

SETTING UP A MULT-VIRTUAL MACHINE LABORATORY ENVIRONMENT FOR MICROSOFT SQL SERVER ALWAYSON, AVAILABILITY GROUP FAILOVER CLUSTERS, USING ORACLE VIRTUALBOX

In 36 Easy Steps. Maybe more like a hundred though.

Abstract

Using Oracle VirtualBox to set up several Windows Server 2022 servers with three of them hosting SQL Server 2022 instances – to demonstrate AlwaysOn Availability Groups with Windows Failover Clustering

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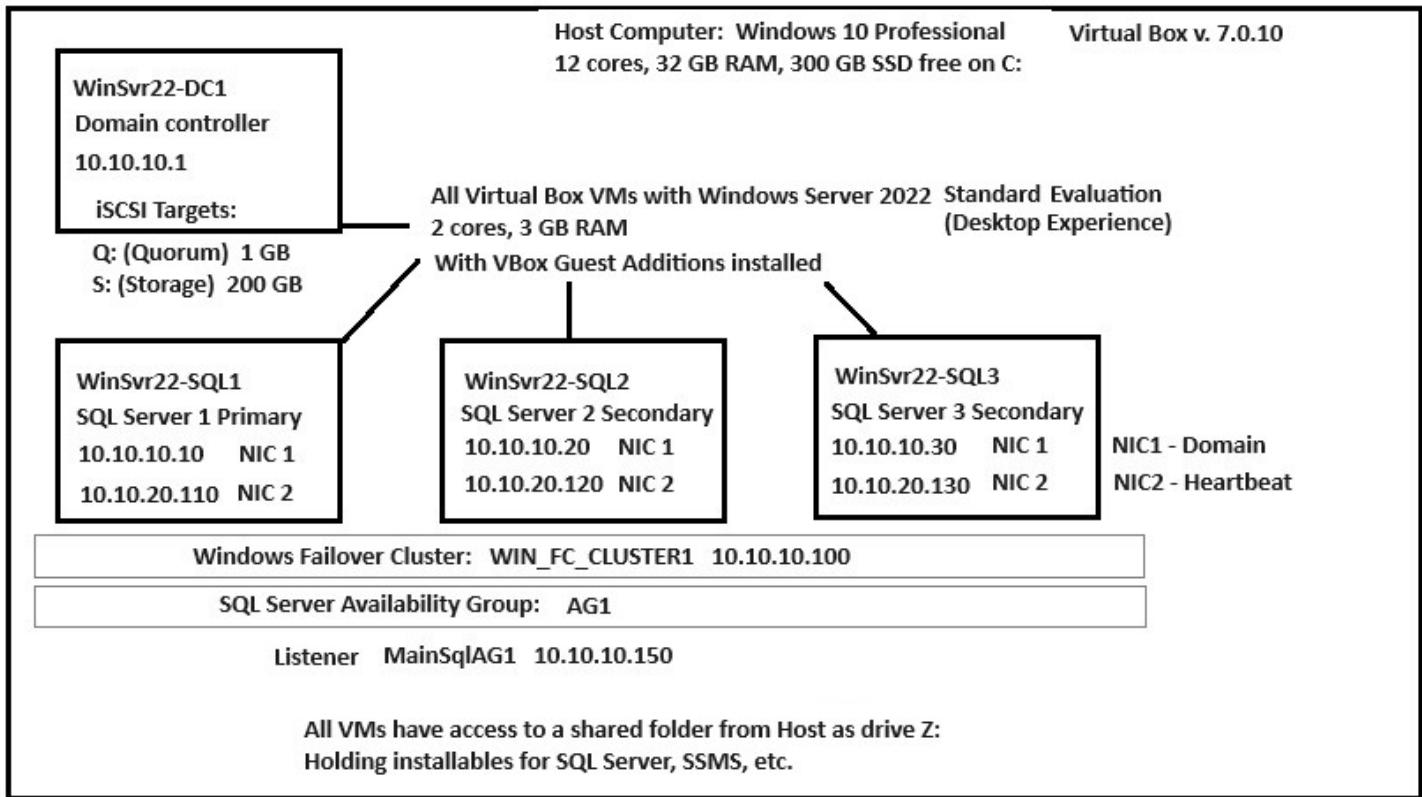
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Step 0) Verify your Host System:

Target Topology:



Your Desktop machine should have plenty of SSD space, memory, and cores.

My Host System Specs:

Windows 10 Professional

AMD Ryzen 5 1600 6 core

3200 mHz 12 logical processors

32 GB DDR4 RAM

SSD: 350 GB available C:

HDD: Two 1 TB drives >500 GB available on each as drives D: and E:

We're going to need to create at 4 virtual machines:

Each with Windows Server 2022.

- One set up as a Domain Controller
- Three with SQL Server 2022 Developer Edition (Not installing SSAS, or SSRS)

Desktop machine must have Virtualization turned on in the BIOS and Hyper-V (along with Hypervisor services) turned on in Windows 10.

Step 1) Install Oracle VirtualBox software.

