Server
  - Refresh
  - Copy

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- Right click on **063-FS2** and select “**Add Roles and Features**”
- Select Role-Based or feature-based installation
- Server Selection: “**063-FS2.corp.cap.ca**”

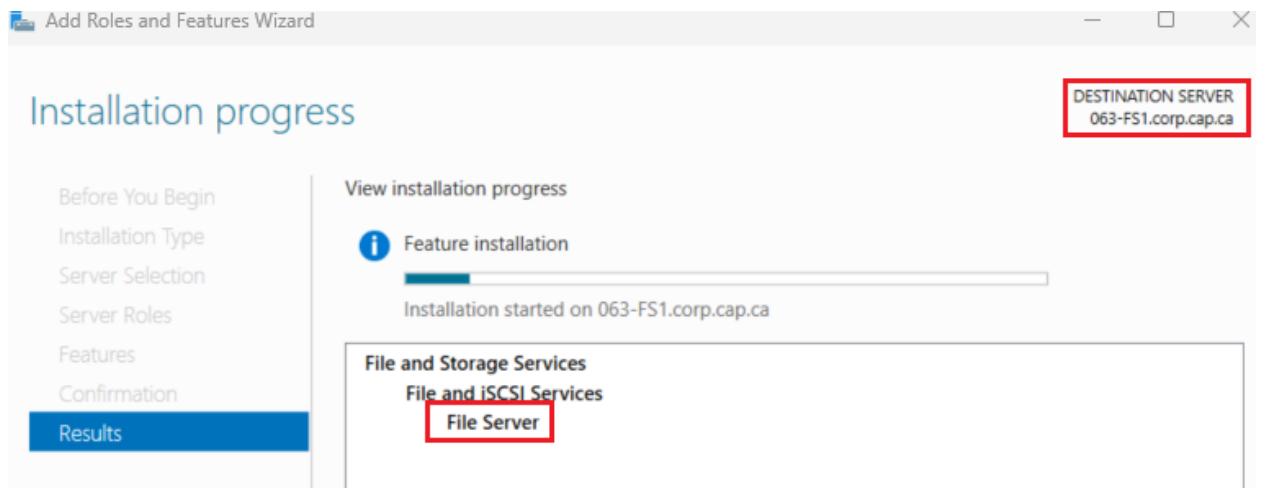


- Click Next
- For Server Roles we want to select “**File Server**”

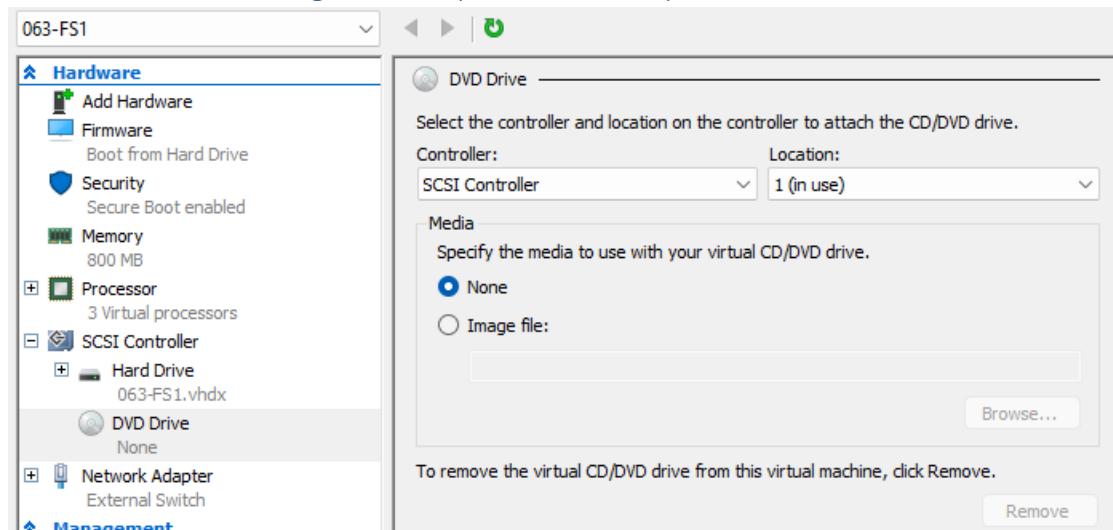


- Click Next > Install

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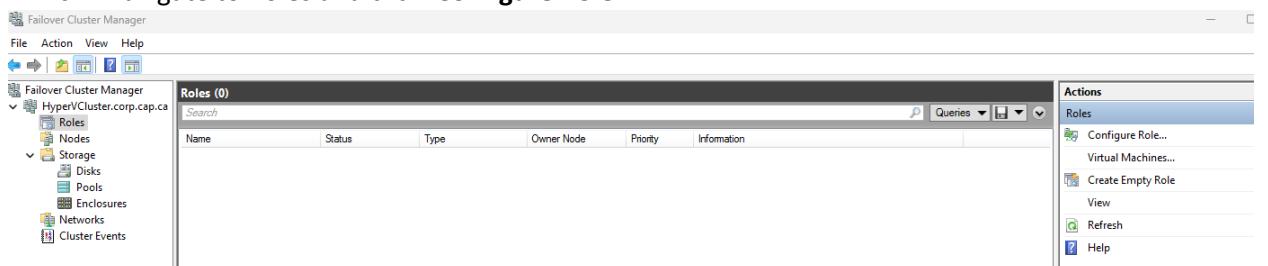
Remove .ISO File from Settings in both (063-FS1 & FS2):



- Click on DVD Drive and select none, we will do this on both VMs

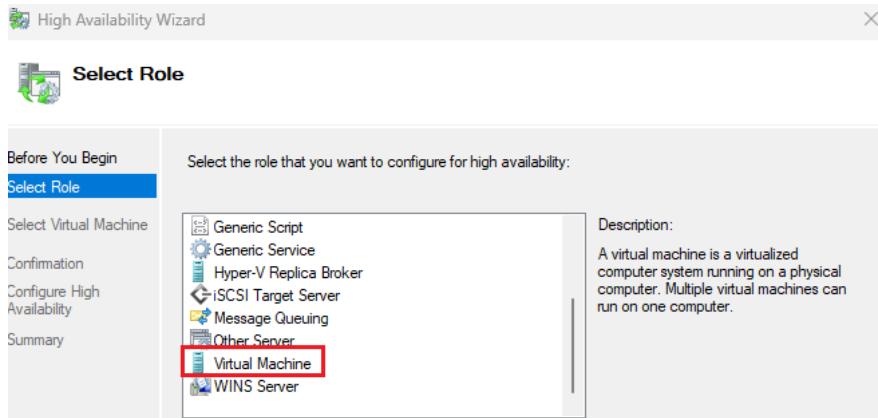
Make the Virtual Machines Highly Available:

- After the VMs are set up, make them highly available through the Failover Cluster Manager:
  - o Open Failover Cluster Manager
  - o Navigate to Roles and click '**Configure Role**'

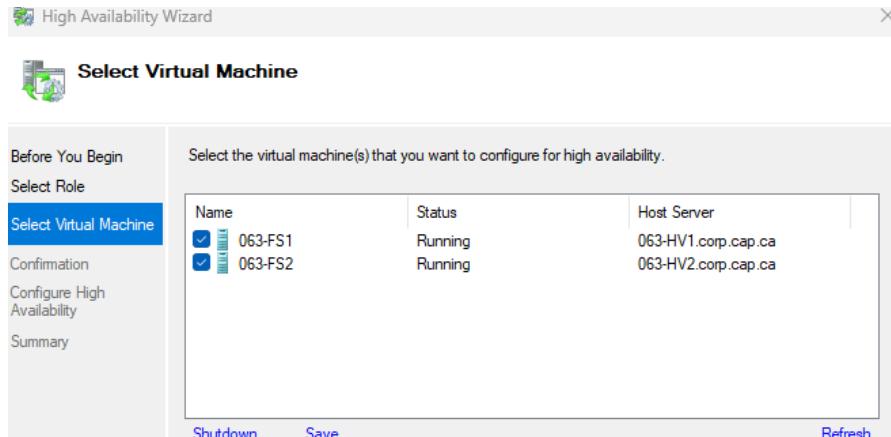


- Select 'Virtual Machine' and click 'Next'

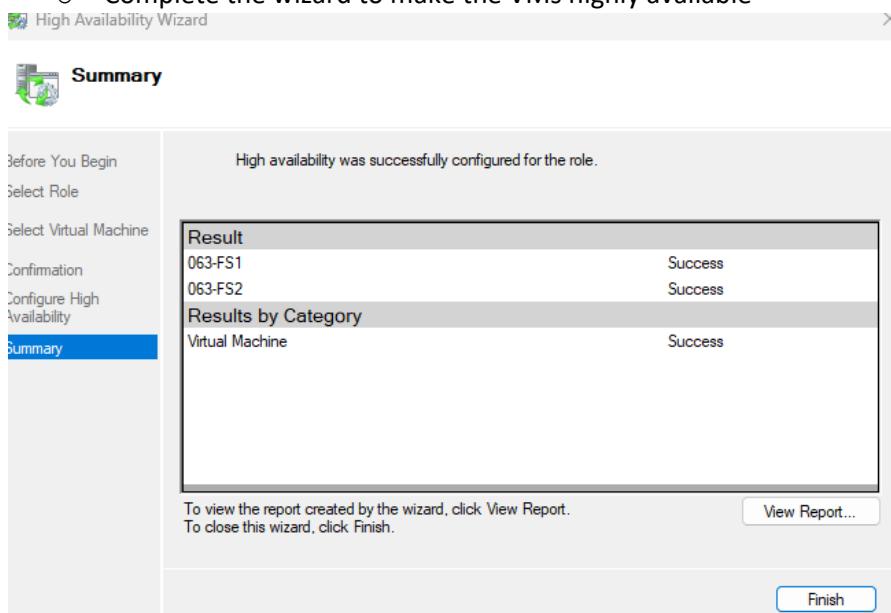
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- Choose the VMs you've just created and add them to the cluster
  - o **063-FS1 and 063-FS2**



- o Complete the wizard to make the VMs highly available

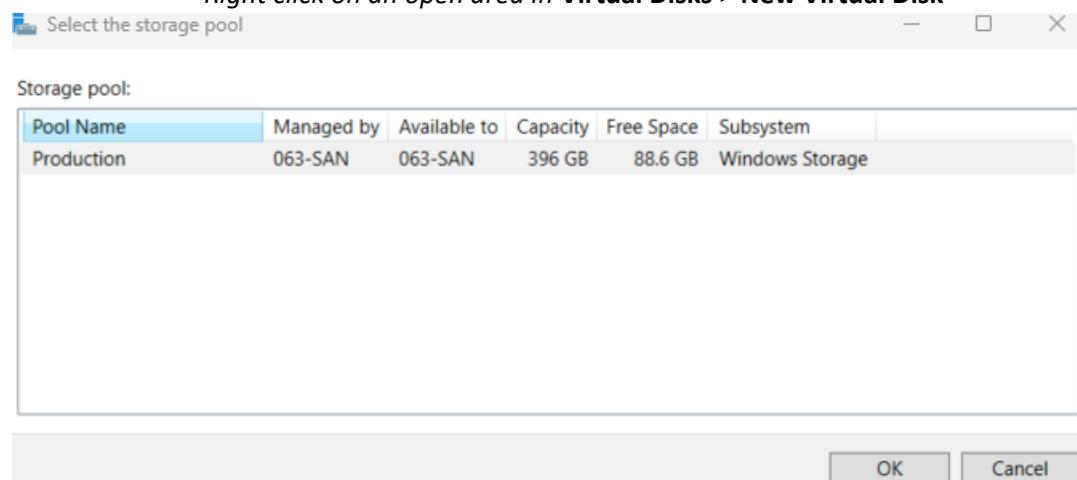


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- Log into both **063-F1** and **063-F2** using the \_sysadmin super Admin account on both File Servers

### Creating a Secondary Witness Disk in Quorum:

- We are attempting to create a disk witness therefore we need to create the secondary disk to make it redundant
- From the **063-SAN** Server we will create an iSCSI
  - o **063-SAN > Server Manager > File and Storage Services > Volumes > Storage Pools**
  - *Right click on an open area in Virtual Disks > New Virtual Disk*

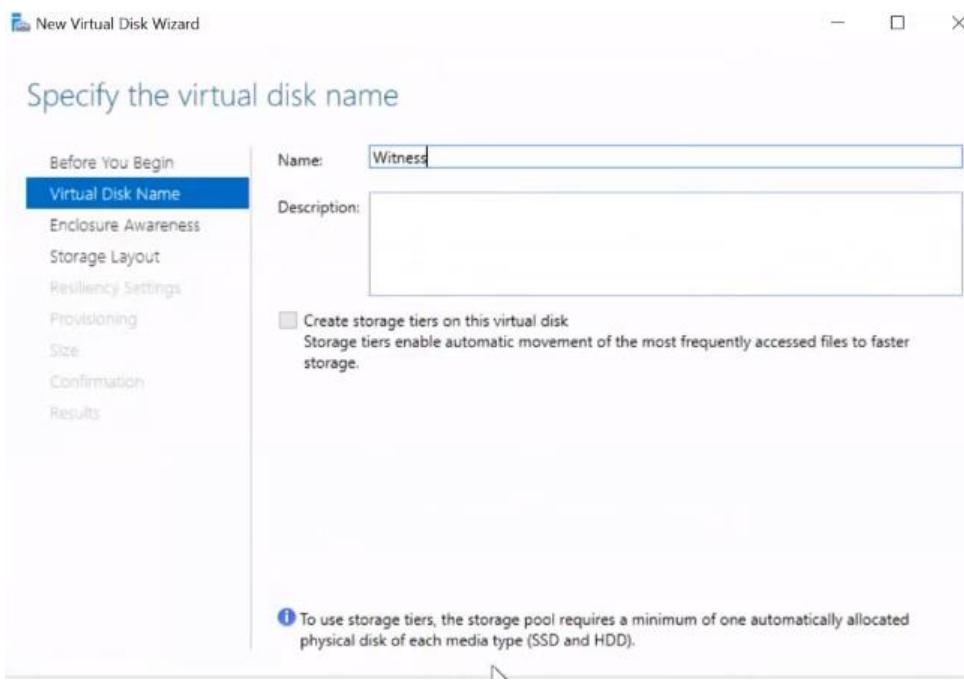


Name	Status	Layout	Provisioning	Capacity	Alloc.
Production	Parity	Thin	200 GB	5.00	
Witness	Parity	Thin	1.00 GB	1.00	

New Virtual Disk...

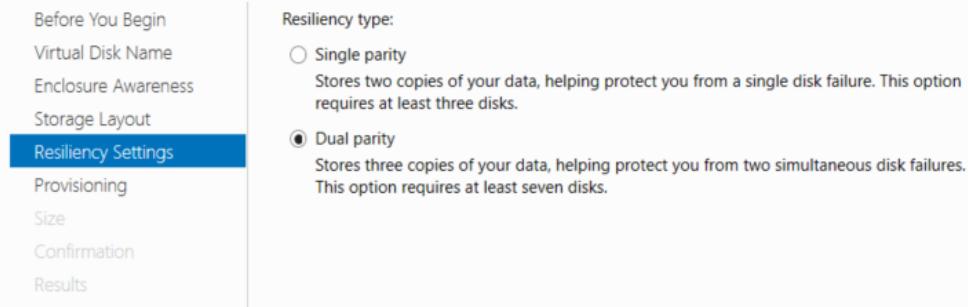
- Name it **Witness**

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- Specify enclosure resiliency:
  - o Default > Next
- Select the storage layout:
  - o Choose **Parity** > **Dual Parity**
  - o Click Next

### Configure the resiliency settings



- Specify the size of the virtual disk:
  - o Fixed > **1GB Size**

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### Specify the size of the virtual disk

The screenshot shows the 'Size' step of a wizard. On the left, a vertical navigation bar lists: Before You Begin, Virtual Disk Name, Enclosure Awareness, Storage Layout, Resiliency Settings, Provisioning, **Size**, Confirmation, and Results. The 'Size' option is highlighted with a blue bar. On the right, it says 'Free space in this storage pool: 24.0 GB'. Below that, there are two radio button options: ' Specify size:' followed by a text input field containing '1' and a dropdown menu set to 'GB', and ' Maximum size'.

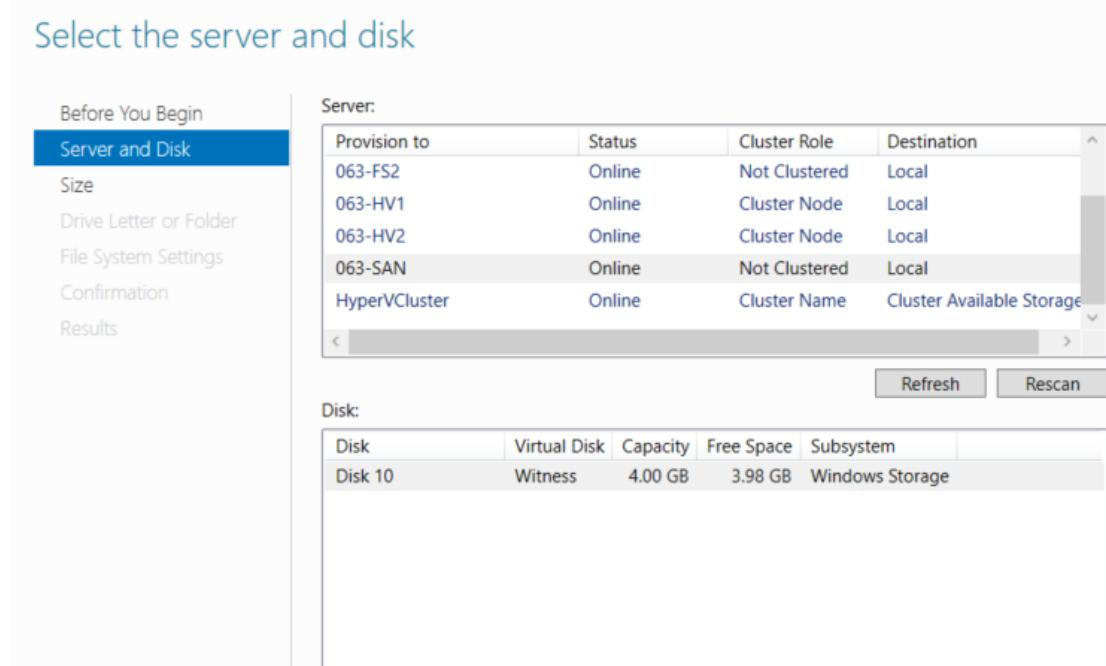
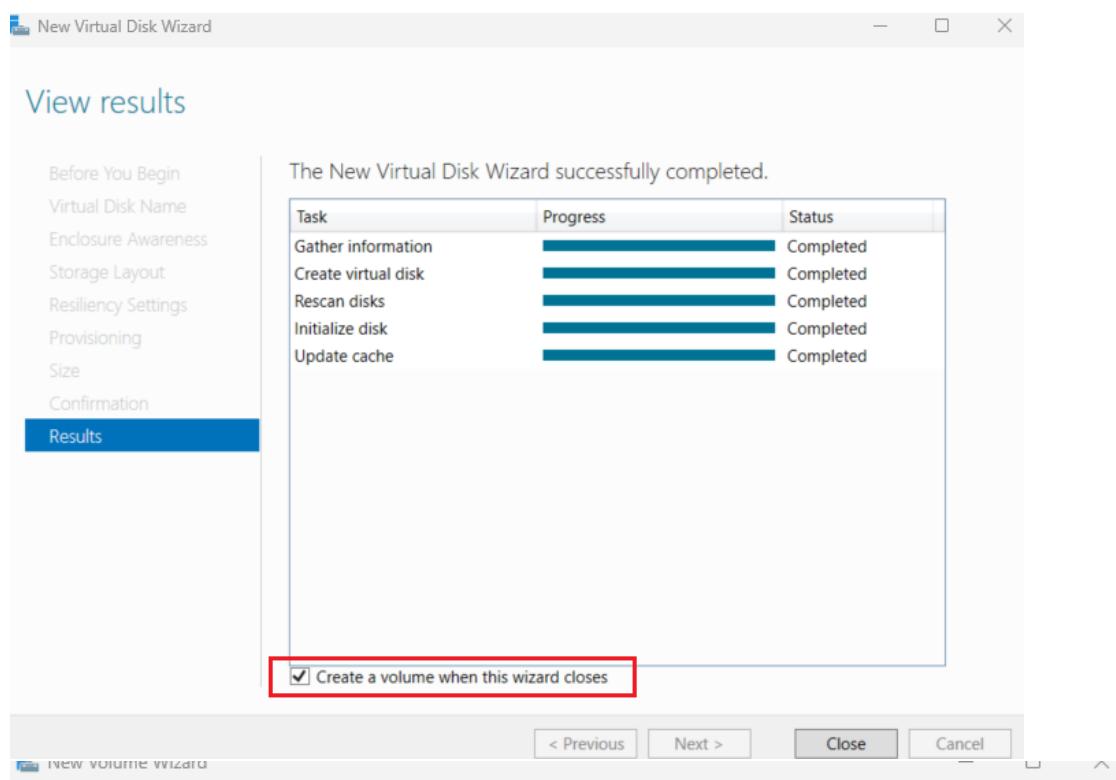
- Confirm selection:
  - o Click Create

### Confirm selections

The screenshot shows the 'Confirmation' step of a wizard. On the left, a vertical navigation bar lists: Before You Begin, Virtual Disk Name, Enclosure Awareness, Storage Layout, Resiliency Settings, Provisioning, Size, **Confirmation**, and Results. The 'Confirmation' option is highlighted with a blue bar. On the right, it says 'Confirm that the following are the correct settings, and then click Create.' Below that, two sections are shown: 'VIRTUAL DISK LOCATION' and 'VIRTUAL DISK PROPERTIES'.  
**VIRTUAL DISK LOCATION**  
Server: 063-SAN  
Subsystem: Windows Storage  
Storage pool name: Production  
Status: OK  
Free space: 88.6 GB  
**VIRTUAL DISK PROPERTIES**  
Name: Witness  
Storage tiers: Disabled  
Storage layout: Parity  
Resiliency type: Dual parity  
Provisioning type: Fixed  
Total requested size: 1.00 GB  
Enclosure awareness: None

- Create a Volume:
  - o Make it **ReFS**

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The screenshot shows the "New Volume Wizard" interface with three main sections:

- Specify the size of the volume**:
  - Available Capacity: 3.98 GB
  - Minimum size: 8.00 MB
  - Volume size:  GB
- Assign to a drive letter or folder**:
  - Select whether to assign the volume to a drive letter or a folder. When you assign a volume to a folder, the volume appears as a folder within a drive, such as D:\UserData.
  - Assign to:
    - Drive letter:
    - The following folder:
    - Don't assign to a drive letter or folder.
- Select file system settings**:
  - File system:
  - Allocation unit size:
  - Volume label:
  - Generate short file names (not recommended)  
Short file names (8 characters with 3-character extensions) are required for some 16-bit applications running on client computers, but make file operations slower.

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## Confirm selections

Before You Begin

Server and Disk

Size

Drive Letter or Folder

File System Settings

**Confirmation**

Results

Confirm that the following are the correct settings, and then click Create.

### VOLUME LOCATION

Server:	063-SAN
Subsystem:	Windows Storage
Virtual disk:	Witness
Disk:	Disk 10
Free space:	3.98 GB

### VOLUME PROPERTIES

Volume size:	3.98 GB
Drive letter or folder:	W:\
Volume label:	Witness

### FILE SYSTEM SETTINGS

File system:	ReFS
Short file name creation:	Disabled
Allocation unit size:	Default

## Completion

Before You Begin

Server and Disk

Size

Drive Letter or Folder

File System Settings

Confirmation

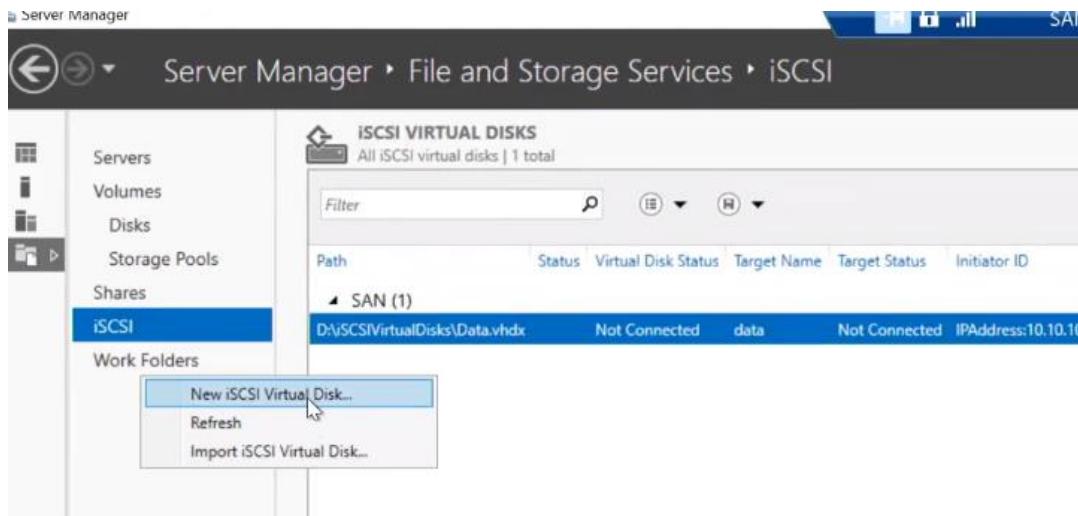
**Results**

You have successfully completed the New Volume Wizard.

Task	Progress	Status
Gather information	<div style="width: 100%; background-color: #0070C0; height: 10px;"></div>	Completed
Create new partition	<div style="width: 100%; background-color: #0070C0; height: 10px;"></div>	Completed
Format volume	<div style="width: 100%; background-color: #0070C0; height: 10px;"></div>	Completed
Add access path	<div style="width: 100%; background-color: #0070C0; height: 10px;"></div>	Completed
Update cache	<div style="width: 100%; background-color: #0070C0; height: 10px;"></div>	Completed

- The witness disk will now be attached to the SAN Server (View in File Explorer)
- Next, create the iSCSI Target
  - o **063-SAN > Server Manager > File and Storage Services > iSCSI**
  - o

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- Choose (W:)

## Select iSCSI virtual disk location

**iSCSI Virtual Disk Location**

Server:

Server Name	Status	Cluster Role	Owner Node
063-SAN	Online	Not Clustered	

ⓘ The list is filtered to show only servers with the iSCSI Target Server role installed.

Storage location:

Select by volume:

Volume	Free Space	Capacity	File System
C:	19.3 GB	29.4 GB	NTFS
D:	451 MB	200 GB	ReFS
W:	3.18 GB	3.94 GB	ReFS

The iSCSI virtual disk will be saved at \iSCSIVirtualDisk on the selected volume.

Type a custom path:

- Name: Witness
  - Path: W:\iSCSIVirtualDisks\Witness.vhdx
- Free space: 152MB

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### Specify iSCSI virtual disk size

The screenshot shows the 'Specify iSCSI virtual disk size' dialog box. On the left, a sidebar lists steps: iSCSI Virtual Disk Location, iSCSI Virtual Disk Name, **iSCSI Virtual Disk Size**, iSCSI Target, Target Name and Access, Access Servers, Enable authentication ser..., Confirmation, and Results. The 'iSCSI Virtual Disk Size' step is selected. The main area shows 'Free space: 3,224 MB'. A 'Size:' input field contains '152' with a 'MB' dropdown. An 'MB' unit is highlighted with a red box. Below it, a radio button for 'Fixed size' is unselected. A checked checkbox 'Clear the virtual disk on allocation' has a note: 'Note: Un-selecting is NOT RECOMMENDED. Clearing a disk to zero will remove any fragments of data that remained on underlying storage, thus protecting from information leaks.' Another radio button for 'Dynamically expanding' is selected. A note for 'Dynamically expanding' says: 'This type of disk provides better use of physical storage space and is recommended for servers running applications that are not disk intensive. The .vhdx file is small when the disk is created and grows as data is written to it.' A third radio button for 'Differencing' is unselected. A note for 'Differencing' says: '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 this virtual hard disk without affecting the parent disk and easily revert the changes later.' At the bottom, a 'Parent virtual disk path:' input field and a 'Browse...' button are shown.

- Assign iSCSI target:

### Assign iSCSI target

The screenshot shows the 'Assign iSCSI target' dialog box. The sidebar steps are: iSCSI Virtual Disk Location, iSCSI Virtual Disk Name, iSCSI Virtual Disk Size, **iSCSI Target**, Confirmation, and Results. The 'iSCSI Target' step is selected. The main area says 'Assign this iSCSI virtual disk to an existing iSCSI target or create a new target for it.' A radio button for 'Existing iSCSI target:' is selected. A table lists targets:

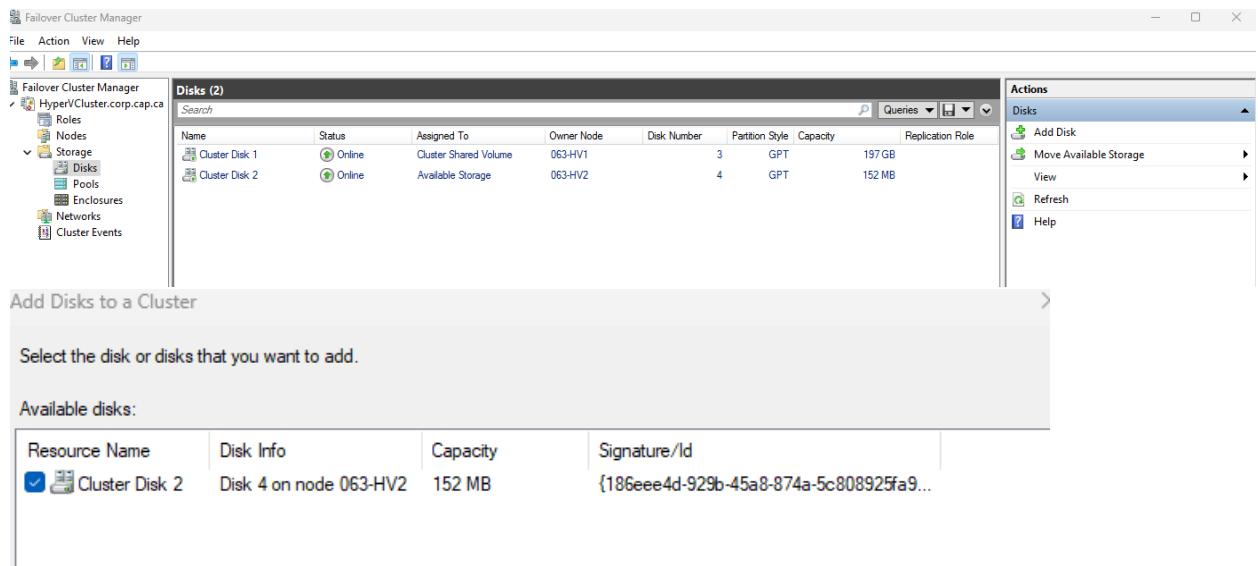
Target Name	Initiator IDs	Description
filedata	IPAddress:192.168.3.5, IPAddress:192...	
fileserverdata	IPAddress:192.168.10.2, IPAddress:19...	
<b>targetdisk</b>	IPAddress:192.168.10.2, IPAddress:19...	

- Click "Create"
- Refresh **iSCSI Initiator** Properties in **063-HV1**
  - o **063-HV1 > Server Manager > Tools > iSCSI Initiator**
  - o **063-HV1 > PowerShell > Diskmgmt > Witness Disk created (raw disk)**
    - Viewing Disk Management to confirm the disk is there

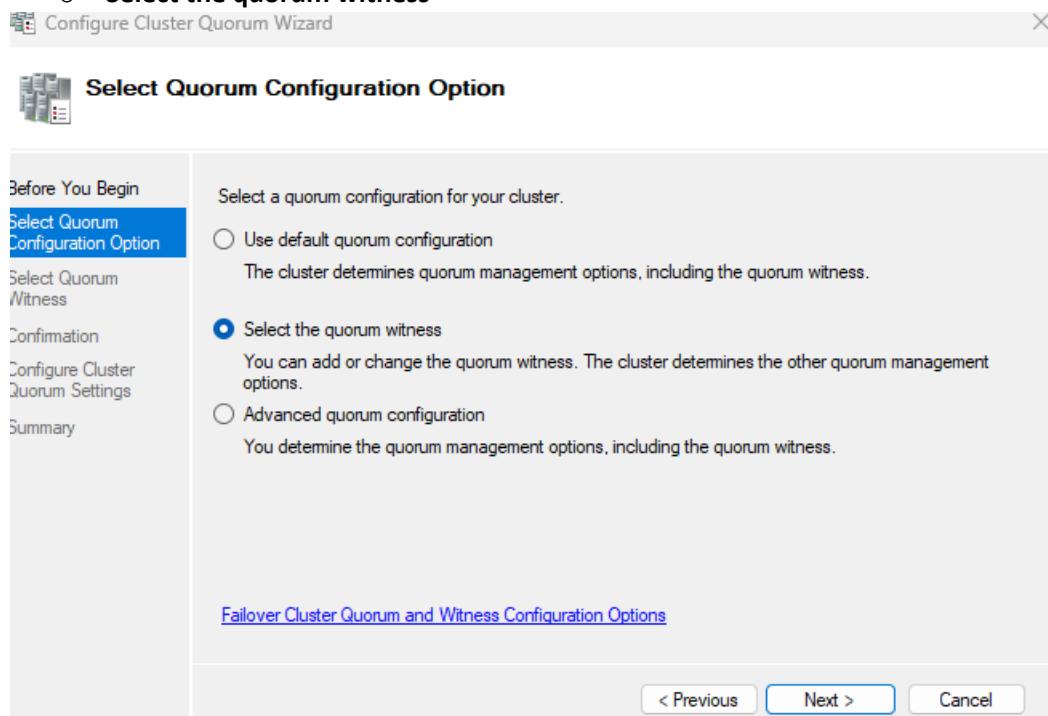
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- Now we Navigate to Failover Cluster Manager:

- Add Disk:

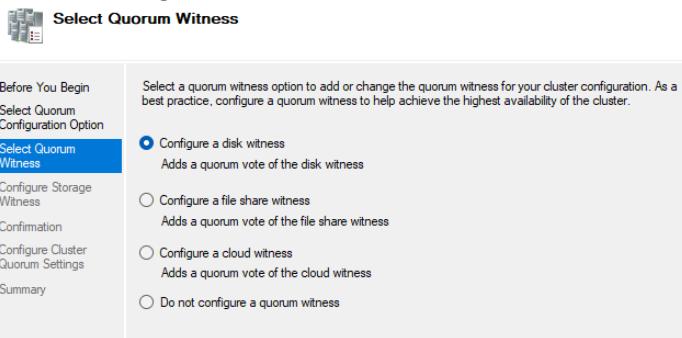


- Use **Server Manager > File and Storage Services > Volumes > Disks > 063-HV1 152MB iSCSI**  
*> Bring the Disk Online and Initialize it*
- Add Cluster Disk 2
  - **FS1 > Failover Cluster Manager > FileServerCluster.corp.tsp.ca > Configure Cluster Quorum Settings...**
- Options:
  - **Select the quorum witness**

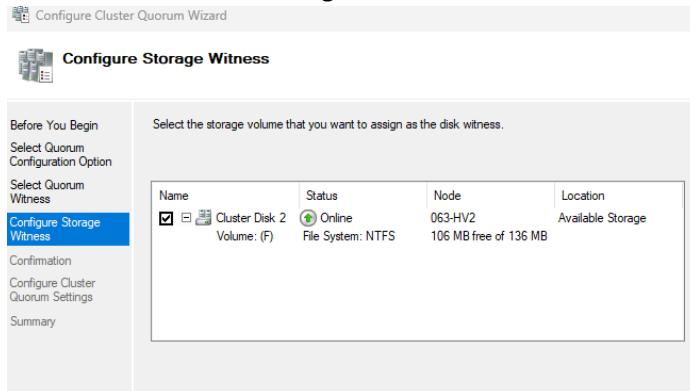


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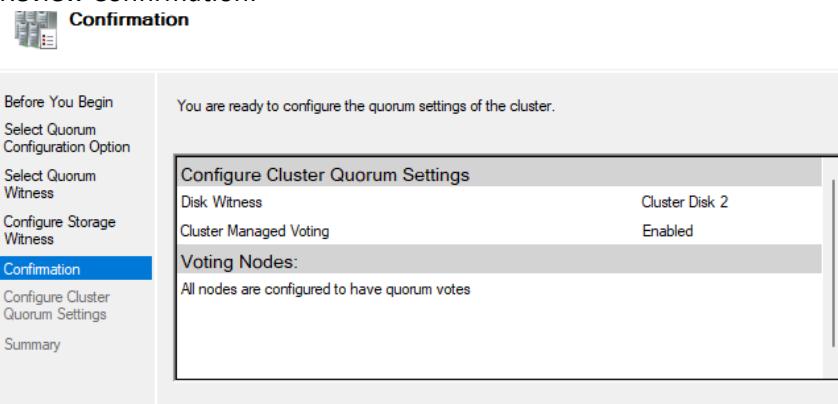
- Configure a Disk Witness



- Choose the available storage

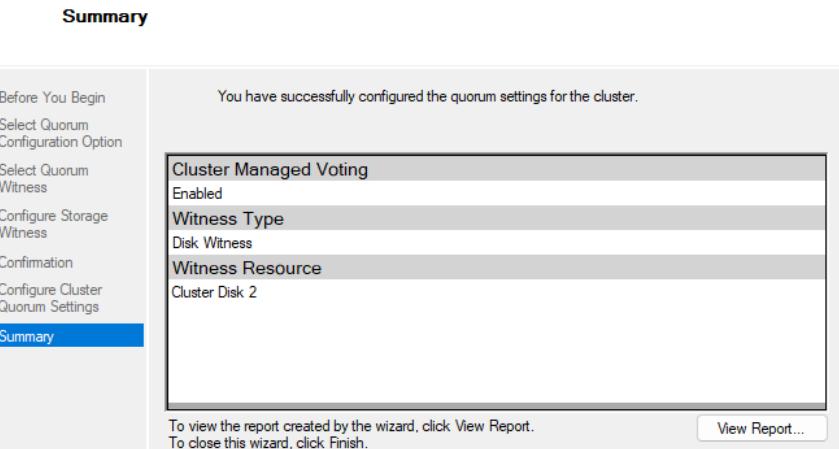


- Review Confirmation:



- Click Create:

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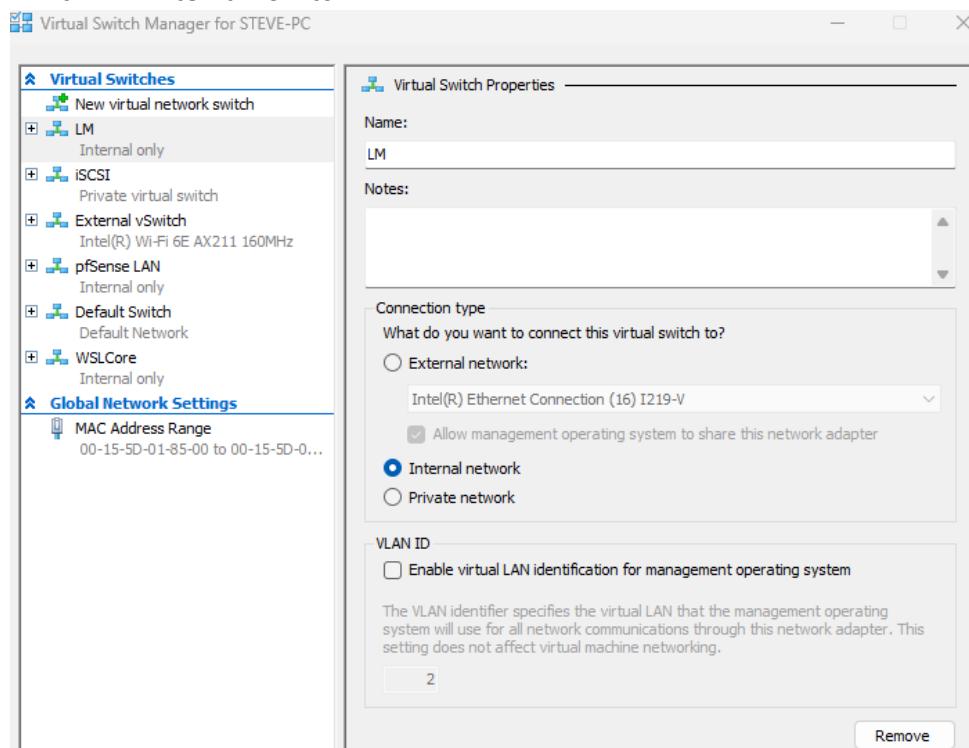


- Navigate to “Disk” under storage in “Failover Cluster Manager” to view the newly added **Witness Disk in Quorum**

### Enable Live Migration in Cluster Manager:

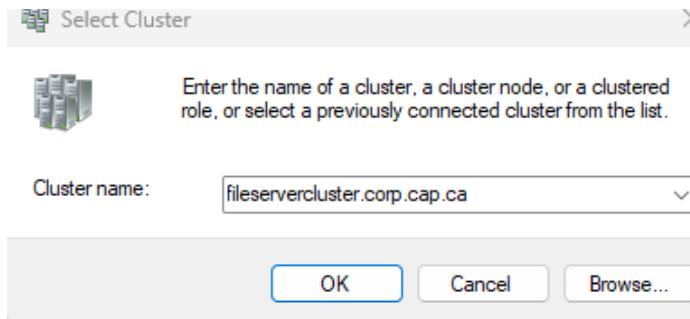
#### Create Live Migration Virtual Switch:

- Access Hyper-V on Host Machine
  - o Open **Virtual Switch Manager**
  - o Create Virtual Switch
- LM (Live Migration)
  - o **LM Internal vSwitch:**



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- Attach the LM Virtual vSwitch to **063-HV1** and **063-HV2** in Settings
- **Open Failover Cluster Manager**
- **Connect to Cluster:** If you haven't already, click on "Connect to Cluster"
  - o in the navigation pane and enter the name of the cluster you want to manage in our case **063-HV1**



The image displays two side-by-side windows of a management interface. The left window is titled 'Settings for 063-HV2 on STEVE-PC' and the right window is titled 'Settings for 063-HV1 on STEVE-PC'. Both windows have a header with the host name and a title bar. Below the title bar is a toolbar with a 'Hardware' button highlighted in blue. The main area is a tree view of hardware components. In the left window (063-HV2), the components listed are: Add Hardware, Firmware, Boot from File, Security (Secure Boot enabled), Memory (3200 MB), Processor (6 Virtual processors), SCSI Controller, Hard Drive (three entries: 063-HV2\_C4ED5B2A-AB58..., 063-HV2db\_B772054F-9E6..., and filetransfer\_F7C850F1-447...), Network Adapter (pfSense LAN, iSCSI), and Network Adapter (LM). In the right window (063-HV1), the components listed are: Add Hardware, Firmware, Boot from File, Security (Secure Boot enabled), Memory (3200 MB), Processor (6 Virtual processors), SCSI Controller, Hard Drive (three entries: 063-HV1\_7BDBB245-6868..., 063-HV1db\_A6E0A0DA-1E..., and filetransfer\_E06E963C-39...), Network Adapter (pfSense LAN, iSCSI), and Network Adapter (LM).

Set Static IP's on both (063-HV1) and (063-HV2):

**063-HV1: IP address: 192.168.30.1**

**Subnet Mask: 255.255.255.252**

**063-HV2: IPaddress: 192.168.30.2**

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Subnet Mask: **255.255.255.252**

```
=====
          Network adapter settings
=====

NIC index:      6
Description:   Microsoft Hyper-V Network Adapter #3
IP address:    192.168.30.1,
               fe80::47a2:572b:c123:31e2
Subnet mask:   255.255.255.252
DHCP enabled: False

Default gateway:
Preferred DNS server:
Alternate DNS server:

 1) Set network adapter address
 2) Set DNS servers
 3) Clear DNS server settings

Enter selection (Blank=Cancel): ■

=====
          Network adapter settings
=====

NIC index:      6
Description:   Microsoft Hyper-V Network Adapter #3
IP address:    192.168.30.2,
               fe80::705b:822d:2d1a:9687
Subnet mask:   255.255.255.252
DHCP enabled: False

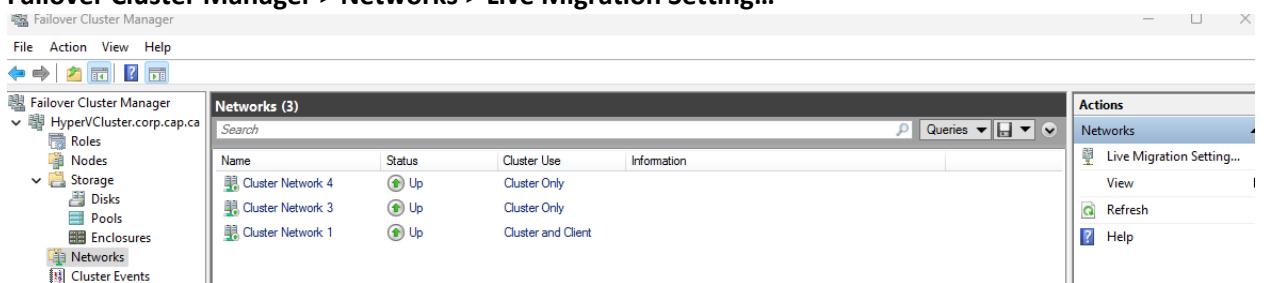
Default gateway:
Preferred DNS server:
Alternate DNS server:

 1) Set network adapter address
 2) Set DNS servers
 3) Clear DNS server settings

Enter selection (Blank=Cancel): ■
```

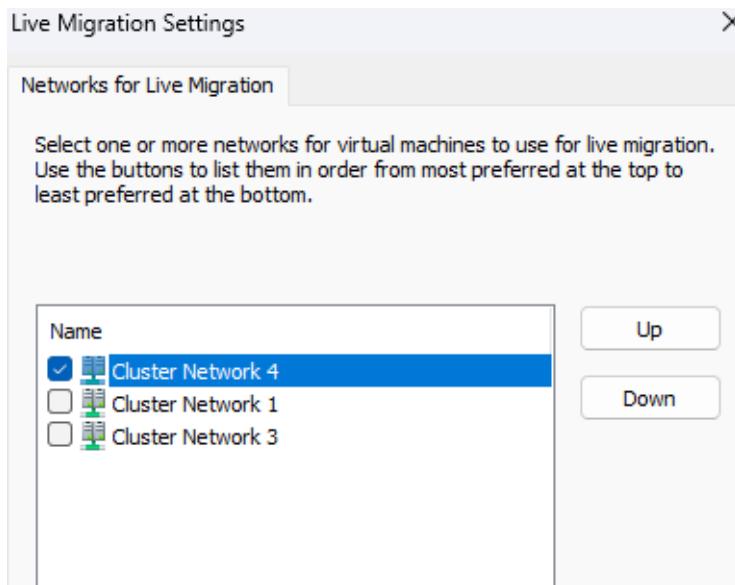
Adjust Live Migration Settings:

- Failover Cluster Manager > Networks > Live Migration Setting...

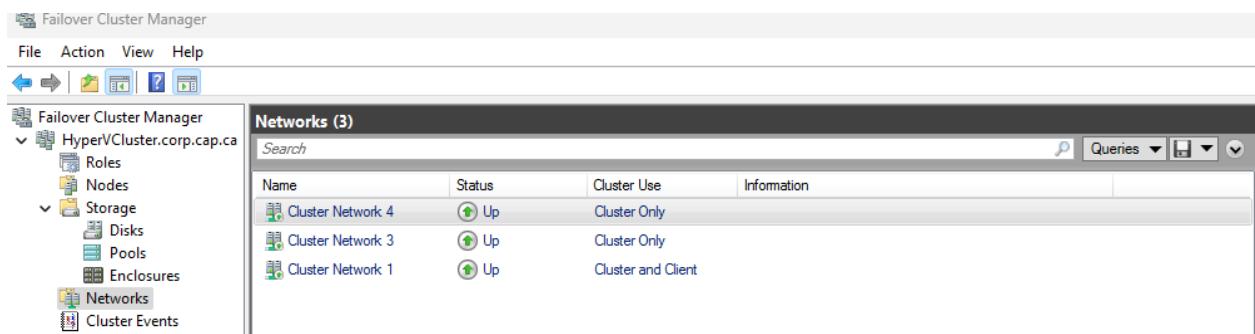


- Move Cluster Network 4 which is the new Live Migration Network that's been attached
  - o Move it to the top of the list and *deselect* the other two (Cluster Network 1 and Cluster Network 3)

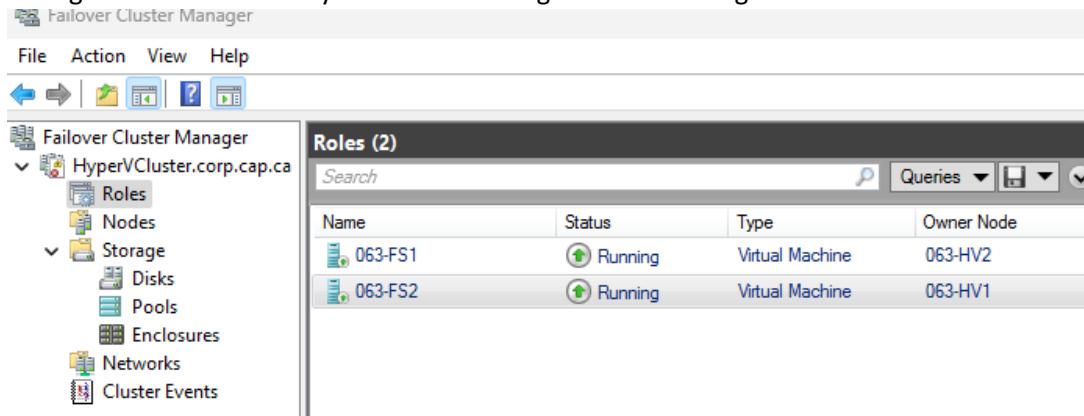
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- Click Apply

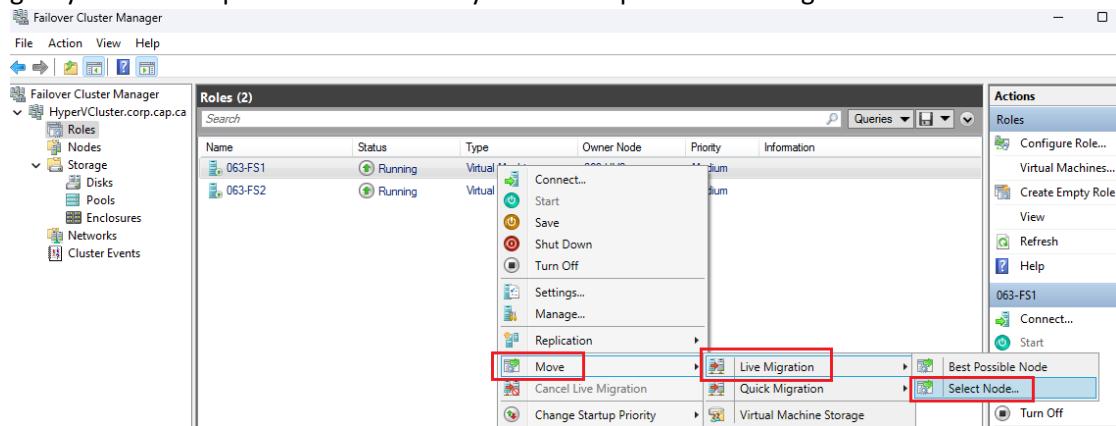


- **Select the Virtual Machine:** In the Roles section, click on the virtual machine that you want to migrate. This is the VM you will be working with for the migration

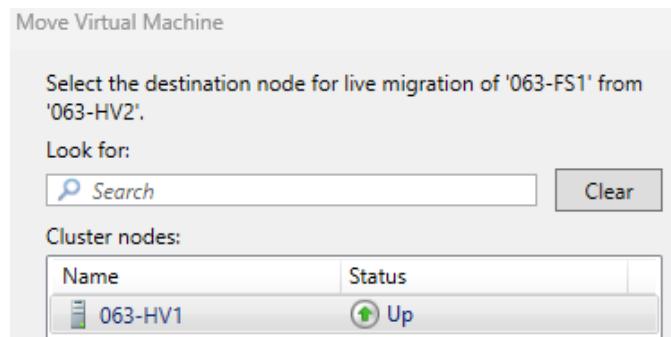


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- **Initiate a Move:** Right-click on the selected VM and hover over the 'Move' option to reveal a submenu
- **Choose Live Migration:** In the submenu that appears, select 'Live Migration'. This will then give you further options to select how you want to perform the migration



- **Select the Migration Type:**
  - o **Best Possible Node:** The system automatically selects the best node to move the VM to
  - o **Select Node:** Allows you to choose a specific node to migrate the VM to:



- **Perform the Migration:**
  - o It should indicate that the VM is being moved and later change the 'Owner Node' to the new node
- **Confirm Completion:** Once the migration is complete, the VM's status should return to 'Running' and the 'Owner Node' should reflect the new host

Create Two File Servers in a Failover Cluster using VHD Set Shared Storage:

Create Folders within the ClusterStorage to store VHD Files in (063-HV1)

- On 063-HV1 > Go to **PowerShell**
- Create a new folder in the “Volume 1” directory of “ClusterStorage” called “VHDSET”
  - o **New-Item -Path “C:\ClusterStorage\Volume1\VHDSET” -ItemType Directory**

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```
Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\_sysadmin> New-Item -Path "C:\ClusterStorage\Volume1\VHDSET" -ItemType Directory

Directory: C:\ClusterStorage\Volume1

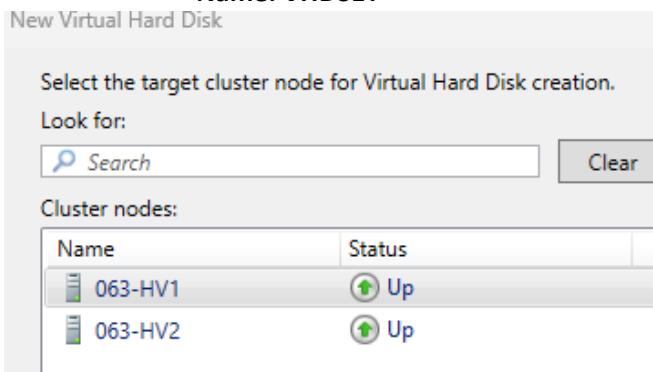
Mode                LastWriteTime         Length Name
----                -----          -----
d-----        4/8/2024 11:15 PM           0 VHDSET

PS C:\Users\_sysadmin>
```

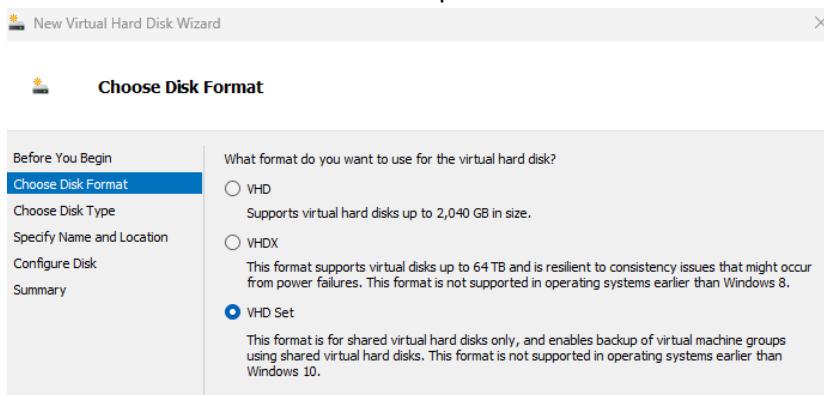
- **Select the Node:** You'll need to select one of the cluster nodes (either **063-HV1** or **063-HV2**)

### Creation of the VHD Set:

- o **In Failover Cluster Manager:**
  - **Select Roles > Virtual Machines > New Hard Disk**
  - **Select one of the Nodes**
  - **063-HV1:**
  - **Name: VHDSET**



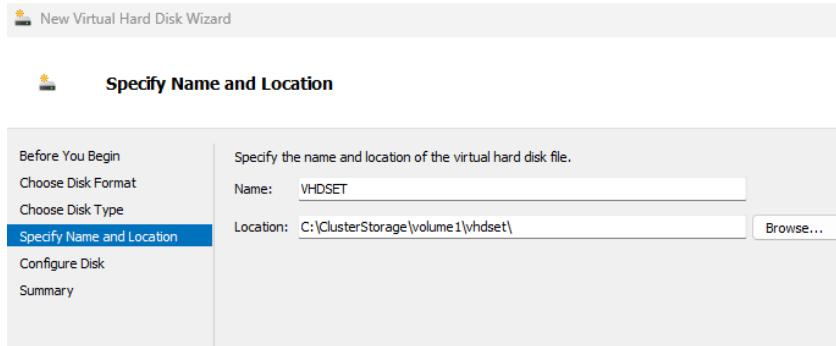
- **New Virtual Hard Disk Wizard** will open



- **Choose Disk Type:**
  - o **Dynamically expanding**

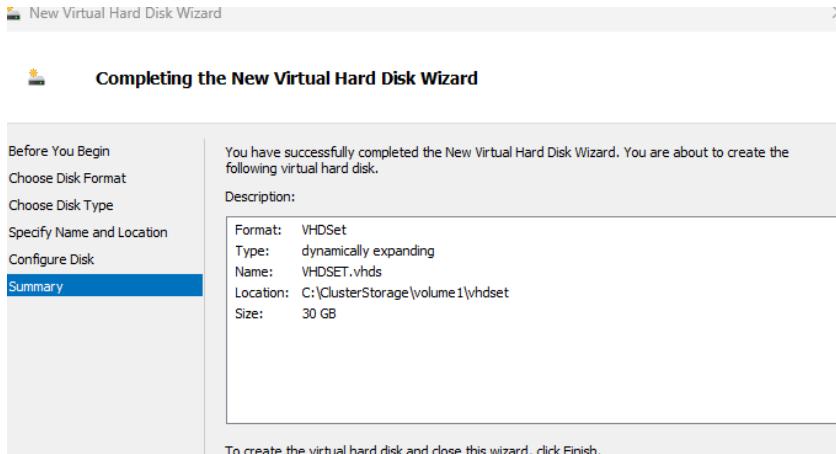
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- Specify the Folder: **ClusterStorage** in **Volume1** called “**VHDSET**”



- Configure Disk:

- **30GB virtual hard disk**

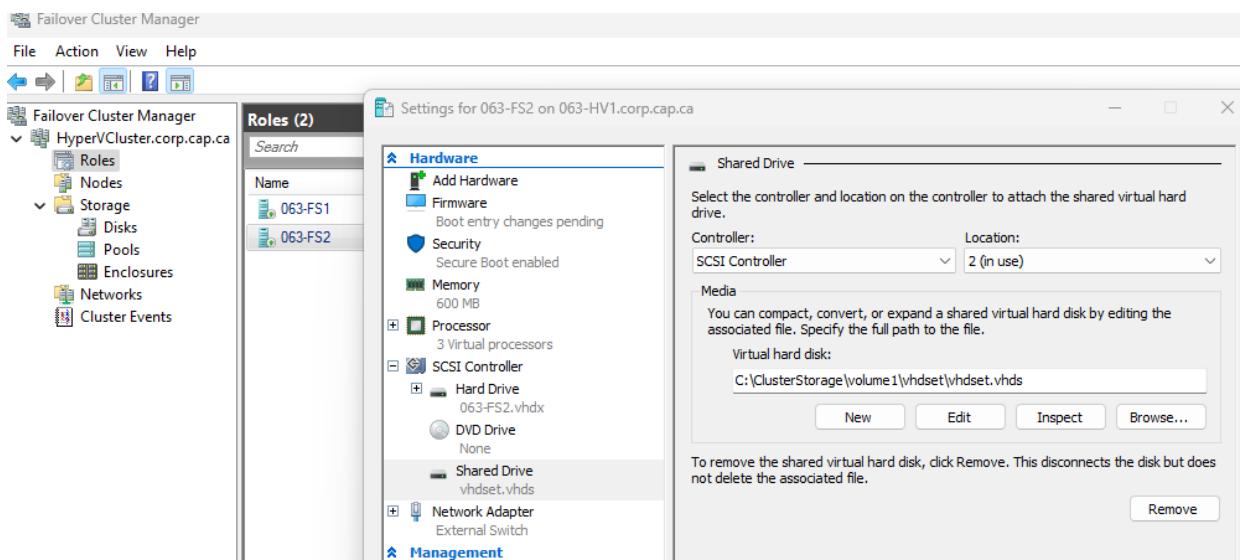


- Create the VHD Set: After selecting the node, you'll proceed with the creation of the VHD Set. This process will create a shared VHDX file that both virtual machines (**063-FS1** and **063-FS2**) will use as shared storage for the failover cluster

## Attach the VHDS Disk to (063-FS2) & (063-FS1)

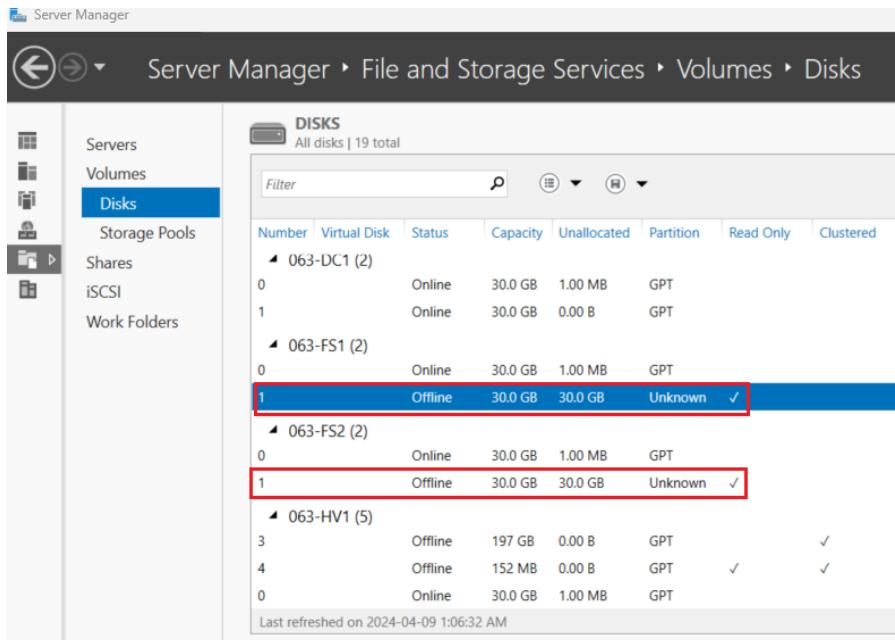
- Once the VHD Set is created, we will need to add it as a shared disk within the failover cluster configuration:
  - Add the VHD Set to the VMs:
    - **Failover Cluster Manager > Roles > Right Click on 063-FS1 > Settings > SCSI Controller > Shared Drive > Add**
  - Click Browse
  - Attach the VHD Set Drive:
    - **Click Local Disk (C:) > Cluster Storage > volume1 > vhds**
    - **Click vhds.vhds**
    - **Click Apply**

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## Initialize the Disks in Server Manager:

- The newly attached Shared Drive have disks that are now shown to be “**offline**” we will need to initialize these disks in order to use them
  - o **Navigate to Server Manager on the Host:**
  - o **File and Storage Services > Volumes > Disks**
- Note the disks which are offline they are the Shared Drives (vhdsset.vhds)
  - o **Right click on 063-FS1 and “Bring Online”**



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### Initialize the Disk using PowerShell:

- In 063-HV1 open PowerShell and run the script command:-
  - o `Get-Disk | Where partitionstyle -eq 'raw' | Initialize-Disk -PartitionStyle GPT -PassThru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS`

```
PS C:\Users\sysadmin> Get-Disk | Where partitionstyle -eq 'raw' | Initialize-Disk -PartitionStyle GPT -PassThru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -Filesystem NTFS

DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining     Size
-----   ~~~~~~   ~~~~~~   ~~~~~~   ~~~~~~   ~~~~~~   ~~~~~~   ~~~~~~   ~~~~~~
F          ~~~~~~   NTFS      Fixed      Healthy    OK           29.91 GB 29.98 GB
```

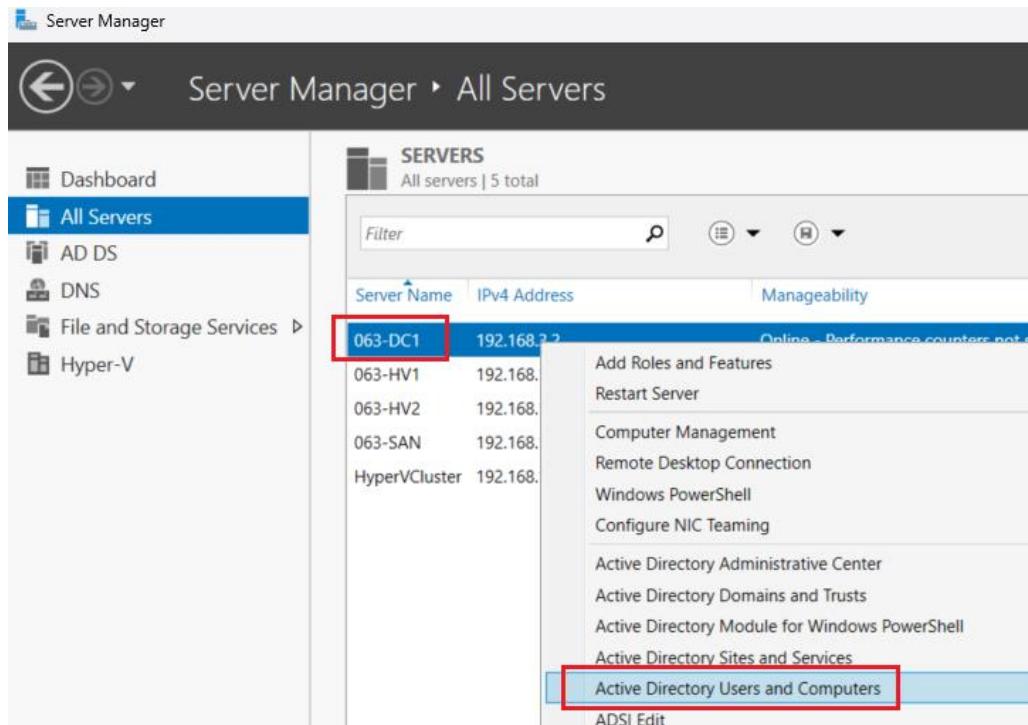
### Creating Permissions for Cluster Name Object (CNO):

- \* The cluster is not configured with a quorum witness. As a best practice, configure a quorum witness to help achieve the highest availability of the cluster.
- \* The cluster network name HYPERVCLUSTER does not have Create Computer Objects permissions on the Organizational Unit OU=HYPERV,OU=Servers,DC=corp,DC=cap,DC=ca. This can result in issues during the creation of additional network names in this OU.

- o *The Cluster Name Object (CNO) named 'HYPERVCLUSTER' does not have permissions to create computer objects in the specified Organizational Unit (OU) within Active Directory (AD)*

### To grant the necessary permissions:

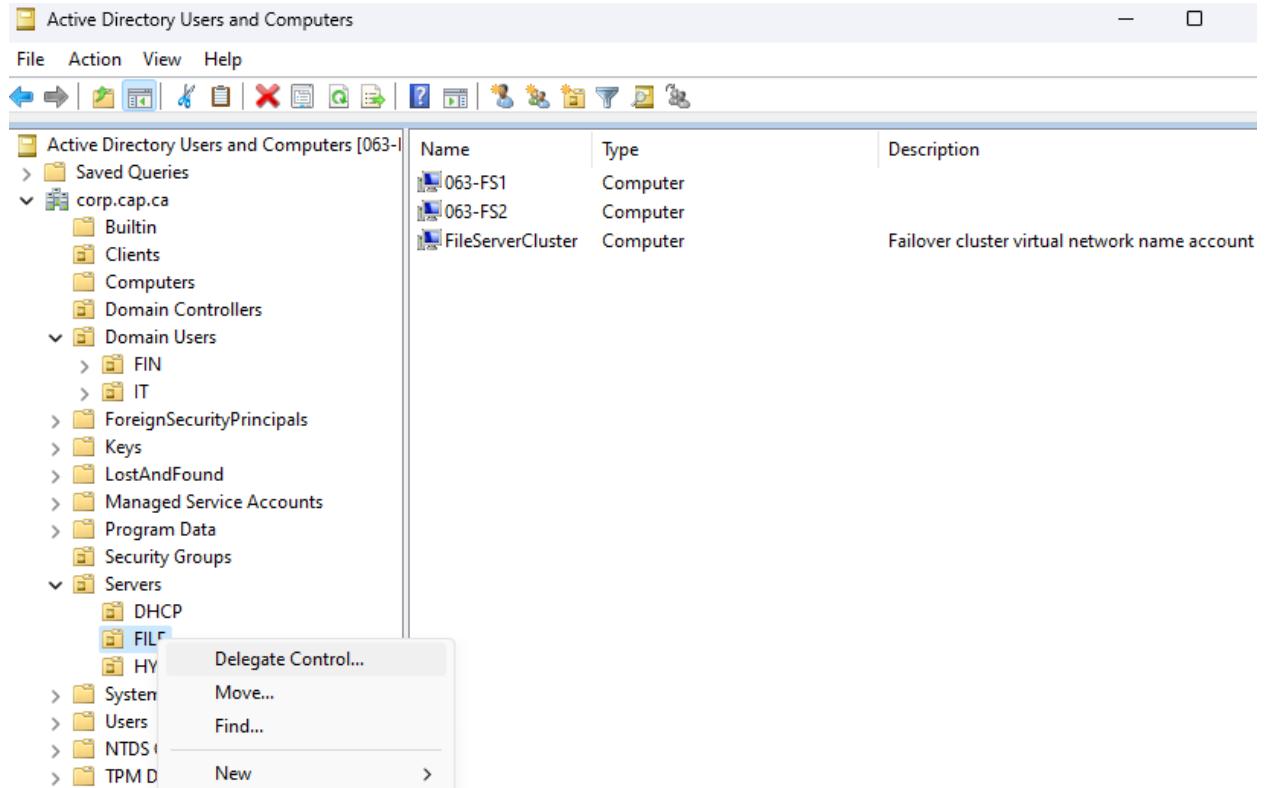
- Open "Active Directory Users and Computers" from Server Manager on the Host Lenovo Machine



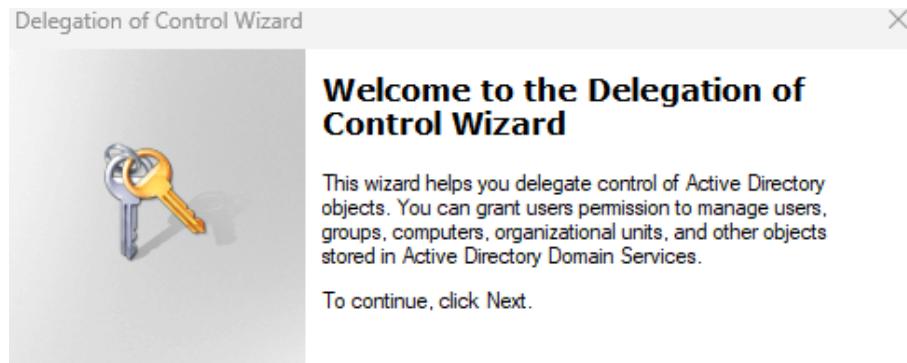
- Navigate to the OU in question: FILE
  - o **OU=HYPERV,OU=Servers,DC=comp,DC=cap,DC=ca**

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- Right-click the OU and choose "Delegate Control"

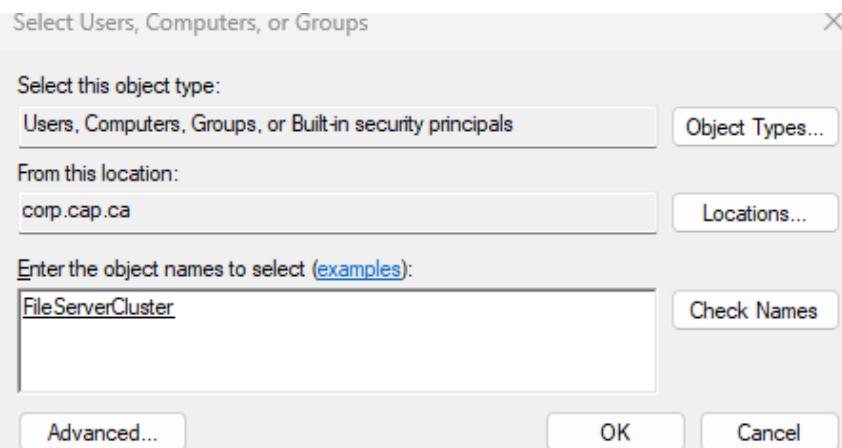


- Click "Next" on the welcome screen

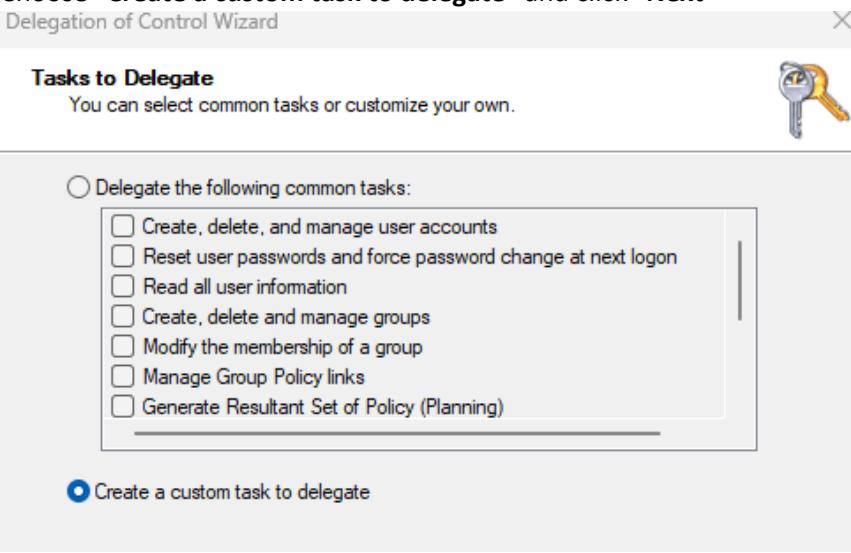


- Click "Add" and enter the name of your cluster CNO (FILESERVERCLUSTER), then click "Next"

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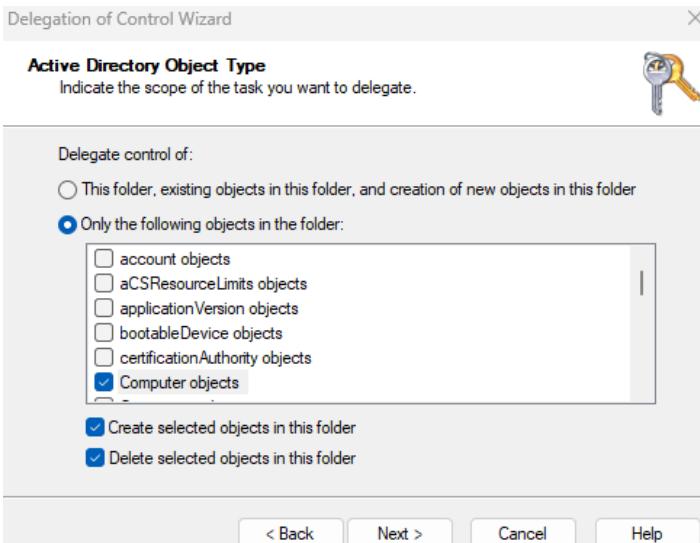


- Choose "Create a custom task to delegate" and click "Next"

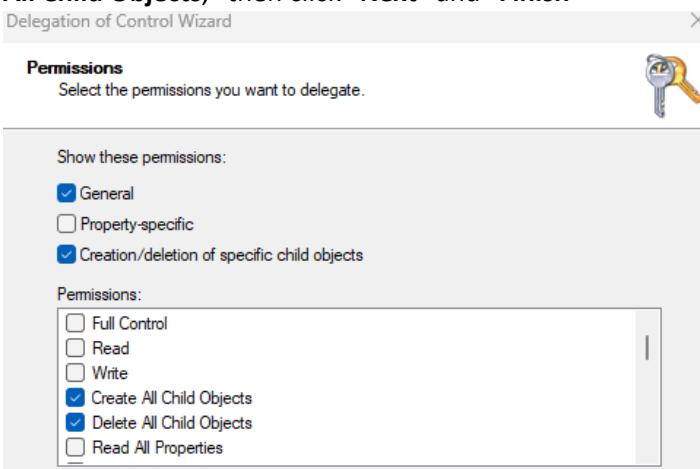


- Select "Only the following objects in the folder," check "Computer objects," and check the boxes for "Create selected objects in this folder" and "Delete selected objects in this folder"

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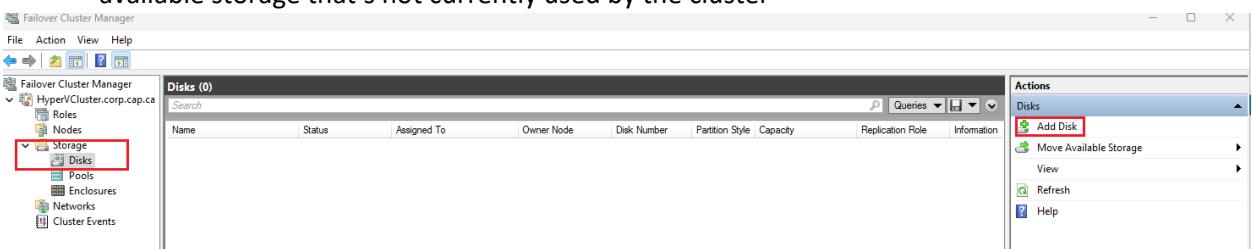
- In the Permissions page, give the CNO the permissions "Create All Child Objects" and "Delete All Child Objects," then click "Next" and "Finish"



After performing these actions, the cluster should have the necessary permissions to function correctly, and we will have improved the overall high availability of your cluster by configuring a quorum witness

## Add the Disk:

- **Navigate to Storage:** In the console tree, select 'Storage'
- **Add Disk:** In the Actions pane, click on 'Add Disk'. The Add Disk wizard will scan for available storage that's not currently used by the cluster

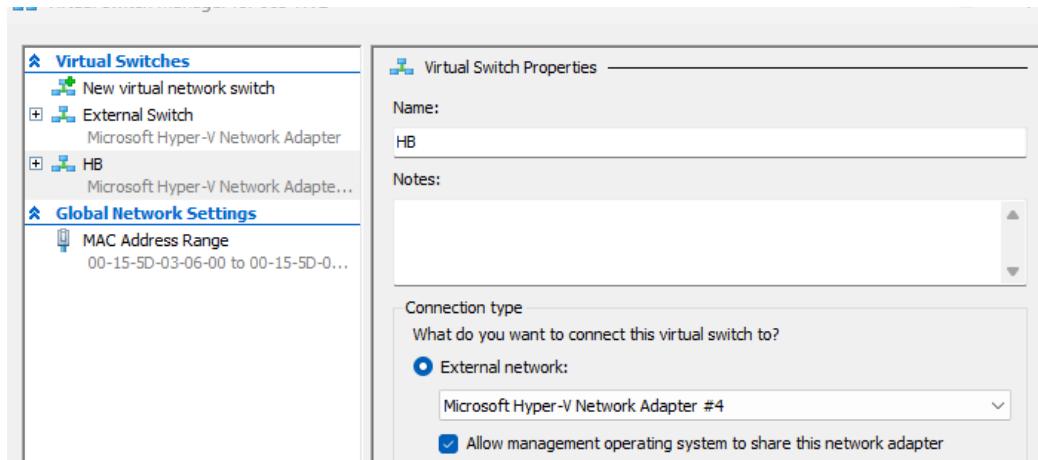


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Create the Heartbeat Network:

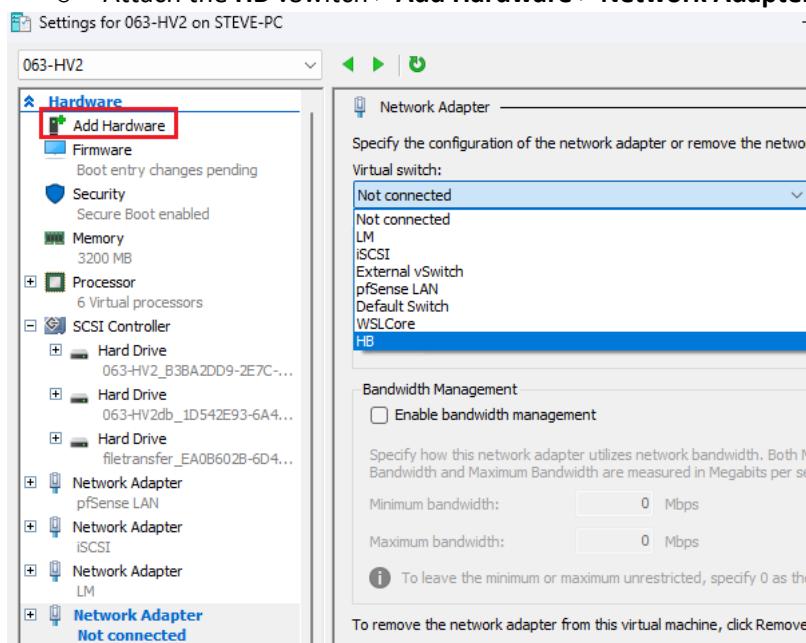
Create a new vSwitch:

- This switch will be designated as “**External**”
  - o From **Hyper-V on 063-HV1 > Virtual Switch Manager > New Virtual Network Switch**
  - o Label it **HB**
  - o From **Hyper-V on 063-HV2 > Virtual Switch Manager > New Virtual Network Switch**
  - o Label it **HB**



Attach the newly created vSwitch to both (063-FS1) and (063-FS2):

- o **Right click on the FS > Failover Cluster Manager > Roles > Settings**
- o Configure properties for **both** VMs
- o Attach the **HB** vSwitch > **Add Hardware > Network Adapter**



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### Enable MAC Spoofing:

- On Host Machine Hyper-V Manager access 063-HV1 and 063-HV1 right click on the VM and access the **Settings** to configure the Mac Spoofing properties. To allow the FS nodes to communicate on the network we must enable MAC Spoofing
  - o Collapse the menu for the Network Adapter 'HB'
    - Click **Advanced Features > Enable MAC address spoofing**

### Set Static IPs to (063-FS1) & (063-FS2):

- We will assign **063-FS1** and **063-FS2** two unique IP addresses using a new broadcast address
  - We will assign **063-FS1** IP:
    - **192.168.20.1/30**
  - We will assign **063-FS2** IP:
    - **192.168.20.2/30**

```
PS C:\Users\sysadmin> Rename-NetAdapter -Name "Ethernet" -NewName "HB"
PS C:\Users\sysadmin> New-NetIPAddress -InterfaceAlias "HB" -IPAddress 192.168.10.1 -PrefixLength 30

IPAddress      : 192.168.10.1
PS C:\Users\sysadmin> Rename-NetAdapter -Name "Ethernet" -NewName "HB"
PS C:\Users\sysadmin> New-NetIPAddress -InterfaceAlias "HB" -IPAddress 192.168.10.2 -PrefixLength 30
```

### Rename the Adapter FS1:

- o **Rename-NetAdapter -Name "Ethernet" -NewName "HB"**

```
PS C:\Users\sysadmin> Rename-NetAdapter -Name "Ethernet" -NewName "HB"
PS C:\Users\sysadmin> Get-NetAdapter

Name           InterfaceDescription          ifIndex Status    MacAddress      LinkSpeed
----           -----
vEthernet (External Sw... Hyper-V Virtual Ethernet Adapter       10 Up      00-15-5D-01-85-CA 10 Gbps
pfSense LAN     Microsoft Hyper-V Network Adapter        9 Up      00-15-5D-01-85-CA 10 Gbps
HB             Microsoft Hyper-V Network Adapter #4      26 Up      00-15-5D-01-85-D1 10 Gbps
iSCSI          Microsoft Hyper-V Network Adapter #2      5 Up      00-15-5D-01-85-CC 10 Gbps
LM             Microsoft Hyper-V Network Adapter #3      4 Up      00-15-5D-01-85-CF 10 Gbps
```

- Set Static IP for HB interface:
  - o **New-NetIPAddress -InterfaceAlias "HB" -IPAddress 192.168.20.1 -PrefixLength 30**

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```
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\sysadmin> New-NetIPAddress -InterfaceAlias "HB" -IPAddress 192.168.20.1 -PrefixLength 30
>>

IPAddress      : 192.168.20.1
InterfaceIndex  : 26
InterfaceAlias   : HB
AddressFamily    : IPv4
Type            : Unicast
PrefixLength    : 30
PrefixOrigin     : Manual
SuffixOrigin     : Manual
AddressState     : Tentative
ValidLifetime   : Infinite ([TimeSpan]::MaxValue)
PreferredLifetime: Infinite ([TimeSpan]::MaxValue)
SkipAsSource     : False
PolicyStore      : ActiveStore
```

### Rename the Adapter on FS2:

- **Rename-NetAdapter -Name "Ethernet" -NewName "HB"**

#### - Set Static IP for HB interface:

- **New-NetIPAddress -InterfaceAlias "HB" -IPAddress 192.168.20.2 -PrefixLength 30**

The screenshot shows a Windows Command Prompt window titled 'Administrator: C:\Windows\system32\cmd.exe'. It displays a list of network adapters with their names, manufacturers, and physical addresses. Below this, a command is run to set a static IP address on the 'HB' interface.

```
Administrator: C:\Windows\system32\cmd.exe
-----
HB           Microsoft Hyper-V Network Adapter #4          26 Up      00-15-5D-01-85-D2  10 Gbps
vEthernet (External Sw...) Hyper-V Virtual Ethernet Adapter 8 Up      00-15-5D-01-85-CB  10 Gbps
iSCSI        Microsoft Hyper-V Network Adapter #2          6 Up      00-15-5D-01-85-CD  10 Gbps
LM           Microsoft Hyper-V Network Adapter #3          5 Up      00-15-5D-01-85-D0  10 Gbps
pfSense LAN  Microsoft Hyper-V Network Adapter           3 Up      00-15-5D-01-85-CB  10 Gbps

PS C:\Users\sysadmin> New-NetIPAddress -InterfaceAlias "HB" -IPAddress 192.168.20.2 -PrefixLength 30

IPAddress      : 192.168.20.2
InterfaceIndex  : 26
InterfaceAlias   : HB
AddressFamily    : IPv4
```

### Ping Test:

#### - Ping **192.168.20.2** (FS1) to (FS2) on the HB Network:

The screenshot shows a Windows Command Prompt window titled 'Administrator: C:\Windows\system32\cmd.exe'. It displays the results of a ping command from FS1 to FS2 on the 'HB' network.

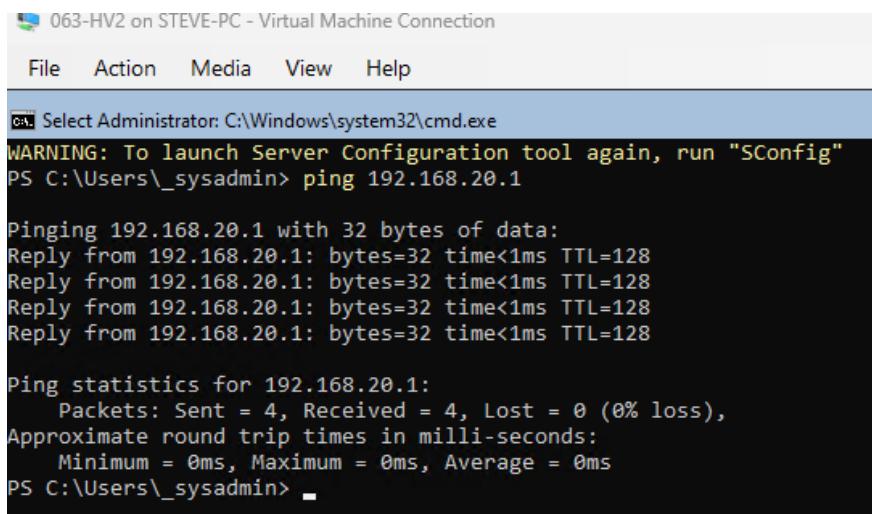
```
Administrator: C:\Windows\system32\cmd.exe
-----
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\sysadmin> ping 192.168.20.2

Pinging 192.168.20.2 with 32 bytes of data:
Reply from 192.168.20.2: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.20.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
PS C:\Users\sysadmin>
```

#### - Ping **192.168.20.1** (FS1) to (FS2) on the HB Network:

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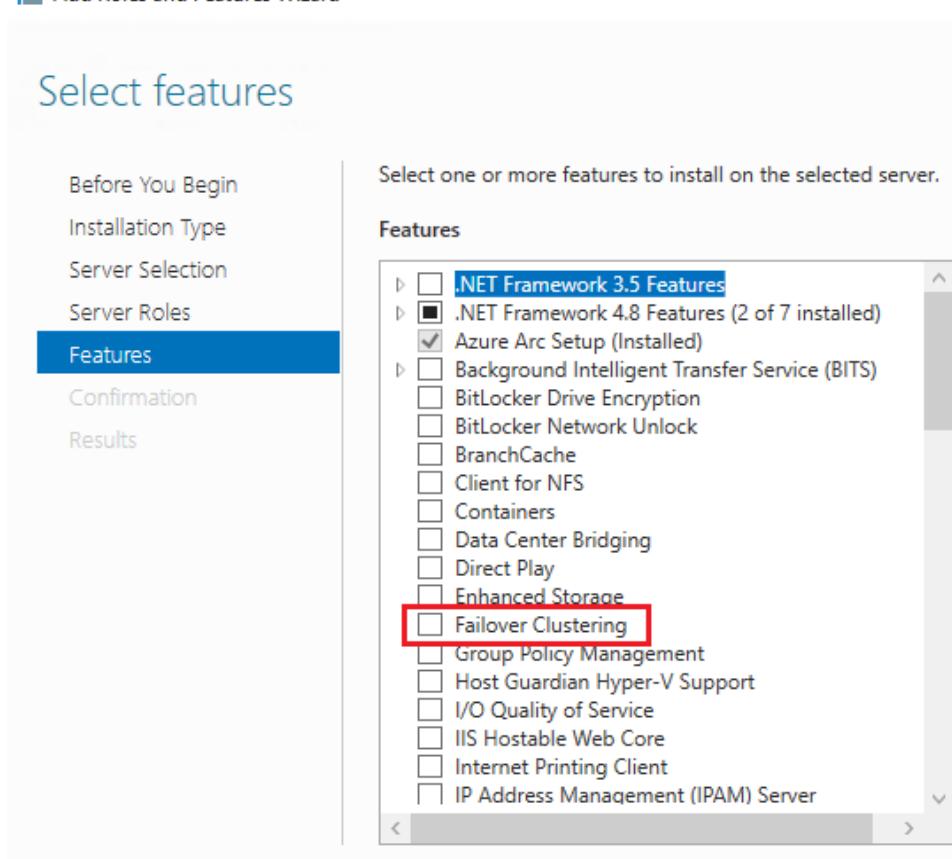
```
063-HV2 on STEVE-PC - Virtual Machine Connection
File Action Media View Help
Select Administrator: C:\Windows\system32\cmd.exe
WARNING: To launch Server Configuration tool again, run "SConfig"
PS C:\Users\_sysadmin> ping 192.168.20.1

Pinging 192.168.20.1 with 32 bytes of data:
Reply from 192.168.20.1: bytes=32 time<1ms TTL=128

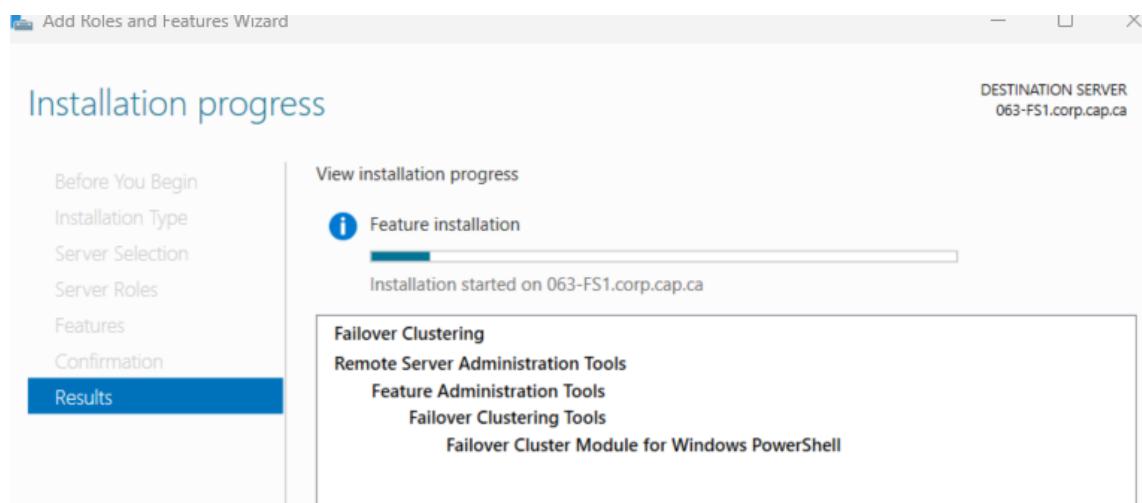
Ping statistics for 192.168.20.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
PS C:\Users\_sysadmin>
```

## Create and Configure the Failover Cluster:

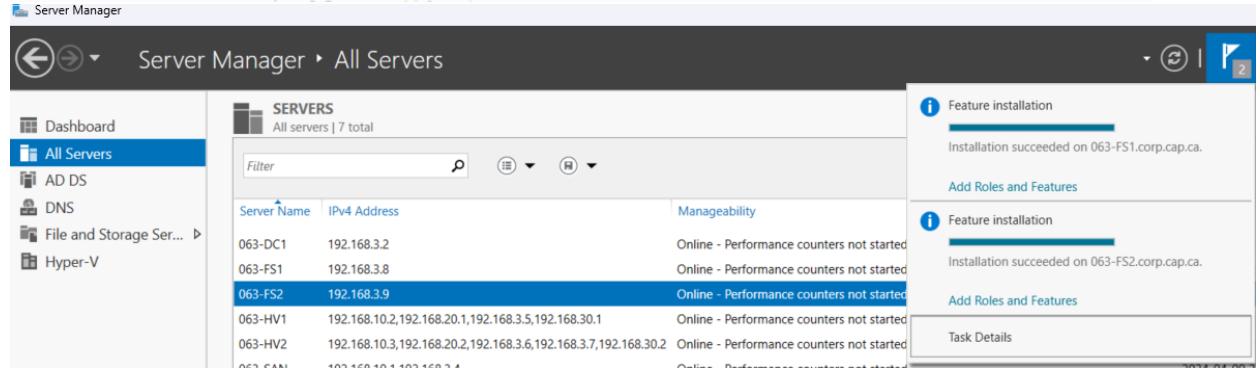
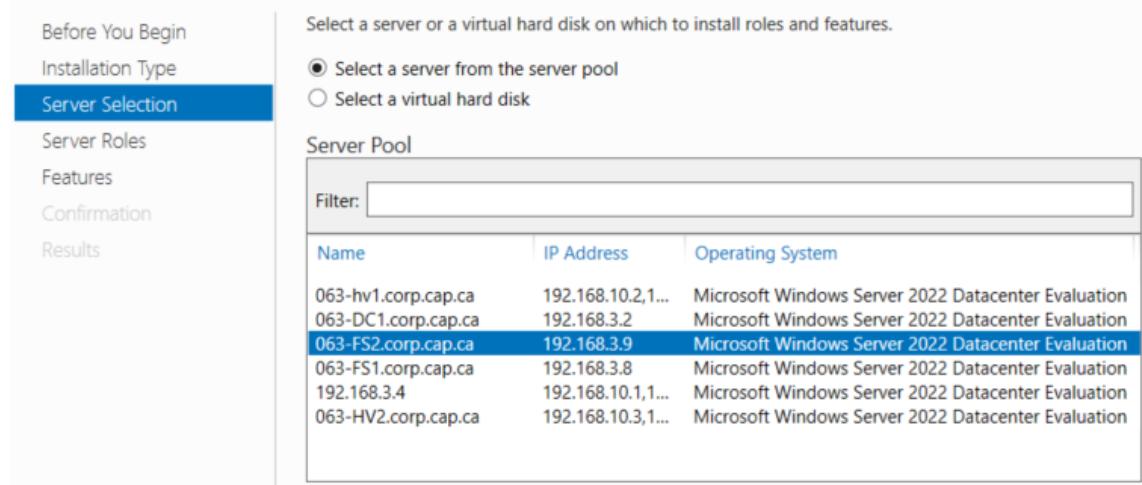
- Install the failover cluster feature on both File Servers
- Navigate to **Server Manager** on Host > **All Servers** > Right Click **063-FS1** > **Add Roles and Features**
  - o Select **Failover Clustering**



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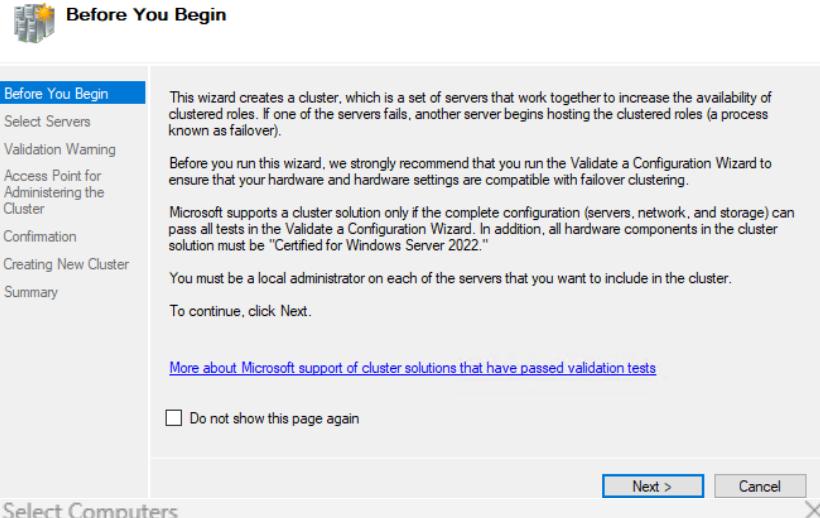
- Navigate to **063-FS2**:
  - o Add the Role
    - **063-FS2 > Server Manager > Manage > Add Roles and Features**
    - Select **Failover Clustering**



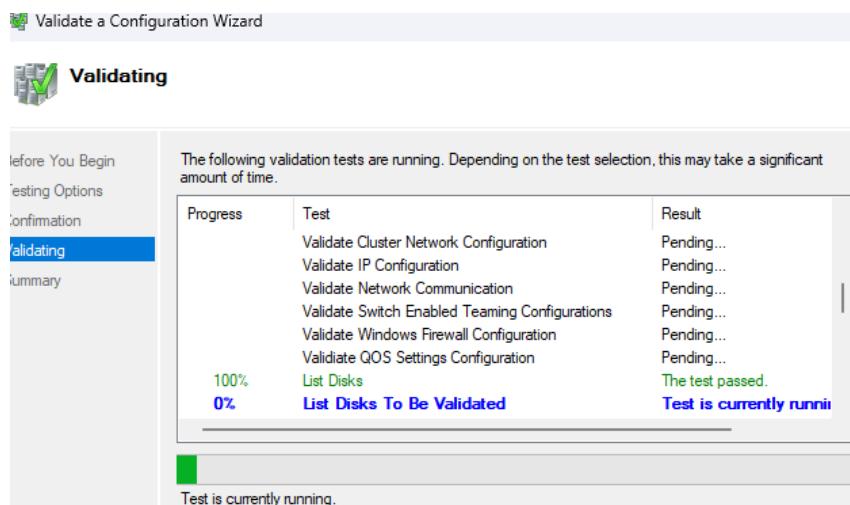
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

Create the Cluster:

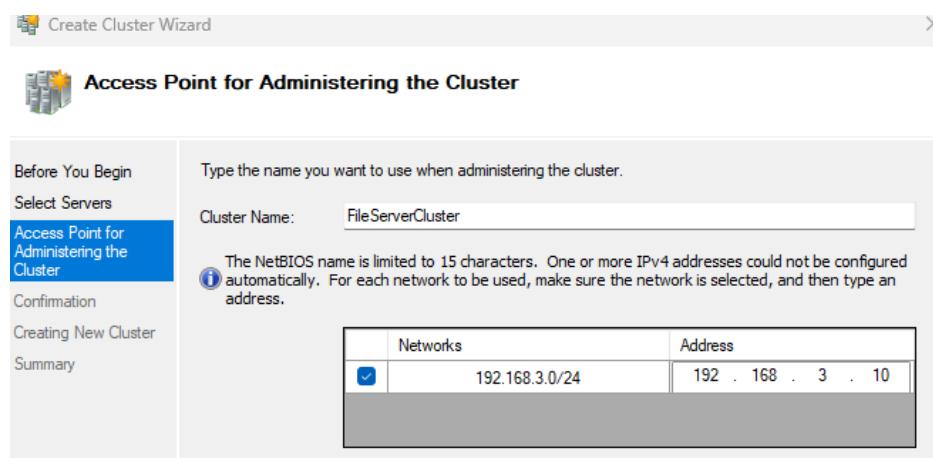
- Open Failover Cluster Manager > Create Cluster Wizard



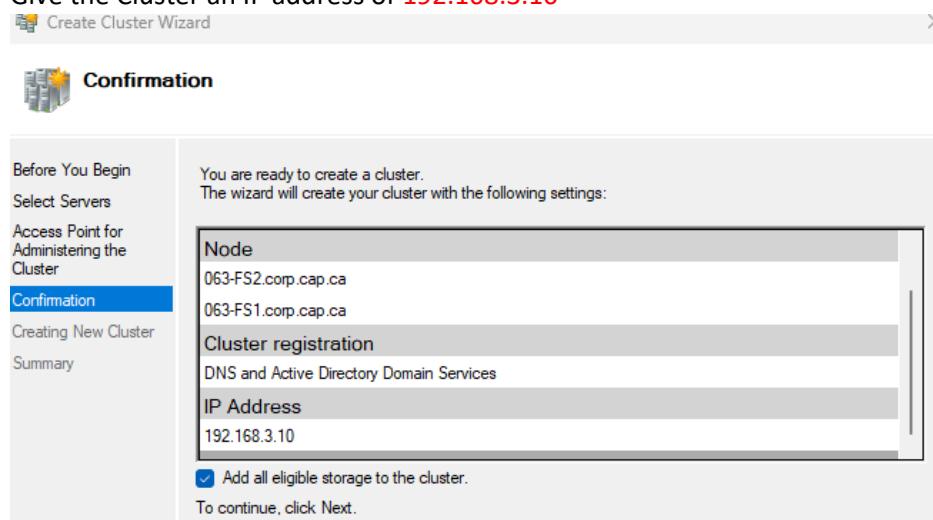
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### - Run Validation Tests



### - Give the Cluster an IP address of 192.168.3.10



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## Creating the Cluster in PowerShell:

- Run the command on one of the nodes in this case **063-FS1**
  - o **New-Cluster -Name FileServerCluster -Node 063-FS1.corp.cap.ca, 063-FS2.corp.cap.ca -StaticAddress 192.168.3.10**

```

Administrator: C:\Windows\system32\cmd.exe
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:

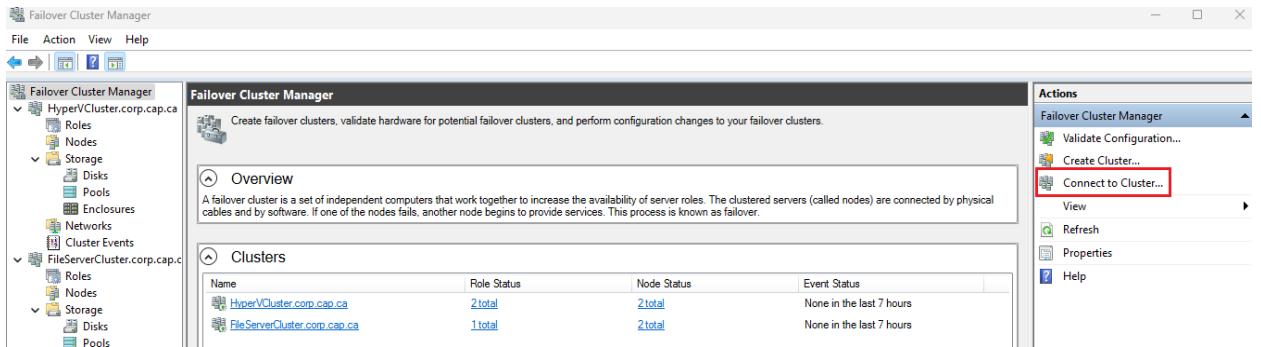
New-Cluster
    Creating resource group 'Cluster Group'.
    [oooooooooooooooooooooooooooooooooooo]

Reply from 192.168.3.9: bytes=32 time=1ms TTL=128
Reply from 192.168.3.9: bytes=32 time=1ms TTL=128
PS C:\Users\sysadmin> New-Cluster -Name FileServerCluster -Node 063-FS1.corp.cap.ca, 063-FS2.corp.cap.ca -StaticAddress 192.168.3.10

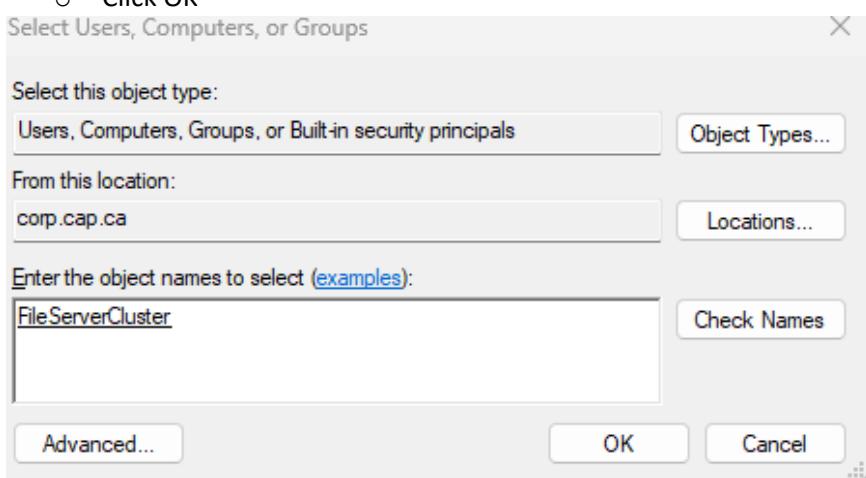
Name
-----
FileServerCluster

```

## Connect to the Cluster:

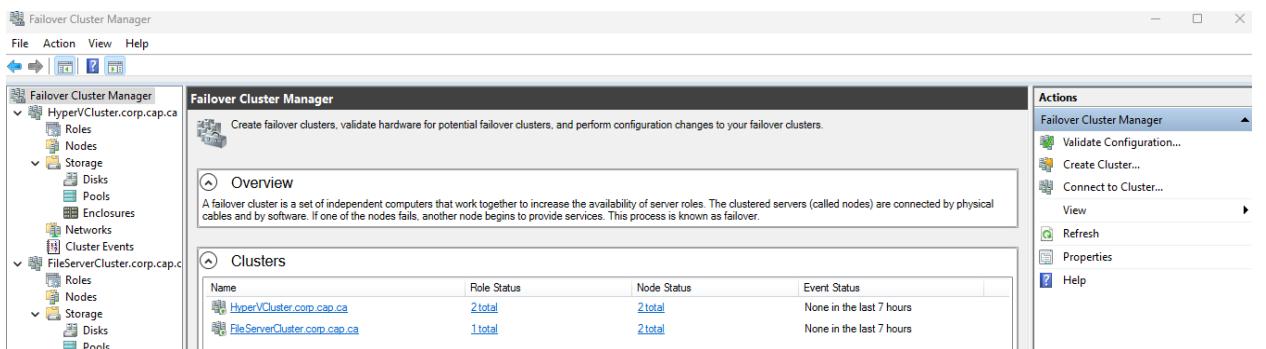


- Enter the name **FileServerCluster**:
  - o Click 'Check Names'
  - o Click OK



- The Cluster will appear on the left pane:

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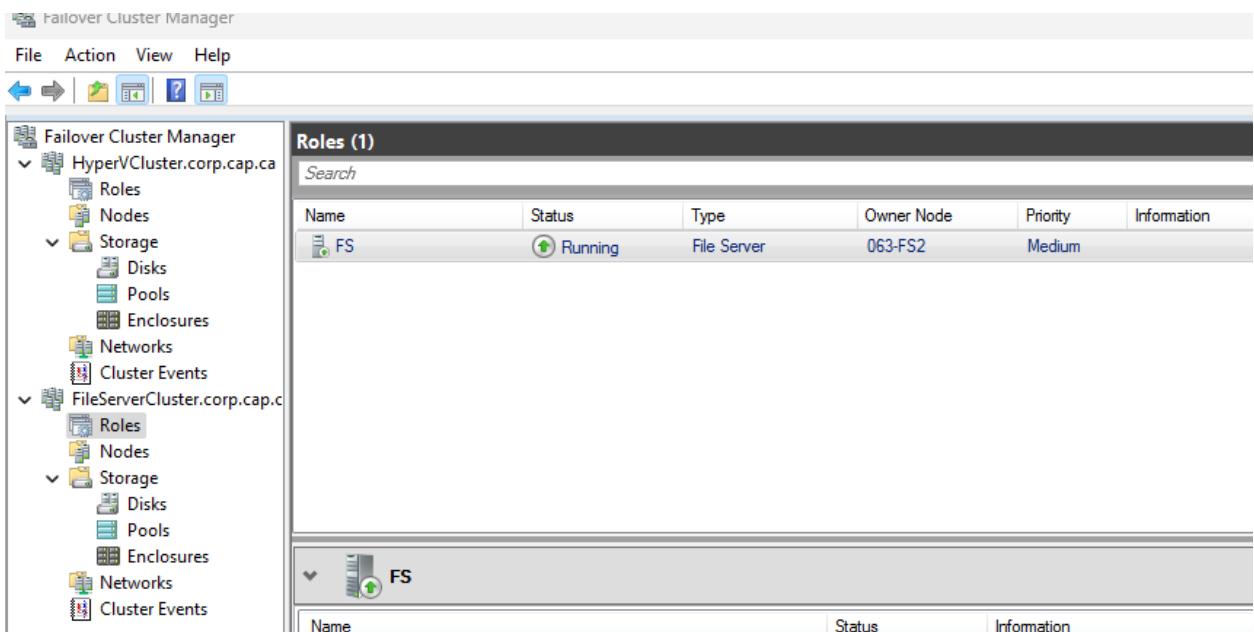


## Create a File Server Role:

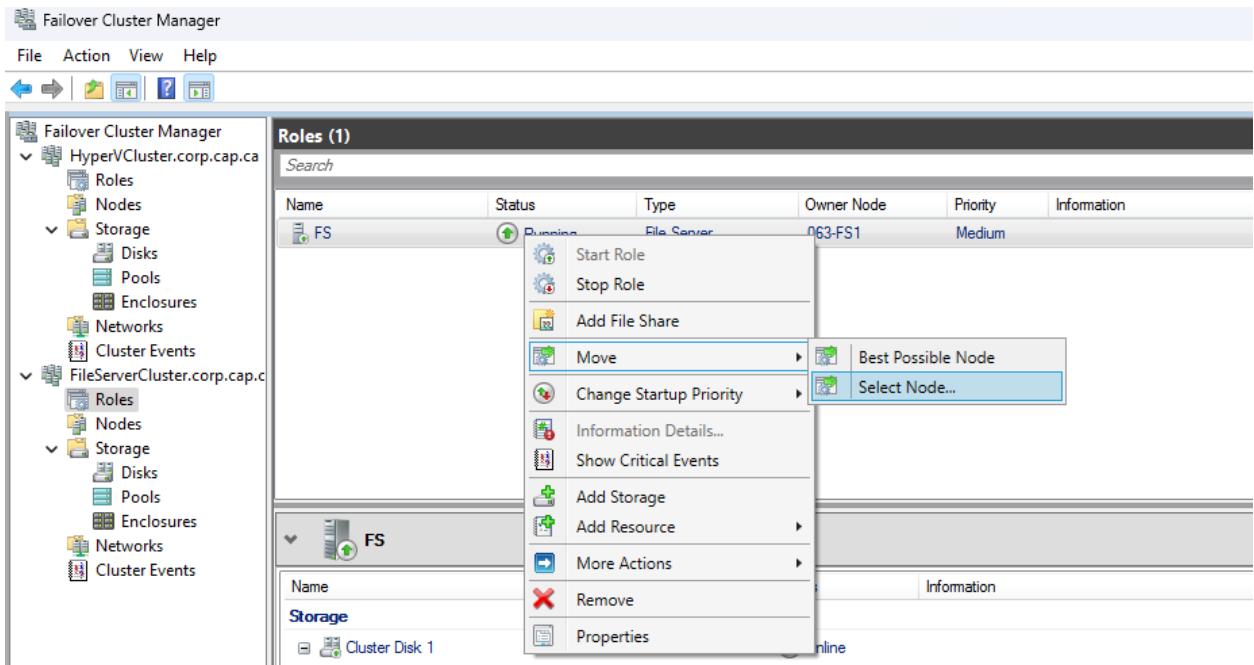
### Create the VHD Set:

- Open Failover Cluster Manager
  - o **HyperVCluster.corp.cap.ca > Roles > Virtual Machines > New Hard Disk**
- Follow the wizard, selecting '**VHD Set**' when asked for the type
- Name It
- Store the VHD Set in a location accessible by all nodes in your cluster (typically in a CSV path)
  - o **C:\ClusterStorage\Volume1\vhds\**
- **Prepare the VHD Set:**
  - Open Server Manager on the Host
  - File and Storage Services > Volumes > Disks
    - o Refresh
  - Locate Unknown Disk and Bring it online
  - Launch PowerShell in **063-FS1**
    - o Enter command to initialize the disk
    - o **Get-Disk | Where partitionstyle -eq 'raw' | Initialize-Disk -PartitionStyle GPT -PassThru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS**
- **Add the VHD Set to the Cluster:**
  - Failover Cluster Manager > FileServerCluster.corp.cap.ca > Disks > Add Disk
- **Create the File Server Role:**
  - In the Failover Cluster Manager:
    - o Right-click on **Roles** and then choose '**Configure Role...**'
    - o Select the '**File Server**' role and click '**Next**'
    - o Choose '**File Server for general use**'
    - o Assign the VHD Set shared disk to the File Server role
    - o Follow the prompts to finish configuring the role

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

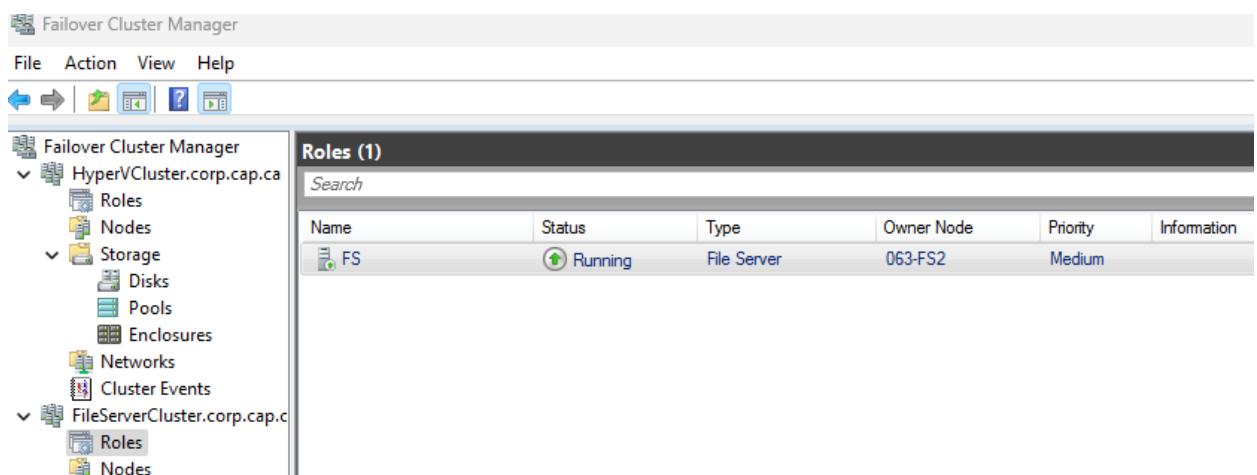
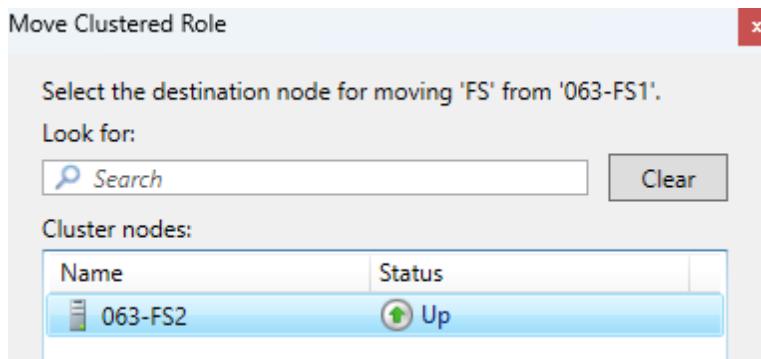


- **Test the Failover:**
- Ensure the file server role can successfully failover between cluster nodes:
  - o In Failover Cluster Manager, right-click the file server role and select 'Move' to move the role to another node



- Move 063-FS1 to 063-FS2:

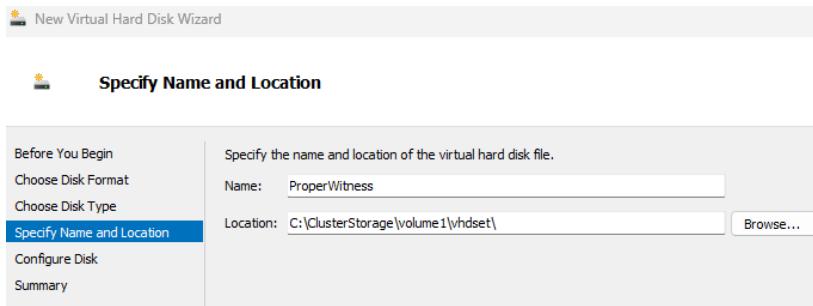
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### Create a Secondary Disk in Quorum for FileServerCluster:

- Create a new Virtual Hard Disk:
  - o Open Failover Cluster Manager
  - o Under FileServerCluster:
    - Roles > Virtual Machine > New Hard Disk
- Choose a Node:
  - o **063-HV1**
- New Virtual Hard Disk Wizard Opens
  - o Choose Disk Format: **VHD Set**
  - o **Dynamically Expanding**
  - o Name: **FSWitness**
  - o **1GB**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



- Navigate to Server Manager on the Host > File and Storage Services > Volumes > Disks
- Refresh
- Bring 'Unknown' Disk Online

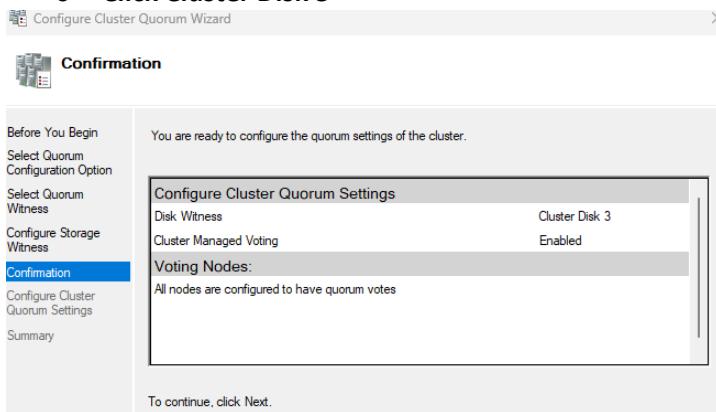
Use PowerShell to Initialize the Disk:

- Open **063-FS1**
  - o Open PowerShell from SConfig Menu
- Enter command:
  - o **Get-Disk | Where partitionstyle -eq 'raw' | Initialize-Disk -PartitionStyle GPT -PassThru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -Filesystem NTFS**

```
PS C:\Users\sysadmin> Get-Disk | Where partitionstyle -eq 'raw' | Initialize-Disk -PartitionStyle GPT -PassThru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -Filesystem NTFS

DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining      Size
-----            File System Type        Type      Status          Status     SizeRemaining      Size
G                NTFS       Fixed     Healthy     OK           991.06 MB 1007.93 MB
```

- Open Failover Cluster Manager
- Click on **FileServerCluster**
  - o More Actions > **Configure Cluster Quorum Settings...**
- Options:
  - o **Select the Quorum Witness**
  - o **Configure a Disk Witness**
- Configure Storage Witness
  - o **Click Cluster Disk 3**



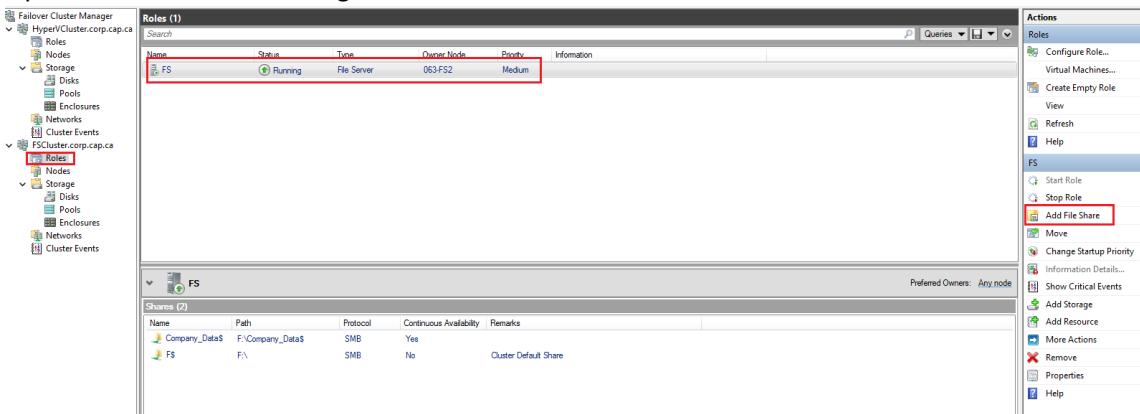
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



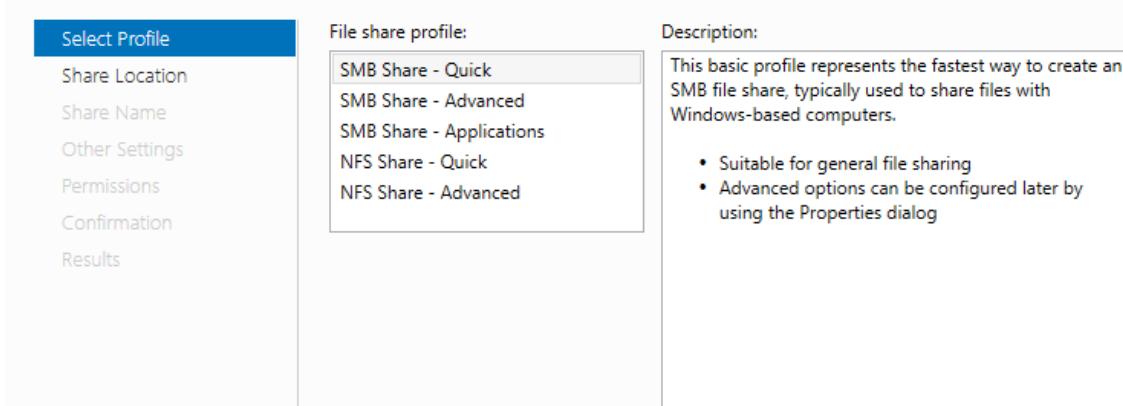
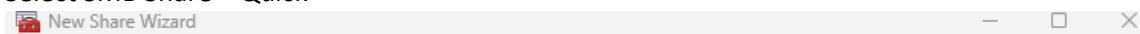
Create the Share on the File Server:

Add a File Share:

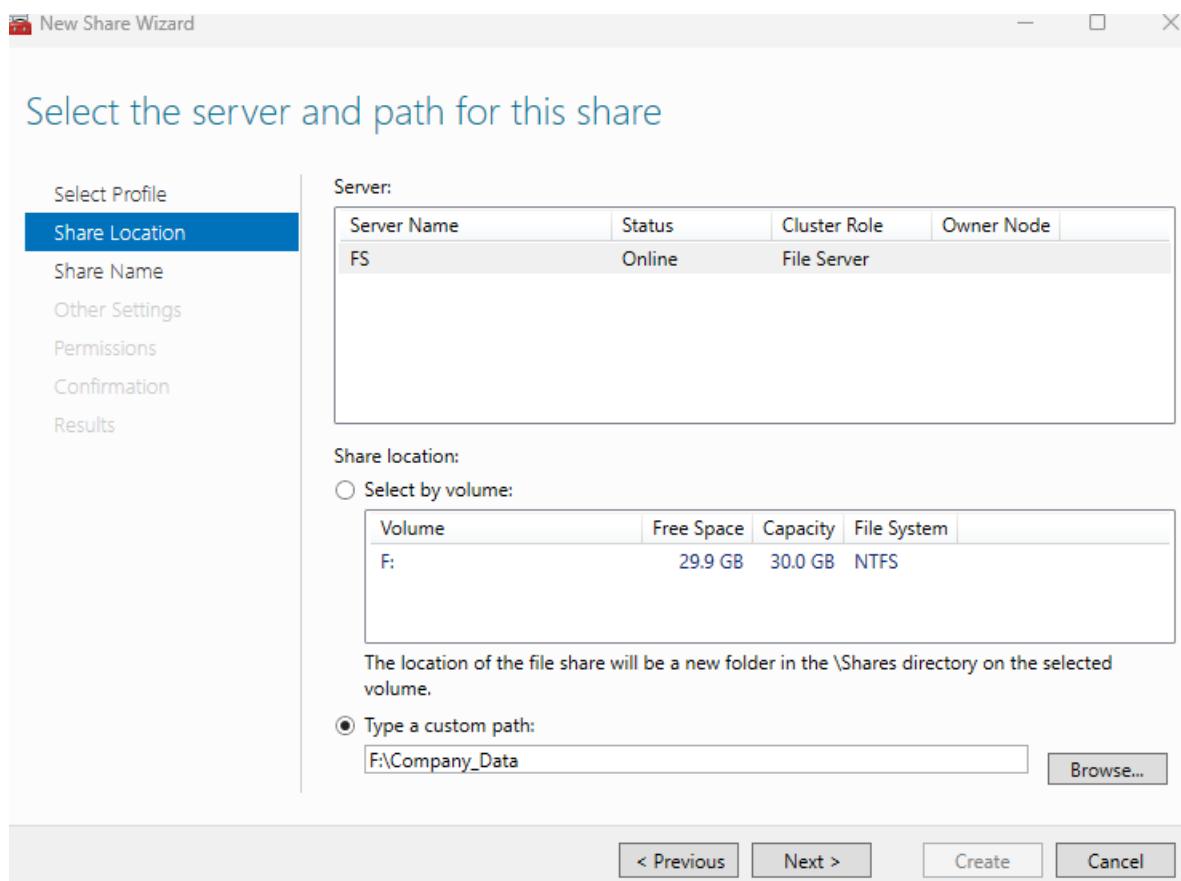
- Open Failover Cluster Manager > Roles > Add Share



- Select SMB Share – Quick

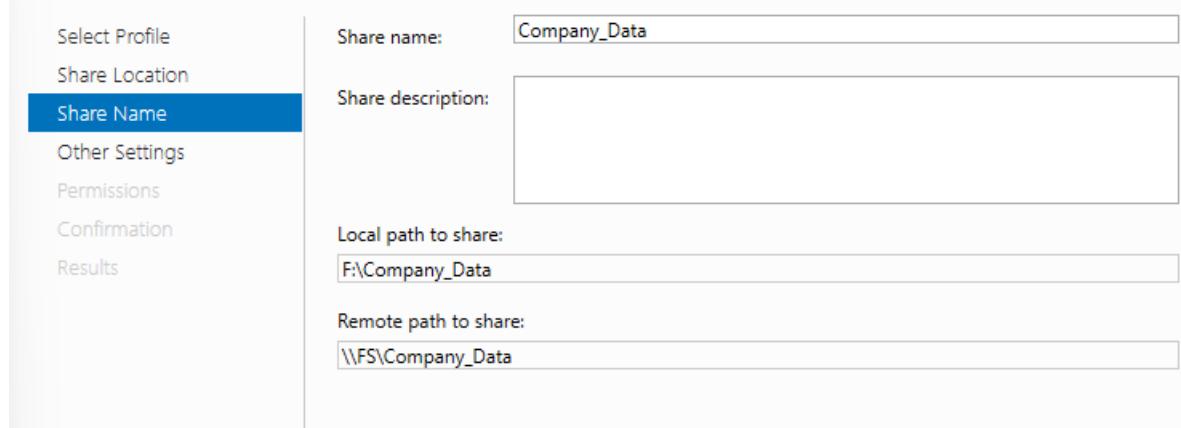


## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



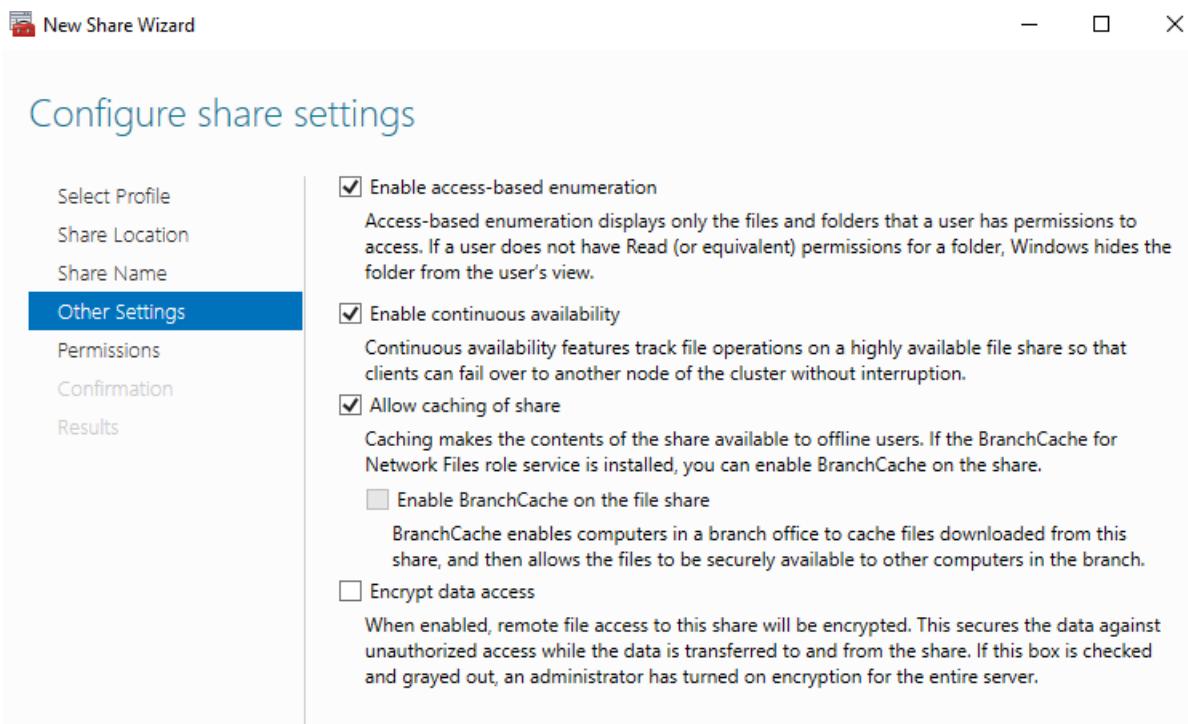
- **F:\Company\_Data**
- Remote Path to Share **\FS\Company\_Data**

### Specify share name



## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Enable access-based enumeration:



- Confirm and Create the Share:

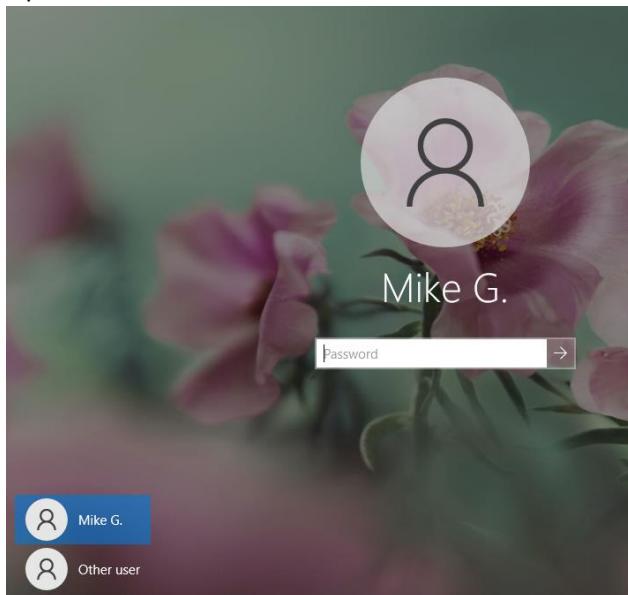
The screenshot shows the 'Shares (2)' list in File Explorer. It displays two shares:

Name	Path	Protocol	Continuous Availability	Remarks
Company_Data\$	F:\Company_Data\$	SMB	Yes	
F\$	F:\	SMB	No	Cluster Default Share

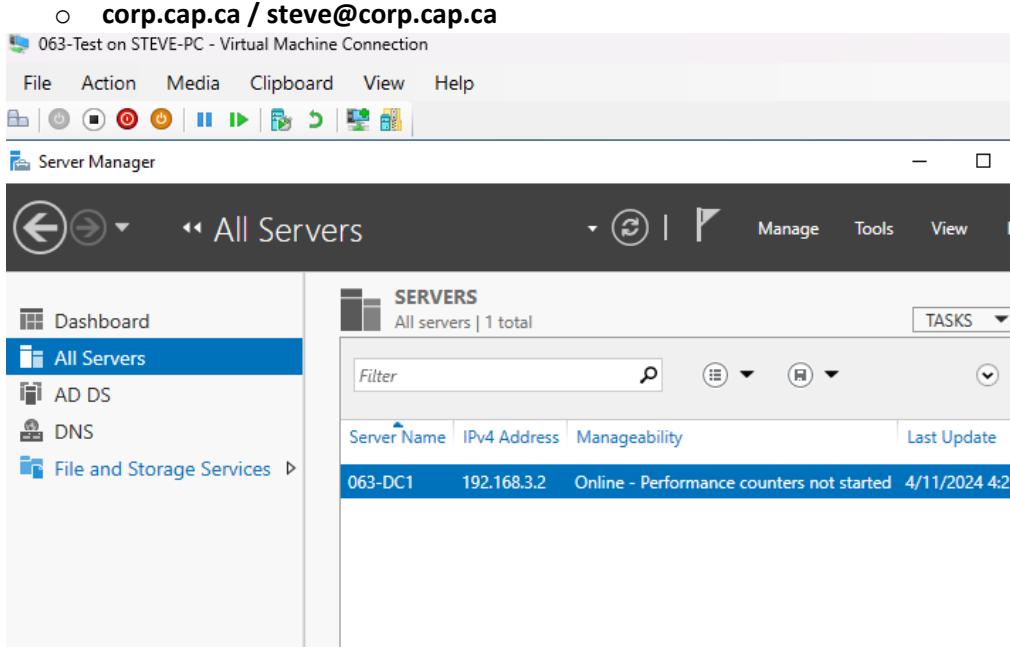
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

### Configure the Folder Redirection Group Policy:

- Open **063-Test** VM



- Set Static IP:
  - o IP: **192.168.3.12**
  - o Subnet Mask: **255.255.255.0**
  - o Default Gateway: **192.168.3.254**
  - o DNS Server: **192.168.3.2**
- Join the Domain > Windows > System > Settings > About > Rename this PC (Advanced)
  - o **corp.cap.ca / steve@corp.cap.ca**



- Install RSAT Tools: In Server Manager add **063-DC1**
- Open PowerShell on **063-Test**

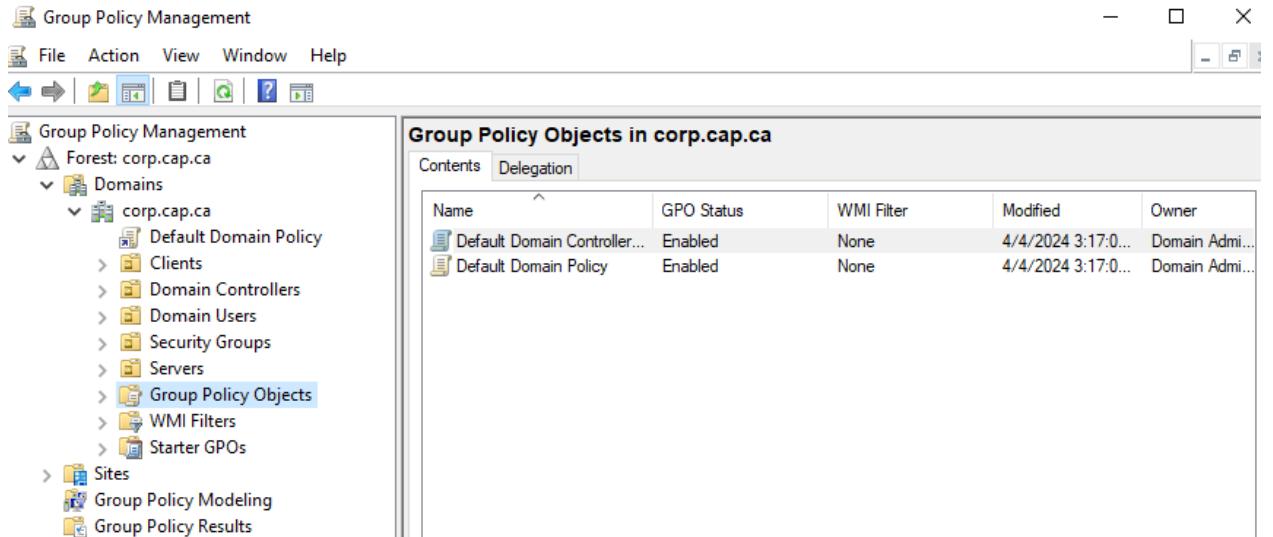
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Install Group Policy Management

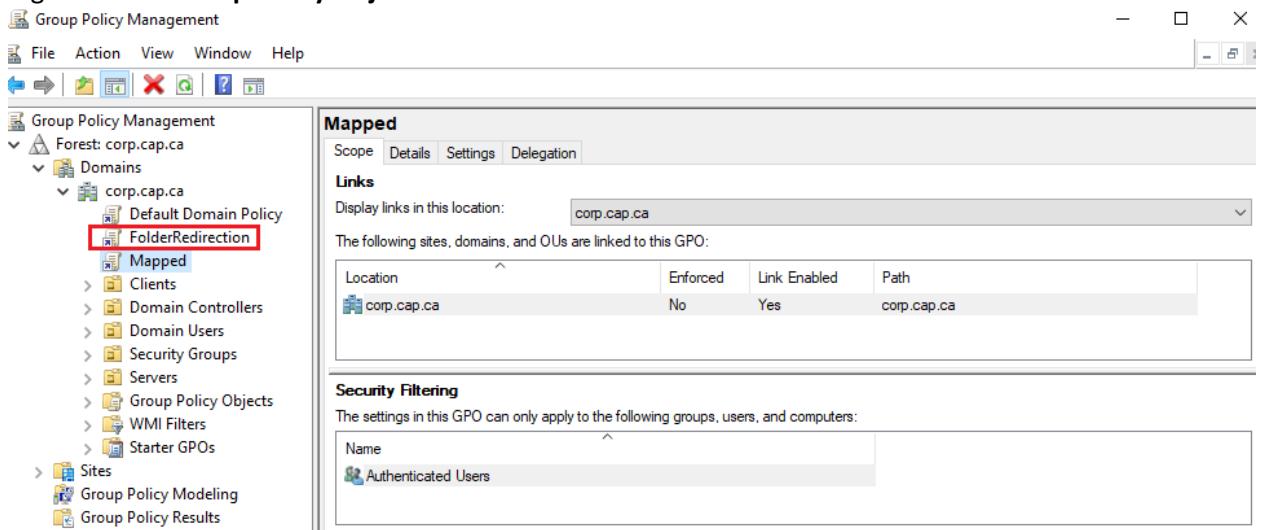
Add-WindowsCapability -Online -Name Rsat.GroupPolicy.Management.Tools~~~~0.0.1.0

- Click Windows button on the taskbar
- Type 'Run'
- gpmc.msc > Enter

- **Group Policy Management:**



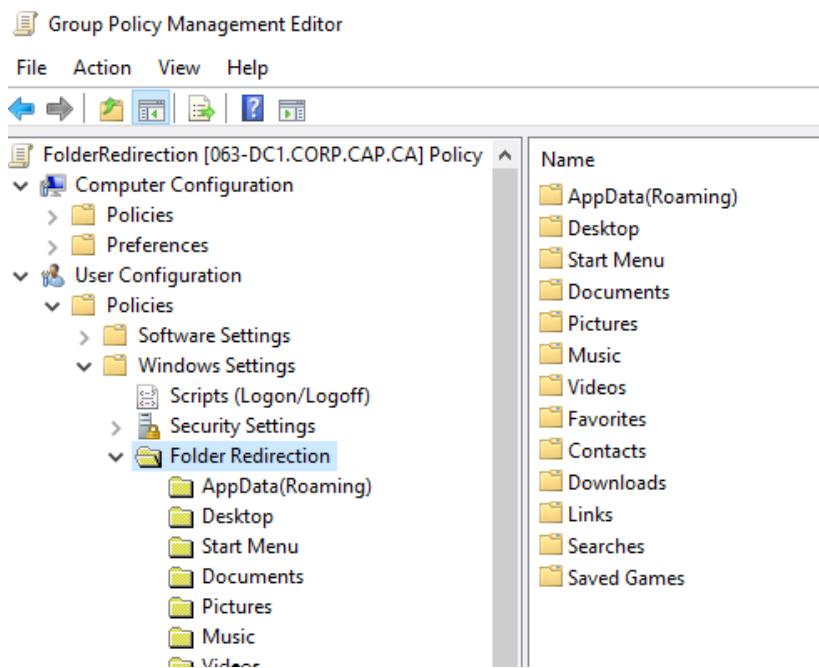
- Right click on **Group Policy Objects** > New



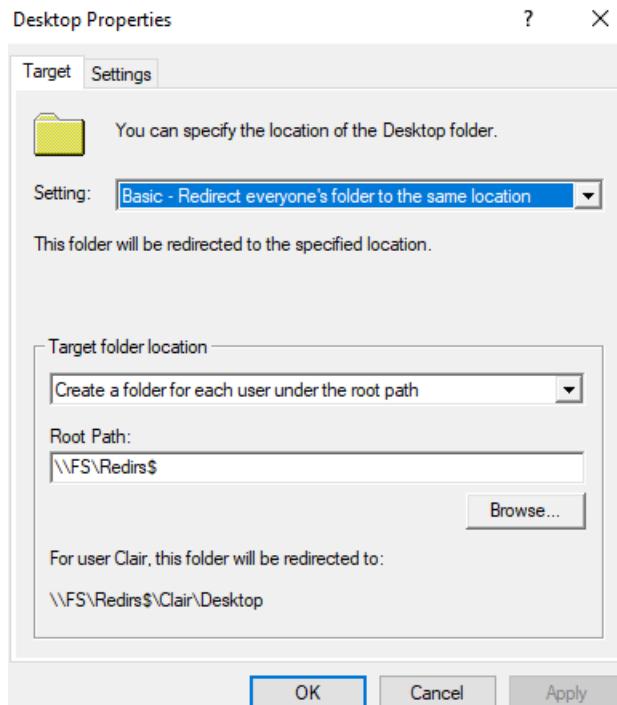
- Name it **FolderRedirection**
- Right click on **FolderRedirection** > Edit
- This will open **Group Policy Management Editor**

Right click on folder named Desktop > Properties

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



- Change the setting on the Target tab to show: Basic – Redirect everyone's folder to the same location:



Link the GPO to the Domain Users GPO:

- **Group Policy Management > Root**
  - o Right click **corp.cap.ca**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- **Link an Existing GPO**
- **Select Folder Redirection**

The screenshot shows the 'Group Policy Management' interface. In the left navigation pane, under 'Forest: corp.cap.ca / Domains / corp.cap.ca', the 'Default Domain Policy' is selected. In the main pane, the 'FolderRedirection' tab is active. The 'Links' section shows 'Display links in this location: corp.cap.ca'. Below it, a table lists 'The following sites, domains, and OUs are linked to this GPO:' with one entry: 'Location: corp.cap.ca' and 'Enforced: No'.

- **Log in with a domain user on a Windows 10 Client Machine to test Folder Redirection**
- User: Bob Ross, he's a Domain Member
- **Do a `gpupdate /force` on the Domain User's Computer**

```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Windows\system32> gpupdate /force
Updating policy...

Computer Policy update has completed successfully.
User Policy update has completed successfully.

The following warnings were encountered during user policy processing:

The Group Policy Client Side Extension Folder Redirection was unable to apply one or more settings because the changes must be processed before system startup or user logon. The system will wait for Group Policy processing to finish completely before the next startup or logon for this user, and this may result in slow startup and boot performance.

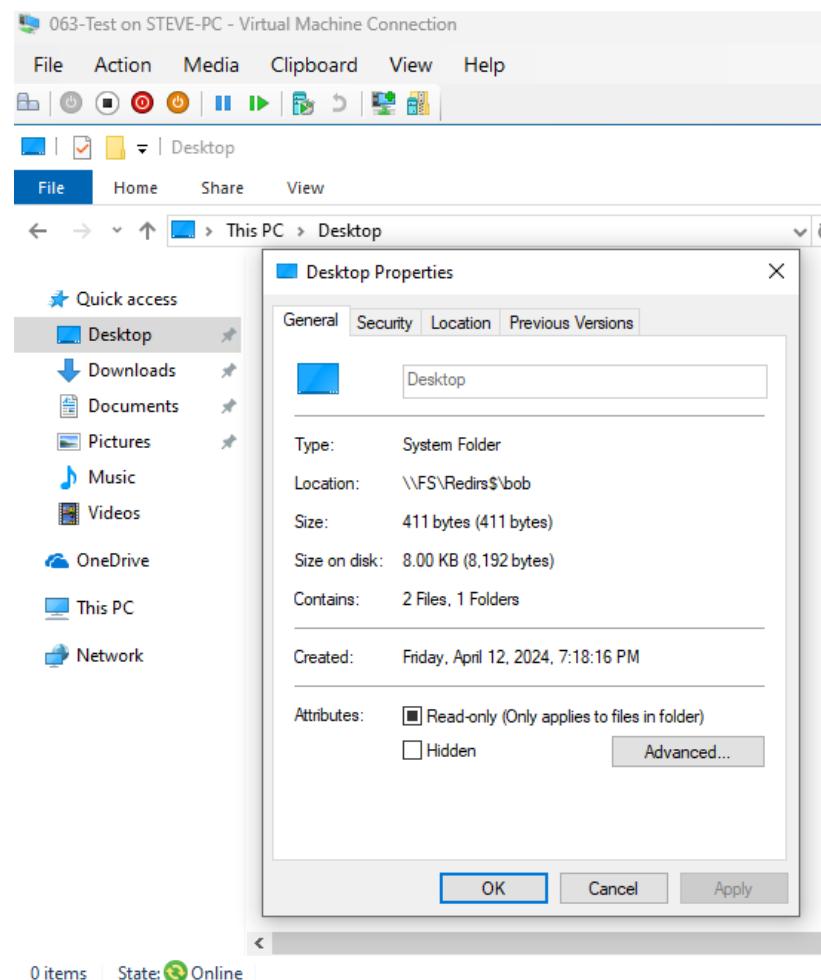
For more detailed information, review the event log or run GPRESULT /H GPReport.html from the command line to access information about Group Policy results.

Certain user policies are enabled that can only run during logon.

OK to log off? (Y/N)
```

- The command will force the user to log off to apply the Group Policy Object
- Log back in and open File Explorer:
- Open the Properties for **Desktop** and **Documents** folder:

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



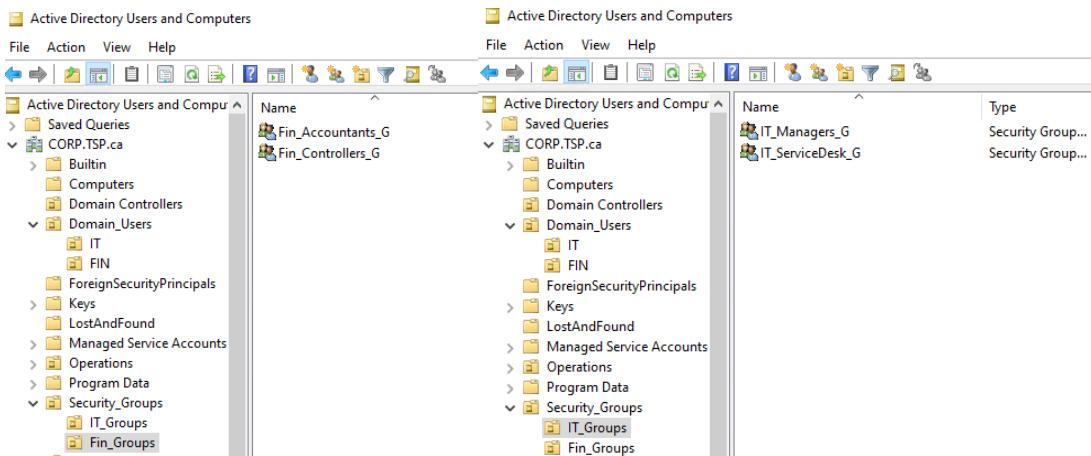
### Create an AGDLP Security Group structure for corp.tsp.ca:

- Create 4 new users in Active Directory Users and Computers. Each user will have different roles within the organization
  - o Two Users will be IT employees and the other two will be finance
  - o Place the Users in the appropriate Organizational Units (OUs)
- Create a new Organizational Unit in ADUC called **Security\_Groups**

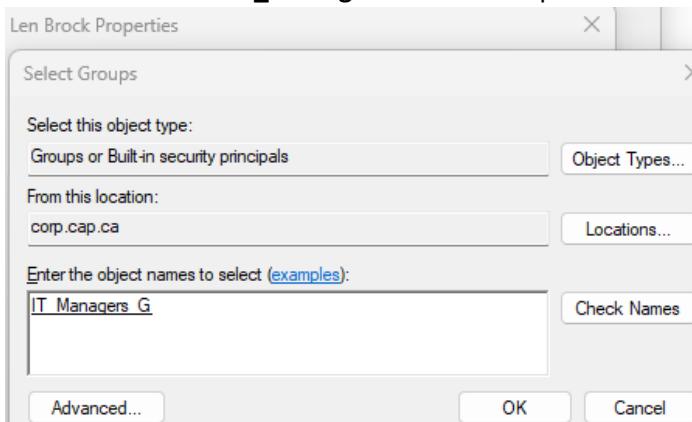
Within the **Security\_Groups** OU create an **IT\_Groups** and a **Fin\_Groups** OU:

- o Inside the **IT\_Groups OU** create a Global Group called **IT\_Managers\_G** and one called **IT\_ServiceDesk\_G**
- o Inside the **Fin\_Groups OU** create a Global Group called **Fin.Controllers\_G** and one called **Fin.Accountants\_G**

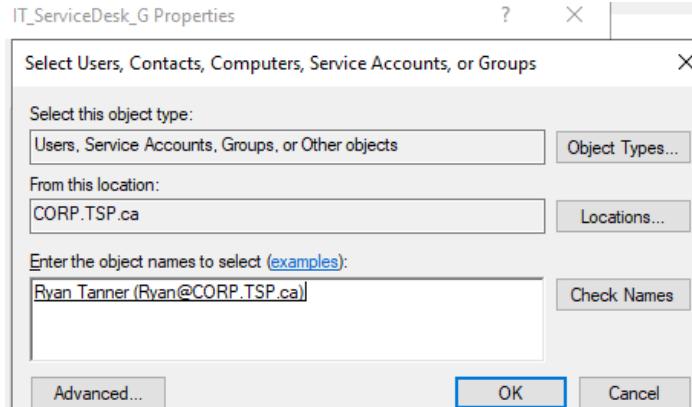
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



- Add the users to their Global Groups
  - o From the IT Organizational Unit, find the User > In this case **Len Brock**. We want to add him to the **IT\_Managers\_G** Global Group



- Apply > OK
  - o We will place Ryan Tanner in the **IT\_ServiceDesk\_G** Global Group:



- **Ken Lance and Tim Lee will be placed in their respective FIN Global Groups:**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

Fin\_Accountants\_G Properties

?

X

Object	Security	Attribute Editor	
General	Members	Member Of	Managed By
Members:			
Name	Active Directory Domain Services Folder		
 Ken Lance	CORP.TSP.ca/Domain_Users/FIN		

Fin.Controllers\_G Properties

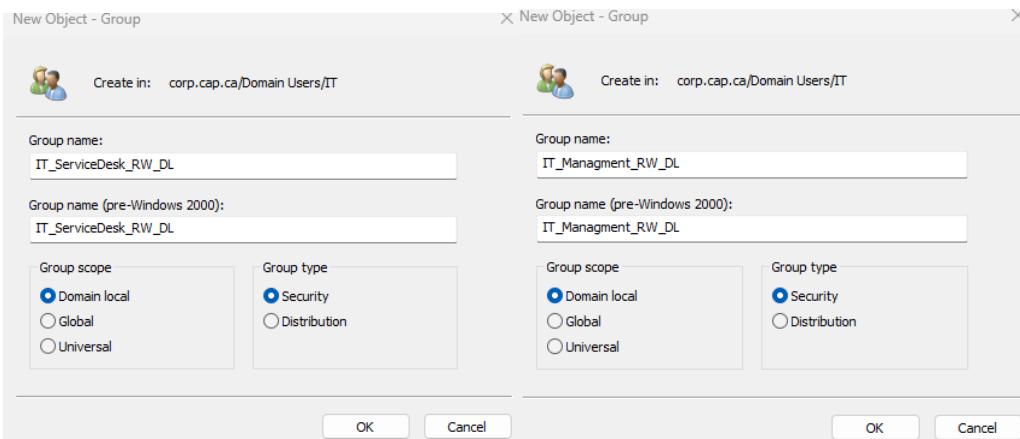
?

X

Object	Security	Attribute Editor	
General	Members	Member Of	Managed By
Members:			
Name	Active Directory Domain Services Folder		
 Tim Lee	CORP.TSP.ca/Domain_Users/FIN		

We will create the Domain Local Groups. The below Domain Local Groups will be the groups assigned to the NTFS permissions:

- Inside the **IT\_Groups OU** create another **Domain Local Security Group** called **IT\_Management\_RW\_DL** and one called **IT\_ServiceDesk\_RW\_DL**:



The image shows two identical 'New Object - Group' dialog boxes side-by-side. Both dialogs have the following fields filled out:

- Create in:** corp.cap.ca/Domain Users/IT
- Group name:** IT\_ServiceDesk\_RW\_DL
- Group name (pre-Windows 2000):** IT\_ServiceDesk\_RW\_DL
- Group scope:** Domain local (radio button selected)
- Group type:** Security (radio button selected)

Both dialogs also show the same bottom buttons: 'OK' and 'Cancel'.

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063

The screenshot shows the 'Active Directory Users and Computers' window. The left pane displays the navigation tree with 'corp.cap.ca' selected. Under 'Domain Users', there is a folder named 'FIN' which is expanded, showing sub-folders like 'IT', 'ForeignSecurityPrincipals', 'Keys', etc. The right pane is a table listing four security groups:

Name	Type	Description
IT_Managers_G	Security Group...	
IT_Management_RW_DL	Security Group...	
IT_ServiceDesk_G	Security Group...	
IT_ServiceDesk_RW_DL	Security Group...	

- Inside the **Fin\_Groups OU** create a **Domain Local Security Group** called **Fin\_Controllers\_RW\_DL** and one called **Fin\_Accounting\_RW\_DL** and another called **Fin\_Accounting\_RE\_DL**:

**New Object - Group**

**New Object - Group**

Create in: corp.cap.ca/Domain Users/FIN

Create in: corp.cap.ca/Domain Users/FIN

Group name:  
Fin\_Controllers\_RW\_DL

Group name:  
Fin\_Accounting\_RE\_DL

Group name (pre-Windows 2000):  
Fin\_Controllers\_RW\_DL

Group name (pre-Windows 2000):  
Fin\_Accounting\_RE\_DL

Group scope

Group type

Group scope

Group type

OK Cancel

OK Cancel

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

The screenshot shows the Active Directory Users and Computers interface. On the left, the navigation pane displays the following tree structure under 'corp.cap.ca':

- Builtin
- Clients
- Computers
- Domain Controllers
- Domain Users
  - FIN
  - IT
  - ForeignSecurityPrincipals
  - Keys
  - LostAndFound
  - Managed Service Accounts
  - Program Data
  - Security Groups
  - Servers
  - System
  - Users
  - NTDS Quotas
  - TPM Devices

On the right, a table lists security groups:

Name	Type	Description
Fin_Accountants_G	Security Group...	
Fin_Accounting_RE_DL	Security Group...	
Fin.Controllers_G	Security Group...	
Fin.Controllers_RW_DL	Security Group...	

Nest the Global Groups into their appropriate Domain Local Groups:

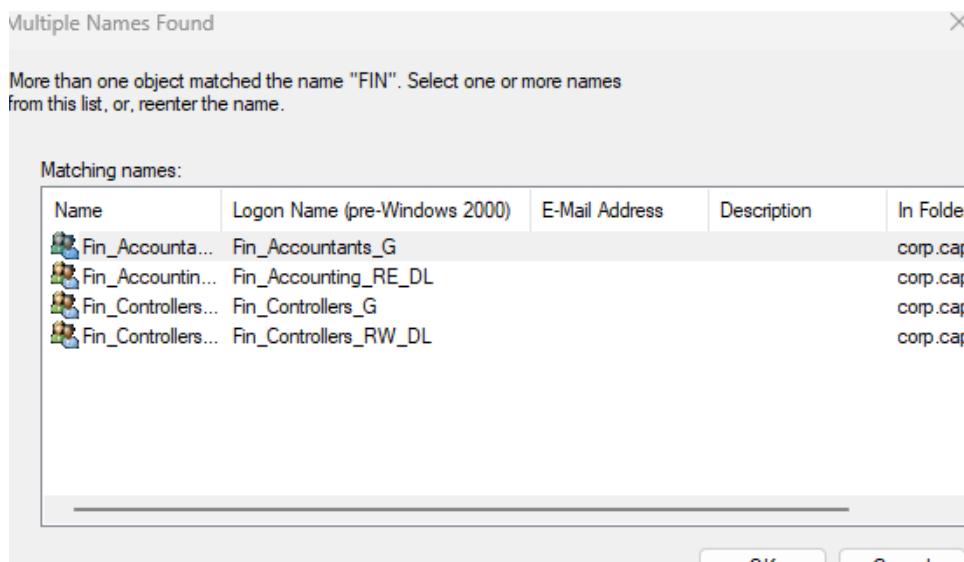
- In Fin\_Groups:
  - o Nest **Fin.Controllers\_G** Global group into the appropriate Domain Local Group (**Fin.Controllers\_RW\_DL**)
- Right click on **Fin.Controllers\_RW\_DL**
  - o **Properties > Members > Add > Fin.Controllers\_G** (The Global Group)

The screenshot shows the 'Fin.Controllers\_RW\_DL Properties' dialog. The 'Members' tab is selected, displaying the following table:

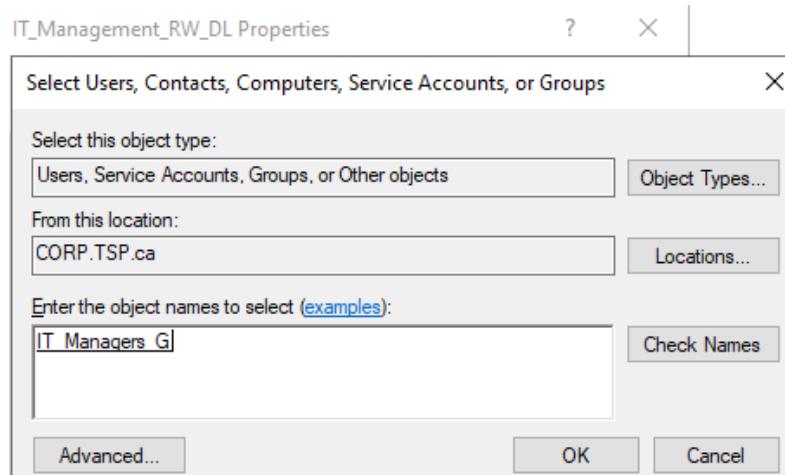
Name	Active Directory Domain Services Folder
Fin.Controllers_G	CORP.TSP.ca/Security_Groups/Fin_Groups

- Do the same for **Fin\_Accounting\_RE\_DL**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

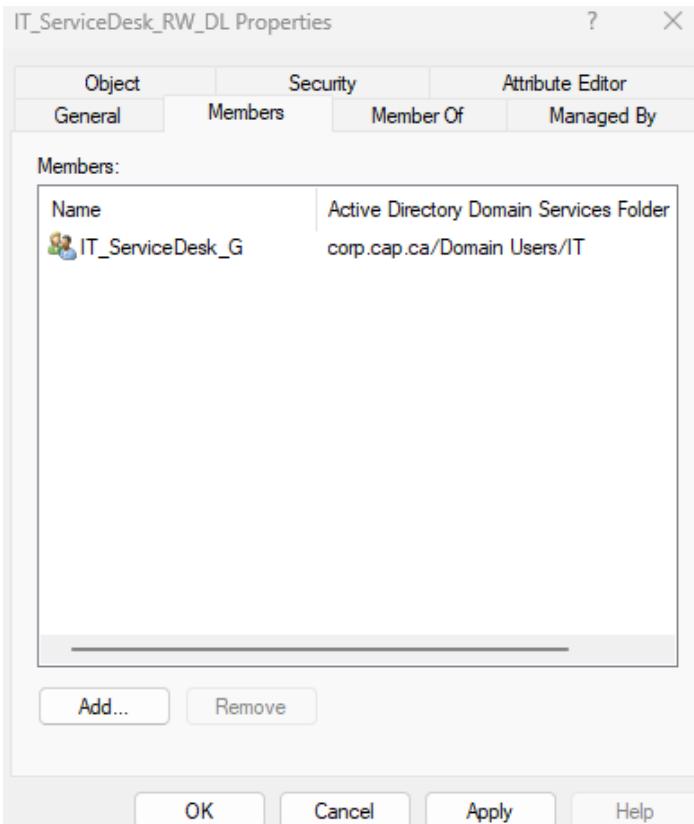
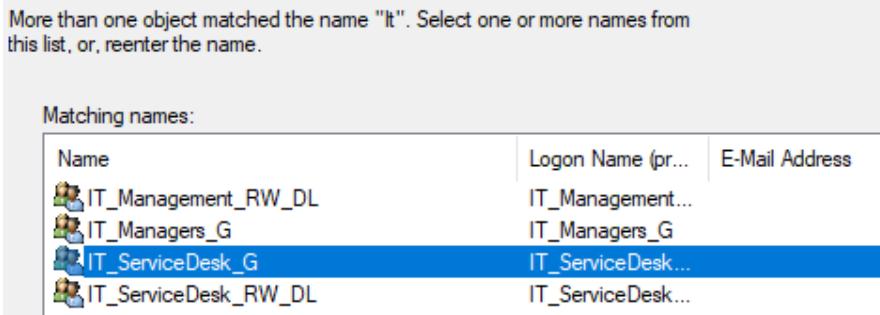


- In IT\_Groups:
  - o Nest **IT\_Managers\_G** Global group into the appropriate Domain Local Group (IT\_Management\_RW\_DL)
- Right click on **IT\_Management\_RW\_DL**
  - o Properties > Members > Add > **IT\_Managers\_G** (The Global Group)
- In IT\_Groups:
  - o Nest **IT\_Managers\_G** Global group into the appropriate Domain Local Group (IT\_Management\_RW\_DL)
- Right click on **IT\_Management\_RW\_DL**
  - o Properties > Members > Add > **IT\_Managers\_G** (The Global Group)



## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

- Do the same for IT\_ServiceDesk\_RW\_DL

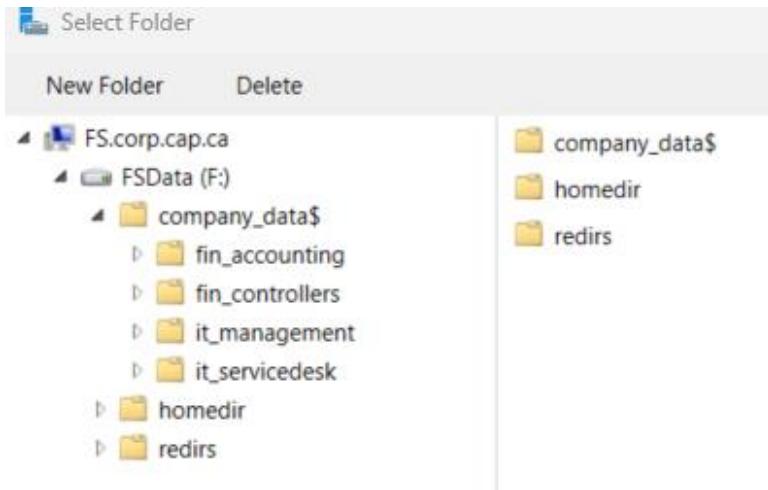


### Create IT Departments directories:

- Under the **Company\_Data\$** share/directory create two directories – one called **IT\_Management** and one called **IT\_ServiceDesk**
- Remote into FS1 from DC1
  - o **Server Manager > File and Storage Services > Shares**
  - o **Right click on empty space > New Share...**
  - o **Choose the Share Location: > FS.corp.cap.ca > Custom Path: > company\_data\$ > New Folder**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

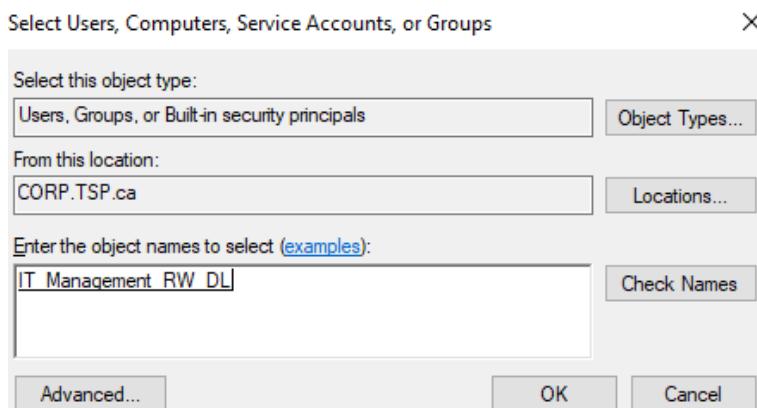
- Create two directories: *IT\_Management* and *IT\_ServiceDesk*



Set Permissions on the IT directories:

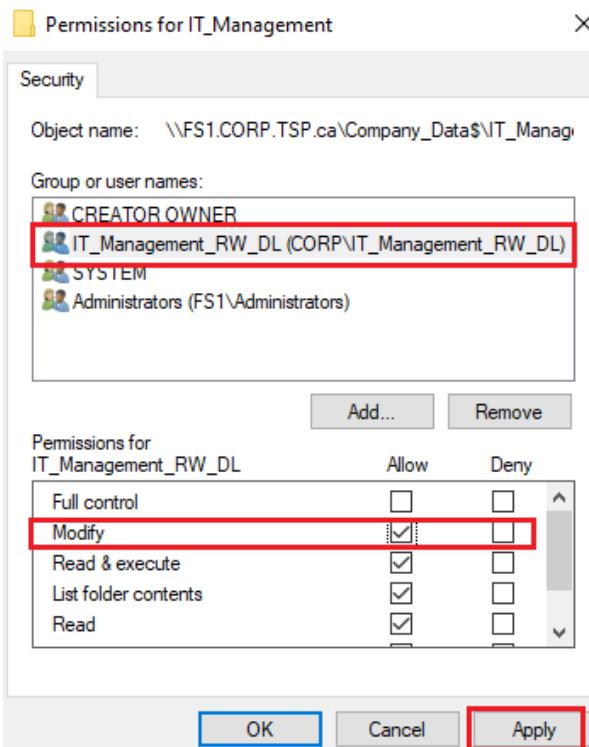
Add the *IT\_Management\_RW\_DL* group with modify permissions to the *IT\_Management* directory

- Navigate to the **IT\_Management** directory on your server
  - Right click on **Company\_Data\$** > Open Share
- Right-click the directory and select '**Properties**'
- Go to the '**Security**' tab
- Click '**Edit**' to change permissions
- Click '**Add**' to include a new group or usernames
- Enter "**IT\_Management\_RW\_DL**" and click '**Check Names**' to ensure the group exists in Active Directory, then click '**OK**'



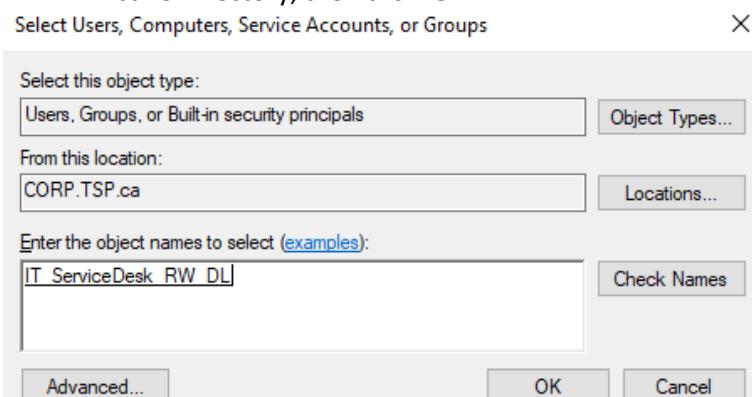
- Select the newly added group in the list and check the '**Modify**' permission to allow them to modify files and folders
- Click '**Apply**' and then '**OK**' to set the permissions:

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



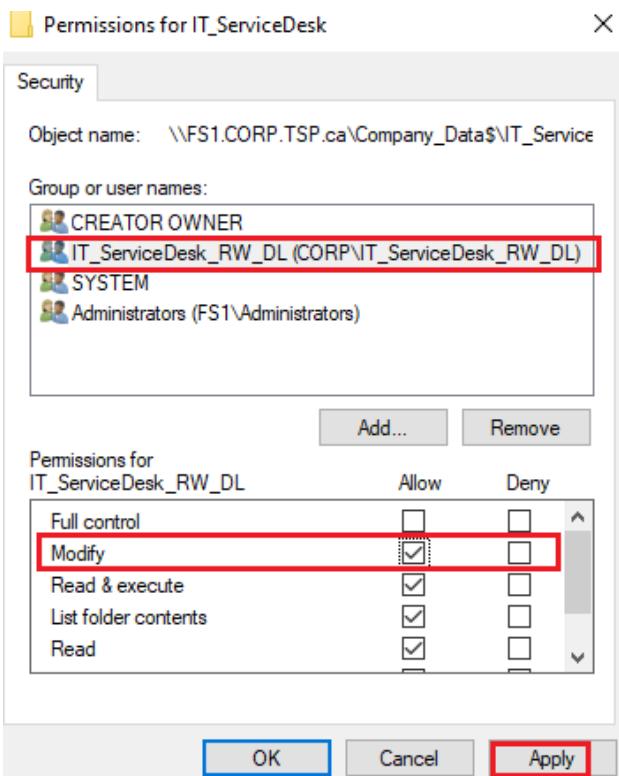
Add the **IT\_ServiceDesk\_RW\_DL** group with modify permissions to the **IT\_ServiceDesk** directory:

- Navigate to the **IT\_ServiceDesk** directory on your server.
- Right-click the directory and select '**Properties**'
- Go to the '**Security**' tab
- Click '**Edit**' to change permissions
- Click '**Add**' to include a new group or usernames
- Enter "**IT\_ServiceDesk\_RW\_DL**" and click '**Check Names**' to ensure the group exists in Active Directory, then click '**OK**'



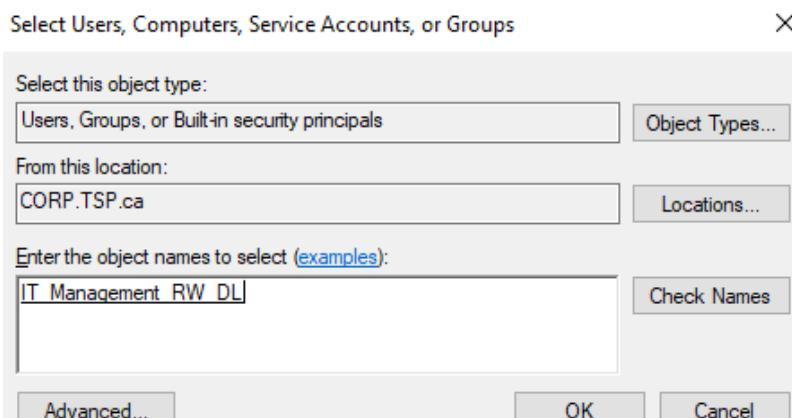
- Select the newly added group in the list and check the '**Modify**' permission to allow them to modify files and folders
- Click '**Apply**' and then '**OK**' to set the permissions:

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



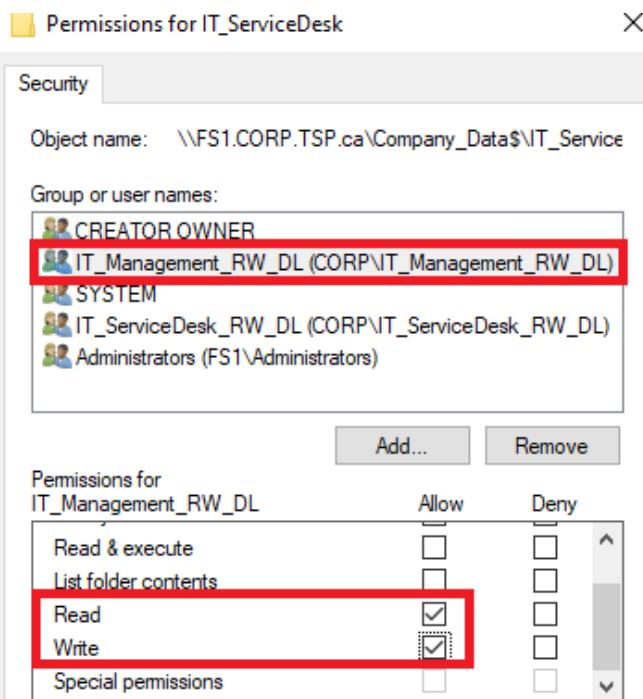
Add Read/Write Permissions for **IT\_Management\_RW\_DL** Group to the **IT\_ServiceDesk** Directory:

- Right-click the **IT\_ServiceDesk** directory and select '**Properties**'
- Go to the '**Security**' tab
- Click '**Edit**' to change permissions
- Click '**Add**' to include the **IT\_Management\_RW\_DL** group



- In the permissions for **IT\_Management\_RW\_DL**, you would typically check 'Modify' because it *includes the ability to read and write*. However, if you **only want to grant explicit Read and Write permissions** without the ability to delete, you would:
  - o Check 'Read' to allow viewing the contents
  - o Check 'Write' to allow adding and modifying files

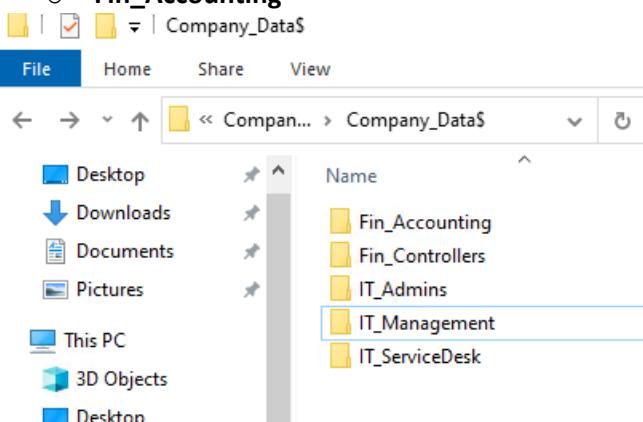
## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



Click 'Apply' and then 'OK' to set the permissions

### Set Permissions on the Finance Department Directories:

- Create two directories under the Company\_Data\$ share/directory:
  - o Fin\_Controllers
  - o Fin\_Accounting

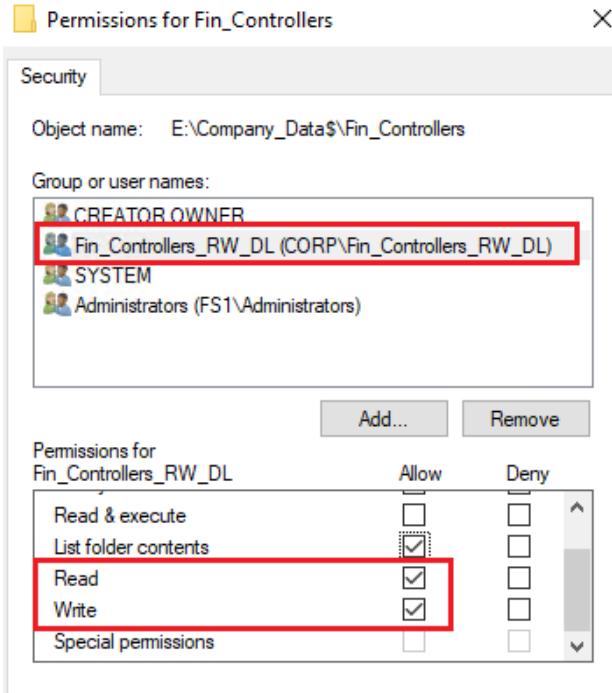


Add the Fin\_Controllers\_RW\_DL Group with Read/Write Permissions to the Fin\_Controllers Directory:

- Navigate to the **Fin\_Controllers** directory on your server
- Right-click the directory and select '**Properties**'
- Go to the '**Security**' tab
- Click '**Edit**' to modify the permissions
- Click 'Add' to include the **Fin\_Controllers\_RW\_DL** group

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063

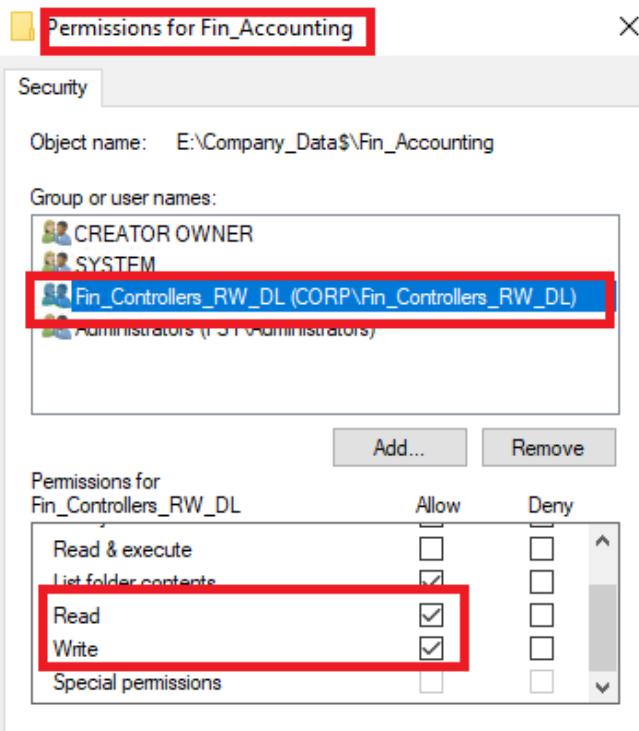
- Enter "**Fin.Controllers\_RW\_DL**" and click '**Check Names**' to verify the group
- Grant the group '**Read**' and '**Write**' permissions by checking the corresponding boxes
- Click '**Apply**' and then '**OK**'



Add the **Fin\_Accountants\_RW\_DL** Group with Read/Write Permissions to the **Fin\_Accounting** Directory:

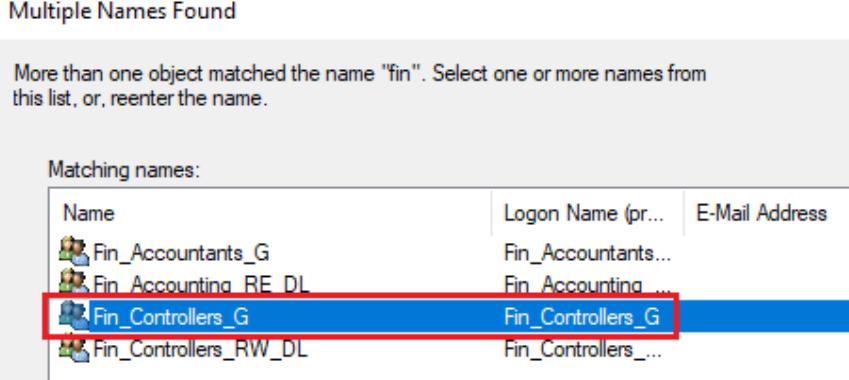
- Navigate to the **Fin\_Accounting** directory on your server
- Right-click the directory and select '**Properties**'
- Go to the '**Security**' tab
- Click '**Edit**' to modify the permissions
- Click '**Add**' to include the **Fin.Controllers\_RW\_DL** group
- Enter "**Fin.Controllers\_RW\_DL**" and click '**Check Names**' to verify the group
- Grant the group '**Read**' and '**Write**' permissions by checking the corresponding boxes
- Click '**Apply**' and then '**OK**'

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



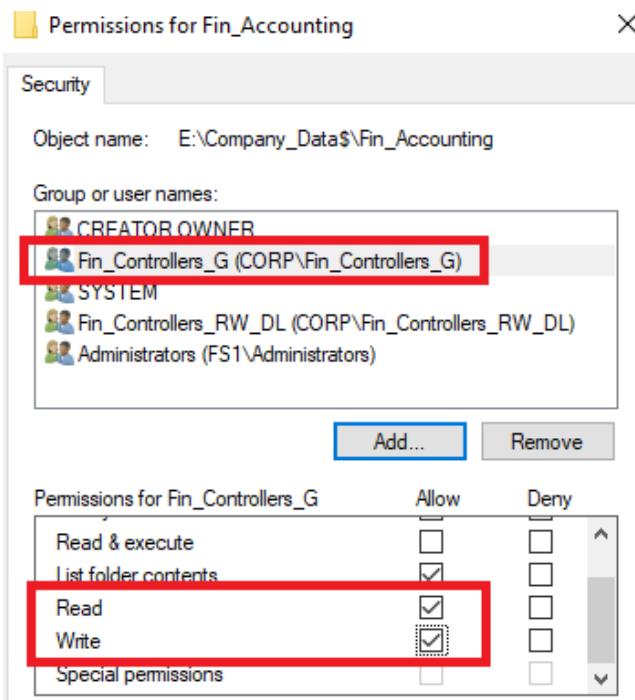
Add Finance Controllers' Group to the Fin\_Accountants\_RW\_DL with Read/Write Permissions:

- Since the finance controllers also need access to the **Fin\_Accounting** directory:
  - o Add the global group for finance controllers to the **Fin\_Accountants\_RW\_DL** group's permissions
- Navigate to the **Fin\_Accounting** directory
- Right-click the directory and select '**Properties**'
- Go to the '**Security**' tab and click '**Edit**'
- Click '**Add**' and enter the global group name for the finance controllers (**Fin.Controllers\_G**)
- Click '**Check Names**' to verify



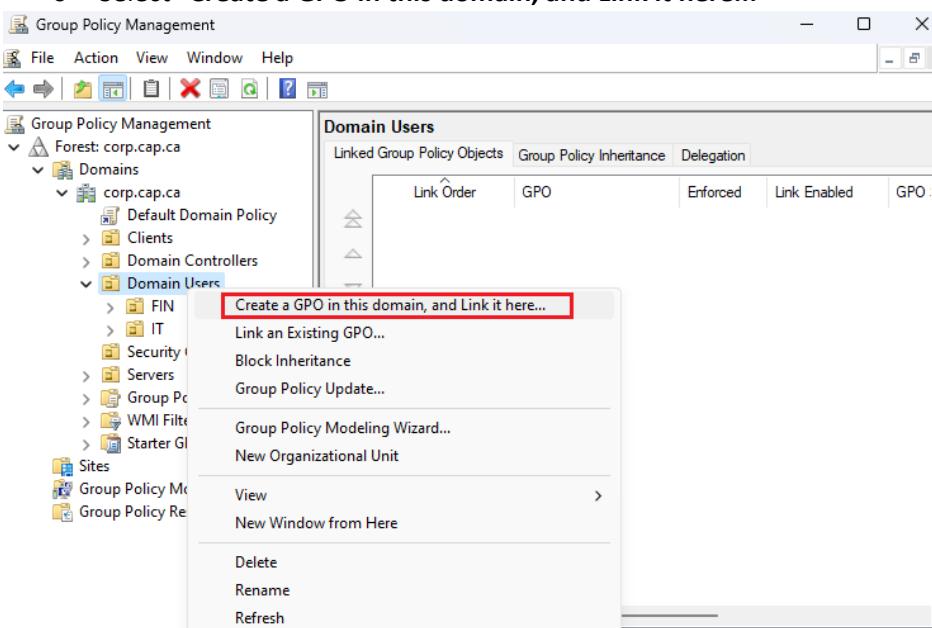
- Grant '**Read**' and '**Write**' permissions to this group as well

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



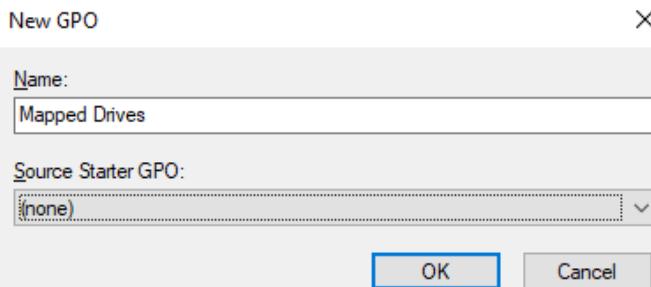
### Create a Mapped Drive through Group Policies:

- Assign the GPO to the relevant OU
  - o Open the **Group Policy Management Console** (GPMC) on your server
  - o Right click the appropriate Organizational Unit (OU) where the users or computers reside that need access to the mapped drive (**IT\_Groups**)
  - o Select "**Create a GPO in this domain, and Link it here...**"

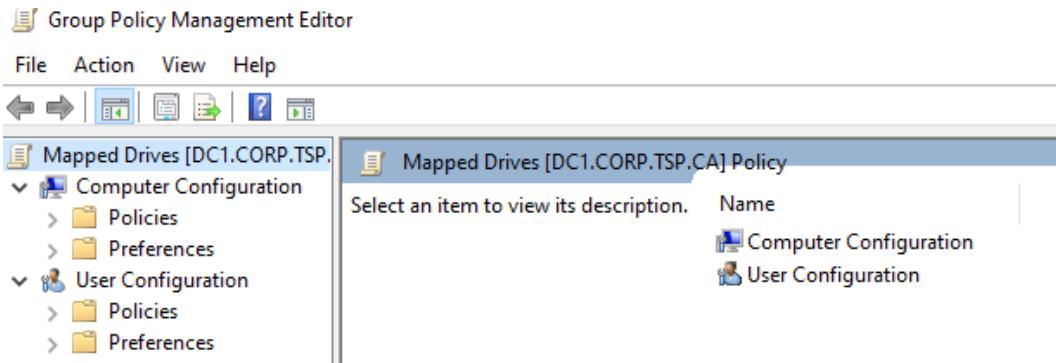


- Name the GPO something relevant like "**Mapped Drives**"

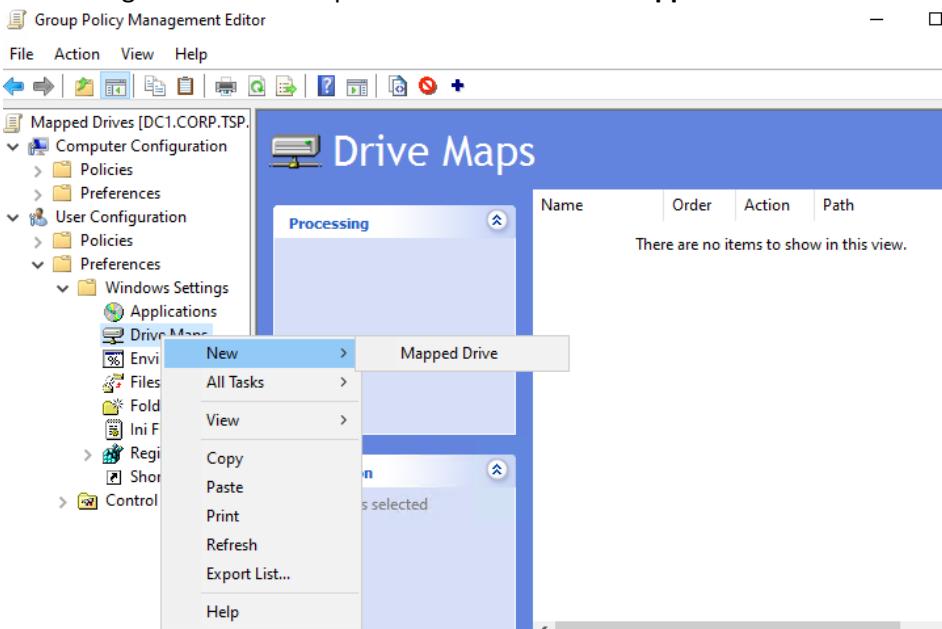
# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



- Right click the new GPO and choose "Edit" to open the Group Policy Management Editor

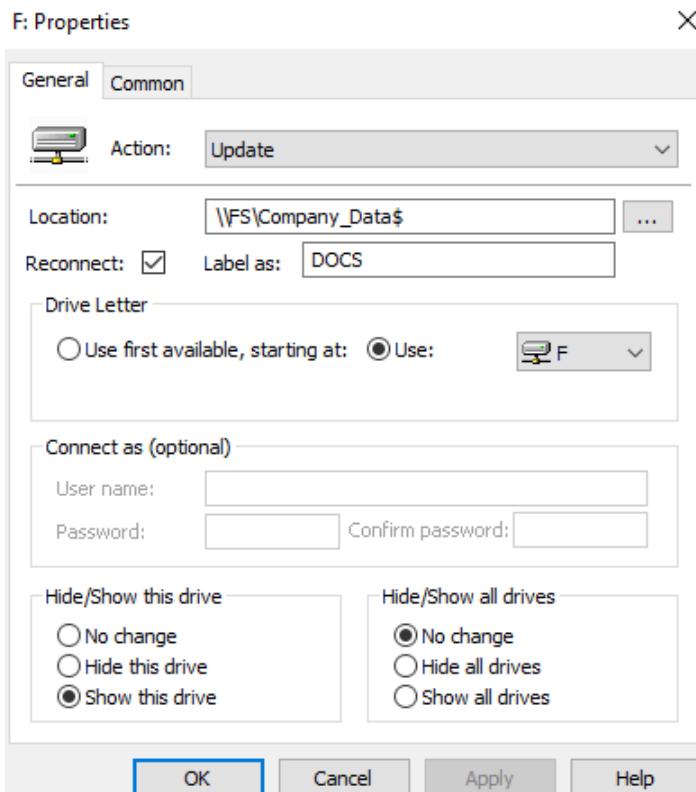


- Set Up the Mapped Drive within the GPO:
  - o Navigate to **User Configuration > Preferences > Windows Settings > Drive Maps**
  - o Right click Drive Maps and select "New" > "Mapped Drive"



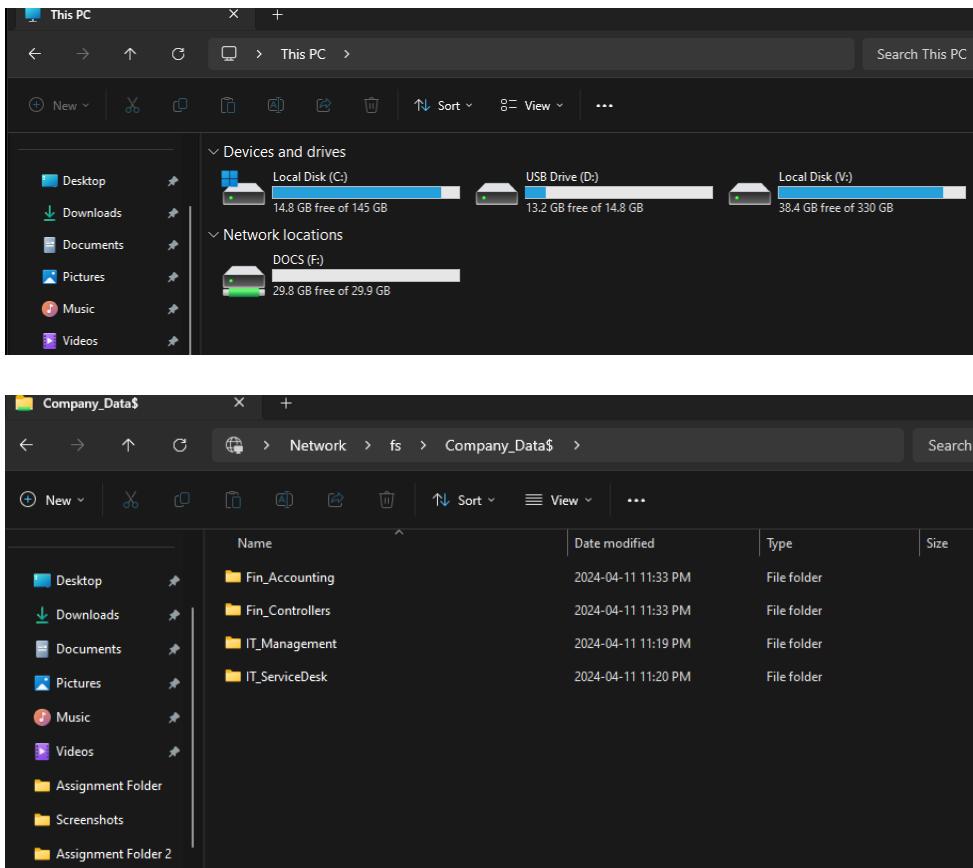
- o Configure the mapped drive settings:
  - Action: Update
  - Location: Enter the path of the share **\\\FS\Company\_Data\\$**

## CAPSTONE PROJECT: STEVEN FONSECA – A00525063



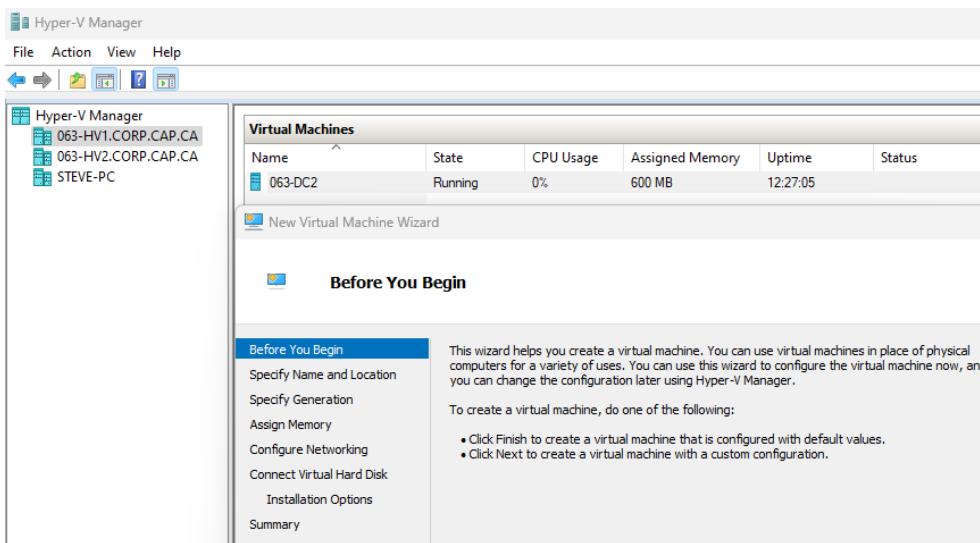
- To get the correct path:
  - Open **Server Manager > File and Storage Services > Shares** > Right click on **Company\_Data\$** > Properties
- **Reconnect:** Yes (*if you want the drive to persist for the user across logins*)
- **Label as:** Enter a name for the drive
  - **Company Documents**
  - G: drive from the drop-down menu
  - Check Reconnect
  - Click on '**Show this drive**'
- **Drive Letter:** Assign a drive letter that users will see
- Click '**OK**' to save the mapped drive configuration
- Log in to WIN10 to confirm access to the mapped drives. Can the users see the mapped drive?
  - After logging in, open File Explorer and look for the new drive under "This PC". It should appear with the drive letter and label you configured
  - Run command **gpupdate /force** if it's not visible

# CAPSTONE PROJECT: STEVEN FONSECA – A00525063



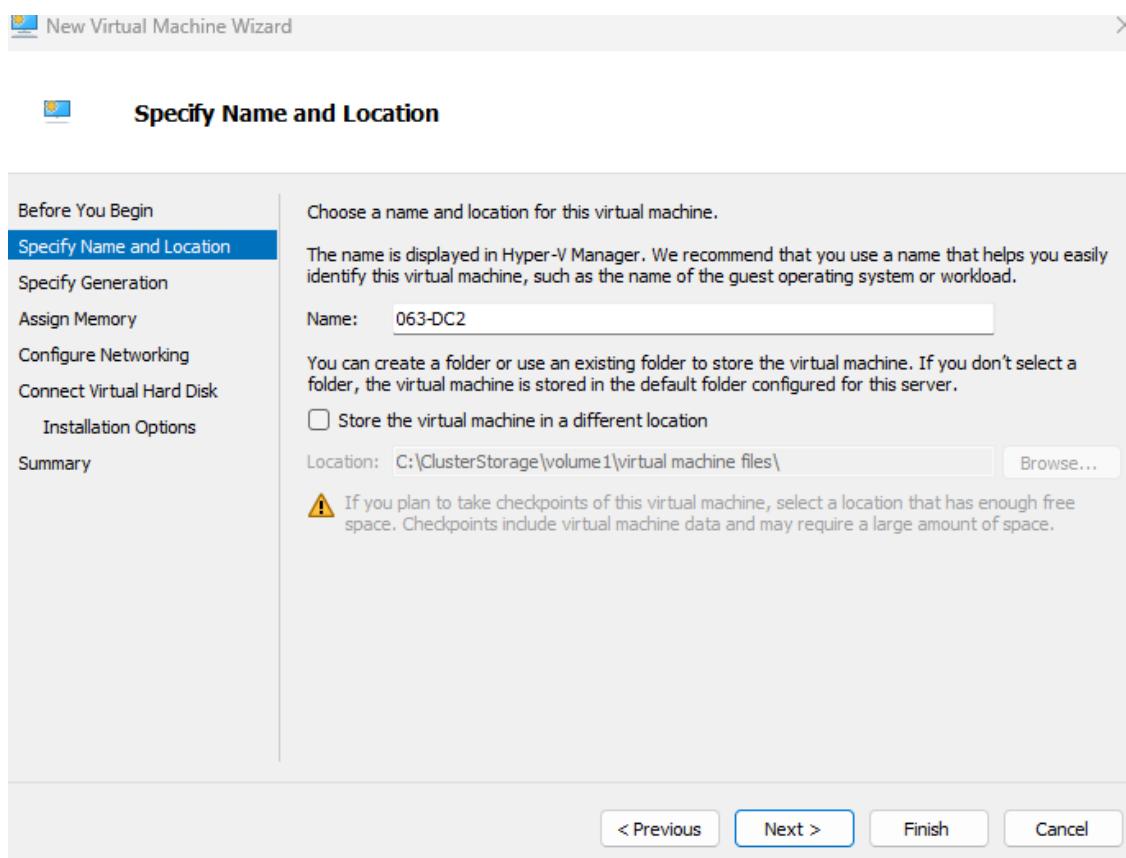
## Creating a Secondary Domain Controller on (063-HV1):

- Connect to **063-HV1.corp.cap.ca**
  - o Click New > Virtual Machine

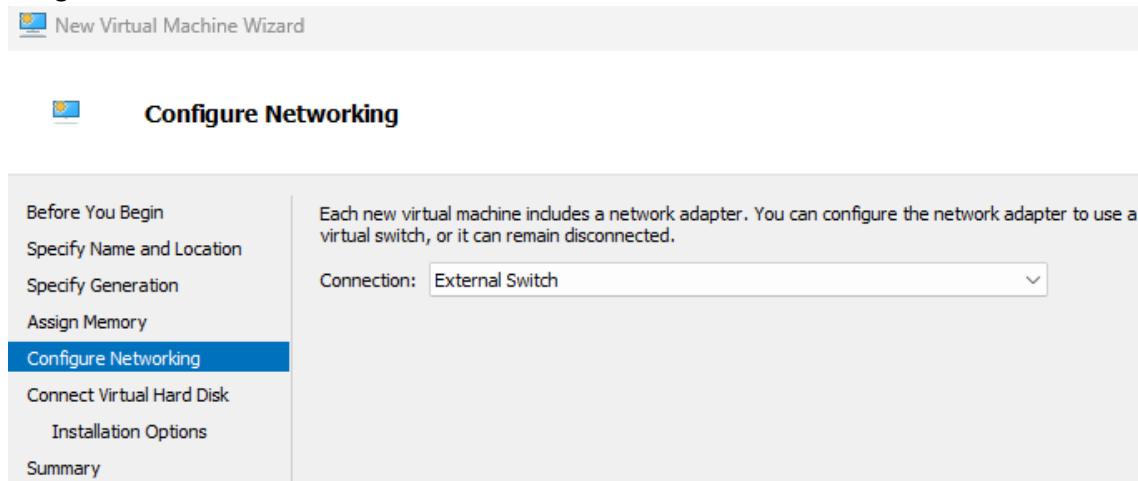


- Name the VM: **063-DC2**

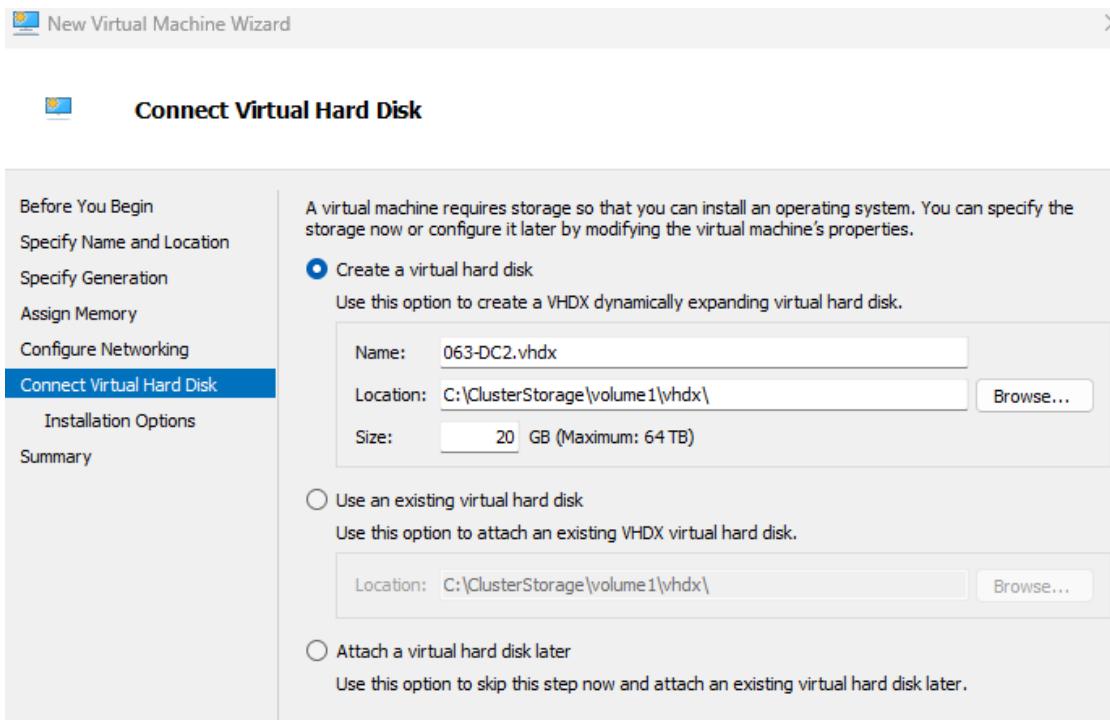
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- 600MB of RAM
- Assign External Switch:



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- Create temporary drive to place Windows Server Core 2022 .ISO file using script:
- Use PowerShell ISE as Administrator:

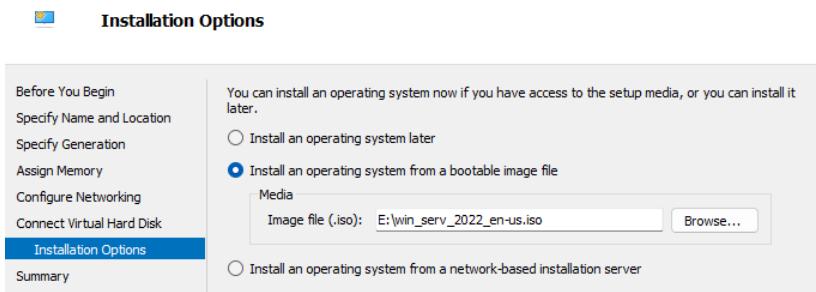
```

file Edit View Tools Debug Add-ons Help
Untitled1.ps1* Untitled2.ps1* 
1 $VHDPATH = "V:\VMs\VHDX\win10folder.vhdx"
2 Dismount-VHD -Path $VHDPATH
3 Add-VMHardDiskDrive -VMName 063-HV1 -Path $VHDPATH

```

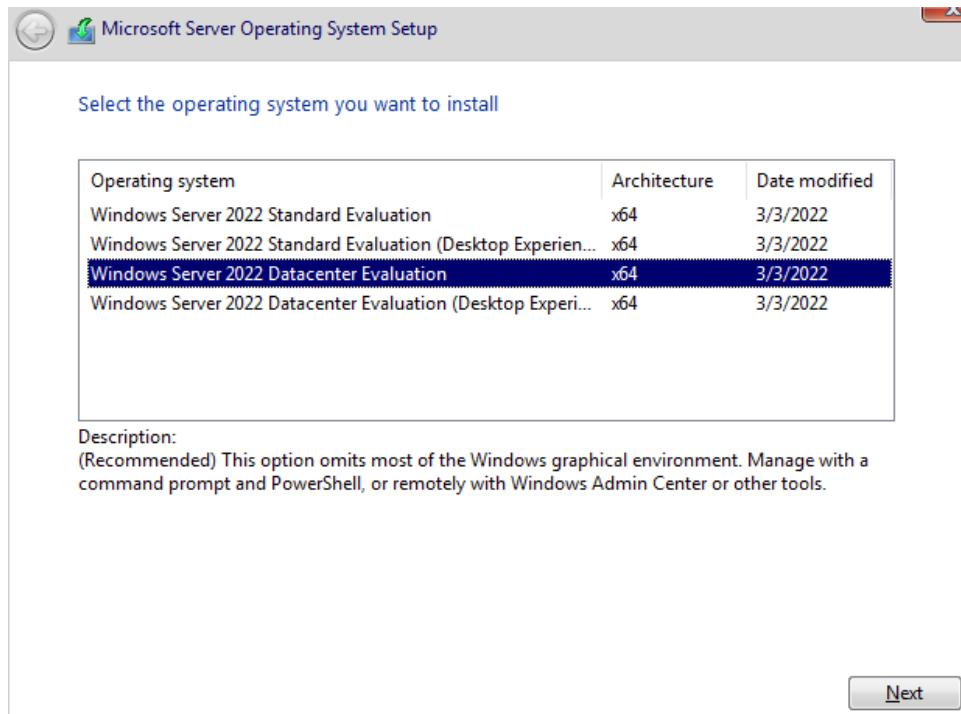
PS C:\Windows\system32> \$VHDName = Read-Host -Prompt 'Input VHD name'
\$sizeInGB = Read-Host -Prompt 'Input the size in GB. Ex 5, 10'
\$VHDPATH = "V:\VMs\VHDX\" + \$VHDName + ".vhdx"
\$sizeBytes = (\$sizeInGB/1 \* 1073741824)
\$alreadyExists = Test-Path -Path \$VHDPATH
New-VHD -Path \$VHDPATH -Dynamic -SizeBytes \$sizeBytes | Mount-VHD -Passthru | Initialize-Disk -Passthru | New-Partition -AssignDriveLetter -UseMaximumSize | Format-Volume -FileSystem NTFS
Input-VHDName: win10Folder
Input the size in GB. Ex 5, 10: 10
DriveLetter FriendlyName FileSystemType DriveType HealthStatus OperationalStatus SizeRemaining Size
----- ----- ----- -----
E NTFS Fixed Healthy OK 9.95 GB 9.98 GB

PS C:\Windows\system32> \$VHDPATH = "V:\VMs\VHDX\win10folder.vhdx"
Dismount-VHD -Path \$VHDPATH
Add-VMHardDiskDrive -VMName 063-HV1 -Path \$VHDPATH
PS C:\Windows\system32>



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- Install Windows:



- Rename the Machine to **063-DC2**

```
C:\> Administrator: C:\Windows\system32\cmd.exe
=====
Computer name
=====
Current computer name: WIN-4BEIOGHV3S8
Enter new computer name (Blank=Cancel): DC2
```

- Rename Network Adapter:

- **Rename-NetAdapter -Name "Ethernet" -NewName "pfSense LAN"**

- Configure Network Settings:

- Set Static IP:
  - **192.168.3.254**

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```
=====
          Network adapter settings
=====

NIC index:    1
Description:  Microsoft Hyper-V Network Adapter
IP address:   192.168.3.13,
              fe80::49ab:1cae:c530:c114
Subnet mask:  255.255.255.0
DHCP enabled: False

Default gateway:     192.168.3.254
Preferred DNS server: 192.168.3.2
Alternate DNS server:

  1) Set network adapter address
  2) Set DNS servers
  3) Clear DNS server settings

Enter selection (Blank=Cancel):
```

- Join the Domain and Promote to Domain Controller:
- Run the Script:
  - o PS C:\Users\Steven> Import-Module ADDSDeployment
  - o PS C:\Users\Steven> Install-ADDSDomainController `
  - o >> -NoGlobalCatalog:\$false `
  - o >> -CreateDnsDelegation:\$false `
  - o >> -DatabasePath "C:\NTDS" `
  - o >> -DomainName "corp.cap.ca" `
  - o >> -InstallDns:\$true `
  - o >> -LogPath "E:\NTDS" `
  - o >> -NoRebootOnCompletion:\$false `
  - o >> -SiteName "Default-First-Site-Name" `
  - o >> -SysvolPath "C:\SYSVOL" `
  - o >> -Force:\$true
  - o >>

```
Success Restart Needed Exit Code      Feature Result
----- ----- ----- -----
False   No           InvalidArgs   {}

PS C:\Users\Administrator> Install-WindowsFeature -Name AD-Domain-Services -IncludeManagementTools

Success Restart Needed Exit Code      Feature Result
----- ----- ----- -----
True    No           Success       {Active Directory Domain Services, Group P...
```

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```
PS C:\Users\Administrator> Install-ADSDomainController -NoGlobalCatalog:$false -CreateDnsDelegation:$false -Credential:(Get-Credential) -CriticalReplicationOnly:$false -DatabasePath "C:\NTDS" -DomainName "corp.cap.ca" -InstallDns:$true -LogPath "C:\NTDS" -NoRebootOnCompletion:$false -SiteName "Default-First-Site-Name" -SysvolPath "C:\SYSVOL" -Force:$true
```

cmdlet Get-Credential at command pipeline position 1  
Supply values for the following parameters:  
Credential  
SafeModeAdministratorPassword: \*\*\*\*\*

Active Directory Users and Computers

File Action View Help

Active Directory Users and Computers [063-D]      Name      Type      DC Type      Site

> Saved Queries

corp.cap.ca      063-DC1      Computer      GC      Default-First-Si...  
  > Builtin  
  > Clients  
  > Computers  
  > Domain Controllers      063-DC2      Computer      GC      Default-First-Si...

### Adding Firewall Block Rule:

- Log into **pfSense Dashboard** using a Web Browser
  - o Enter the IP of the LAN Default Gateway:
    - 192.168.3.254
- Navigate to **Firewall > Aliases**
- Alias names are used to refer to the collection of hosts, networks, ports, etc., that are grouped under this name within firewall rules or other settings
- We can specify the IP addresses or fully qualified domain names (FQDN) that belong to the alias. In the example shown, three IP addresses have been added to the alias: **192.168.3.5**, **192.168.3.6**, and **192.168.3.13**
- When this alias is used in firewall rules, any rule applied to the alias "**BlockRule**" would affect traffic from or to all three of the specified IP addresses

The screenshot shows the pfSense Firewall Aliases IP configuration page. The URL is 192.168.3.254/firewall\_aliases.php. The page has a navigation bar with links for System, Interfaces, Firewall, Services, VPN, Status, Diagnostics, and Help. Under Firewall, the sub-menu Aliases is selected. On the left, there are tabs for IP, Ports, URLs, and All. The IP tab is selected. Below the tabs is a table titled 'Firewall Aliases IP' with columns Name, Type, Values, and Description. A single entry named 'BlockRule' is listed with Type 'Host(s)' and Values '192.168.3.5, 192.168.3.6, 192.168.3.13'.

- Add a Rule:
  - o Name: **BlockRule**
- Enter the IPs of the Host Machines that will not get internet access but blocking all traffic

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[Firewall](#) / [Aliases](#) / [Edit](#)

[?](#)

Properties			
Name	BlockRule		
The name of the alias may only consist of the characters "a-z, A-Z, 0-9 and _".			
Description			
A description may be entered here for administrative reference (not parsed).			
Type	Host(s)		
Host(s)			
Hint	Enter as many hosts as desired. Hosts must be specified by their IP address or fully qualified domain name (FQDN). FQDN hostnames are periodically re-resolved and updated. If multiple IPs are returned by a DNS query, all are used. An IP range such as 192.168.1.1-192.168.1.10 or a small subnet such as 192.168.1.16/28 may also be entered and a list of individual IP addresses will be generated.		
IP or FQDN	192.168.3.5	HV1	<a href="#"></a>
	192.168.3.6	HV2	<a href="#"></a>
	192.168.3.13	DC2	<a href="#"></a>
<a href="#"></a> Save <a href="#"></a> Export to file <a href="#"></a> + Add Host			

- We want to prevent **(063-HV1/HV2/DC2)** from internet access
- Next, Navigate to **Firewall > Rules > LAN**

[Firewall](#) / [Rules](#) / [LAN](#)

[?](#)

Floating	WAN	LAN									
Rules (Drag to Change Order)											
	States	Protocol	Source	Port	Destination	Port	Gateway	Queue	Schedule	Description	Actions
<input checked="" type="checkbox"/>	2/411 kB	*	*	*	LAN Address	80	*	*		Anti-Lockout Rule	<a href="#"></a>
<input type="checkbox"/>	<a href="#"></a> 0/0.09 MiB	IPv4 *	BlockRule	*	*	*	*	none			<a href="#"></a> <a href="#"></a> <a href="#"></a>
<input type="checkbox"/>	<a href="#"></a> 35/1.00 GiB	IPv4 *	LAN subnets	*	*	*	*	none		Default allow LAN to any rule	<a href="#"></a> <a href="#"></a> <a href="#"></a> <a href="#"></a>
<input type="checkbox"/>	<a href="#"></a> 0/0 B	IPv6 *	LAN subnets	*	*	*	*	none		Default allow LAN IPv6 to any rule	<a href="#"></a> <a href="#"></a> <a href="#"></a> <a href="#"></a>
<a href="#"></a> Add <a href="#"></a> Add <a href="#"></a> Delete <a href="#"></a> Toggle <a href="#"></a> Copy <a href="#"></a> Save <a href="#"></a> Separator											

- Configure the following set of rules:
  - o Action: **Block**
  - o Interface: **LAN**
  - o Address Family: **IPv4**
  - o Source: **Address or Alias**
  - o Destination: **Any**

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The screenshot shows the 'Edit Firewall Rule' interface. The 'Action' dropdown is set to 'Block'. A red box highlights the 'Interface' dropdown set to 'LAN' and its descriptive text below. The 'Address Family' dropdown is set to 'IPv4' and the 'Protocol' dropdown is set to 'Any'. In the 'Source' section, the 'Source' dropdown is set to 'Address or Alias' and the 'BlockRule' dropdown is set to '/'. In the 'Destination' section, the 'Destination' dropdown is set to 'Any'.

- Save and Apply Changes

## Test BlockRule:

- Open PowerShell on 063-HV1
- Ping Google.ca:

A screenshot of a Windows PowerShell window titled '063-HV1 on STEVE-PC - Virtual Machine Connection'. The window shows the command 'ping google.ca' being run. The output indicates that all four ping attempts timed out, resulting in 100% loss.

```

Administrator: C:\Windows\system32\cmd.exe
PS C:\Users\steve> ping google.ca

Pinging google.ca [142.251.33.99] with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 142.251.33.99:
  Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PS C:\Users\steve>

```

## Assessment Checkbox:

- Professional Documentation
- NAT/Firewall Configuration
- Virtual Networking

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- Domain Creation
- Physical Hyper-V Host Configuration
- DHCP Configuration
- DNS Configuration
- Active Directory OU Structure
- SAN Configuration
- Configure Two Nested Hyper-V Servers
- Secondary DC Creation
- Failover File Servers
- File Share, NTFS Permissions
- Folder Redirection
- Hyper-V Failover
- Group Policies and Mapped Drives
- Reflective Writing

### Reflective Writing Portion:

#### My thoughts on the Project:

- I found the project to be very challenging, but it forced me to think back on concepts previously learned and understand how to execute at a much faster rate of speed. When I first began to plan and build the environment, I was logged into my local user account and immediately I found that it was less practical than joining my host machine to the domain.
- Oddly enough joining the domain did not solve all issues as opening Group Policy Management gave me a token error and to save time my only work around was creating a client machine to test and run Server Admin tools to access the properties needed to create group policy objects.
- Having a plan and mapping out how all the switches connect to all the networks helped make sense of how I was going to configure this infrastructure. Assigning IP's and defining each network was also very beneficial to my overall understanding. Many times, during various configuration attempts I was met with phantom problems. I was certain my procedure was sound, but the result wasn't there, however recreation of the VM or the process with a different user for example fixed the issue.
- One example was attempting to configure Folder Redirection. I had a user that had all the correct permissions but when I used his account to log into the test machine the folders that were designated to redirect (desktop and documents) wouldn't correctly show. After many tedious attempts at reviewing what I had done I decided to create a new user in the same OU instead. By creating this new User with a different name, the GPO worked as intended and all the permissions I had set before populated correctly and worked successfully.

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- Above all I feel like I gained confidence in my ability to tackle projects of this magnitude. Having to document each step required a lot of foresight and the ability to remember what had been done and how it would affect the next step and what role it would function within the infrastructure. I did notice that with each new addition there was an extra layer of complexity to it.
- Methodical logical thinking is required to execute each movement as efficiently as possible but that wasn't always the case as trial and error was present. I found it particularly interesting being able to configure the iSCSI target through a PowerShell command that created a GUI interface to connect to the target (iscsicpl). Initially the targets wouldn't connect so I had to restart the 'Win Target' with restart-service wintarget on the SAN so that the targets would be visible to the network and connect.
- When I went to create the File Servers, I had mistakenly installed them as stand-alone servers, so they had to be erased. This is an example of planning and analyzing the schematic and taking a closer look realizing that it would require two VMs with Hyper-V role installed from Active Directory enabling the file servers to be nested within the Hypervisor on a failover cluster disk.
- I enjoyed the networking configuration aspect and using /30 subnets to connect single link to link points and understanding the purpose of each network adapter and what its intended role would be between two nodes. Setting up the LAN Network and then blocking certain hosts from gaining access to the internet using firewall rules.
- I think when I reached the part of being able to make the file server nodes live migrate between Hypervisors, I felt the project was coming together positively. I had major difficulty with managing resources at times. It made the situation a little unnerving when trying to launch VM's and staying within a certain threshold of allocated RAM. I believe I hovered mostly around 98% of all resources consumed so I found that shutting down unnecessary VM's such as the Linux DHCP Server helped conserve resources and speeding up intensive tasks.
- I began with the intention of trying to complete all aspects of the project, when I came to a point where I was comfortable with a configuration I tried to checkpoint but also being mindful of the space I had left on the drive where all the .vhdx and .avhdx are stored as to not go over and cause a catastrophic failure which happened to me before creating a failover cluster so it gave me more experience building this type of infrastructure and what could happen with corrupted disks and running out of disk space.
- I had to balance my time, but I was driven to complete the project, I found that stress can sometimes impede my learning, but I found a way to push through that because I realized troubleshooting works better with a confident calm mind and taking a break from a problem if it seems stubborn in the moment.

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- Nonetheless I feel much more confident about pursuing a role in this field after managing to implement all the pieces to each network. I refused to rest until I achieved the desired result which was full optimization. When I encountered errors or the server manager would fail to refresh, I learned through various troubleshooting techniques how to bring up all the servers optimally online with no warnings. That was a personal goal of mine.
- It took daily diligence at trying to deal with each issue one at a time but once everything was set up I was very satisfied with the final product and having every VM online which took careful resource management and testing at every level to ensure connectivity had been established. I was not able to keep the secondary domain controller on while trying to live migrate as I believe that process is too resource intensive, but the live migration feature itself responded to each command.

### Resources:

- <https://www.tecmint.com/installation-and-configuration-of-pfsense-firewall-router/>
- Assignment 2 and 6.1 (Creating a Firewall Linux DHCP Server)
- <https://www.thegeeksearch.com/how-to-configure-dhcp-server-in-centos-rhel-7/>
- Assignment 3 – 3.3 (Folder Redirection, Failover Cluster, SAN and iSCSI Connections)
- ChatGPT Troubleshooting tool
- <https://learn.microsoft.com/en-us/virtualization/hyper-v-on-windows/user-guide/enable-nested-virtualization>
- <https://www.nakivo.com/blog/hyper-v-cluster-setup/>
- <https://learn.microsoft.com/en-us/windows-server/networking/dns/quickstart-install-configure-dns-server?tabs=powershell>
- <https://www.starwindsoftware.com/resource-library/vhd-set-feature-in-microsoft-windows-server-2016/>
- <https://www.backup.com/enterprise-backup/hyper-v-failover-cluster-manager.html>
- Assignment 10 -12 (File Share, Security Groups OU Placement, NTFS Permissions)
- <https://support.microsoft.com/en-us/topic/how-to-set-minimum-ntfs-permissions-and-user-rights-for-iis-5-x-or-iis-6-0-263194ff-bf28-9dc2-c3da-aee109d6cc73>
- [https://docs.ipswitch.com/WS\\_FTP\\_Server80/Installation/index.htm?27206.htm?toc.htm](https://docs.ipswitch.com/WS_FTP_Server80/Installation/index.htm?27206.htm?toc.htm)
- <https://learn.microsoft.com/en-us/powershell/module/failoverclusters/test-cluster?view=windowsserver2022-ps>

STEVEN G. FONSECA

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