The most current version of Oracle's VirtualBox (7.0.10 as of late August, 2023) is at:

<https://download.virtualbox.org/virtualbox/7.0.10>

You can just enter this into your browser:

<https://download.virtualbox.org/virtualbox/7.0.10/VirtualBox-7.0.10-158379-Win.exe>

and it should place this executable file in your Downloads folder:

`VirtualBox-7.0.10-158379-Win.exe`

So run it to install VirtualBox. It's very easy. All it needs to know is where to install it to.

You can find the User Manual for this version at:

<https://download.virtualbox.org/virtualbox/7.0.10/UserManual.pdf>

That pdf file is also included locally in the installation folder off Program Files

Also download and install the Virtual Box Extension Pack, of the same version.

Step 2) Set up a folders on the Host OS:

On the Host machine, create folder off of C:

`C:\VM Files`

Step 3) Get the files you need on the Host OS for:

Windows Server 2022 ISO image

SQL Server 2022 Installer

SQL Server Management Studio

Windows Server 2022 ISO image:

Windows_Server_2022_Datacenter_Eval_en-us_14393_refresh.ISO UPDATE THIS

You will have to get this from Microsoft, in their Evaluation area. You may need to supply your name, email and phone number - but when you do - it will let you download the 180 day trial:

This is: **6,808,810 kb (6.8 GB)** in size

SQL Server 2022 Installer is at:

<https://download.microsoft.com/download/5/A/7/5A7065A2-C81C-4A31-9972-8A31AC9388C1/SQLServer2017-SSEI-Dev.exe> UPDATE THIS

Filename is: **SQL2022-SSEI-Dev.exe** **5,811 kb**

SQL Server Management Studio download site:

<https://aka.ms/ssmsfullsetup>

Filename is: **SSMS-Setup-ENU.exe** **644,163 kb**

So now, on the Host OS, I placed these 3 files in this folder:

C:\VM Files

SOME NOTES BEFORE WE EVEN GET STARTED: WE MAY LOSE THE MOUSE !!!!

There is a well-known issue where after running a VM for a while (minutes / hours), either

- a) The left-click button of the mouse becomes unresponsive
- b) The mouse becomes unavailable altogether

After a bit of research – here's what I've found:

~~Disable Windows Hyper V. Although I use this machine for Android development and need it on for the Emulator to work, it causes screen freezes in Virtual Box. I think the docs say you have to a) Enable BIOS virtualization and b) Turn off Windows Hyper V. Hyper V is said to cause screen locking.~~

~~DONE: Before starting Vbox, run Hyper-V Stop Service~~

NO: You want Hyper-V but must also have the Hypervisor services running on the Windows machine.

In Vbox, Settings – Acceleration – Set ParaVirtualization to Hyper-V and ensure Hardware Virtualization box for Enable Nested Paging is checked.

~~Set the video to VBoxVGA NOT: VBoxSVGA This may cause random locking!~~

~~The video may be fuzzier, but reports are that this stops the random freezing.~~

~~Do this before installing Vbox Guest Additions. Also, uncheck the 3-D Acceleration.~~

~~Also: You might want to give the video 256 MB of memory instead of the default 128 MB~~

~~DONE: But only allows 128 MB RAM~~

Actually, this is not recommended. Vbox will complain about your using VBoxVGA as an invalid configuration.

And it doesn't seem to make a difference for me. Have not used 3-D Acceleration yet.

Set the Memory to 3097 (if you have a lot of memory) Resource constraints can cause locking

Set the VMs to use 2 cores. Resource constraints cause locking (this will limit # of VMs though)

DONE. I don't mind doing this – but I've never seen the memory go even close to 2 GB. The additional core seems to make things go faster though. Not sure if two cores is actually making the machine more stable.

Do not Check for Windows Updates! These take forever (like 2 hours), and increases your file size immensely. Best not to have your VM even connected to the Internet (except during SQL Server installation).

SQL1 and SQL2 had done updates – VHD is 17 GB. Not sure how complete the Update was.

If the VM shows as "Paused" – You need to go to the management UI and continue the VM manually.

Another possible reason for Pause, is that **Vbox does not grab its allocated memory until it needs it.** We can tell it to "get" its memory at startup by:

Find the .vbox file of your virtual machine. It contains all configuration parameters and is formatted as XML. Edit this file using a text editor. Find the element <ExtraData> and add a new element <ExtraDataItem> with following content: <ExtraDataItem name="VBoxInternal/RamPreAlloc" value="1"/> ← I haven't tried this yet.

Other potential fixes to Freezing that someone mentioned:

1) **Clean up the firewall access** in Win 10. Too much being allowed, unnecessarily (meaning programs allowed through firewall). NO – I'm actually turning off Windows Firewall for Domain, Public, and Private access...

2) Go into BIOS and ~~disable USB legacy Emulation~~. ~~USB legacy emulation is only necessary for systems old enough to not recognize USB.~~

NOT SO SURE ABOUT THAT ONE.

Keep System "Pointing Device" to USB Tablet. But Disable Shared Clipboard and Drag N Drop??

If it's just the mouse that stops responding to clicks – right click the mouse!

Sept 11, 2023: Screen Freezing seems to have gone away? TESTING

If you lose the Menu bar at the top – press the Right CONTROL key + C to go to a stretched mode?

'<https://www.youtube.com/watch?v=CPEiy4S3nt0>

(This guy says it fixes it, but I don't want stretched mode, and it doesn't even seem to fix it...)

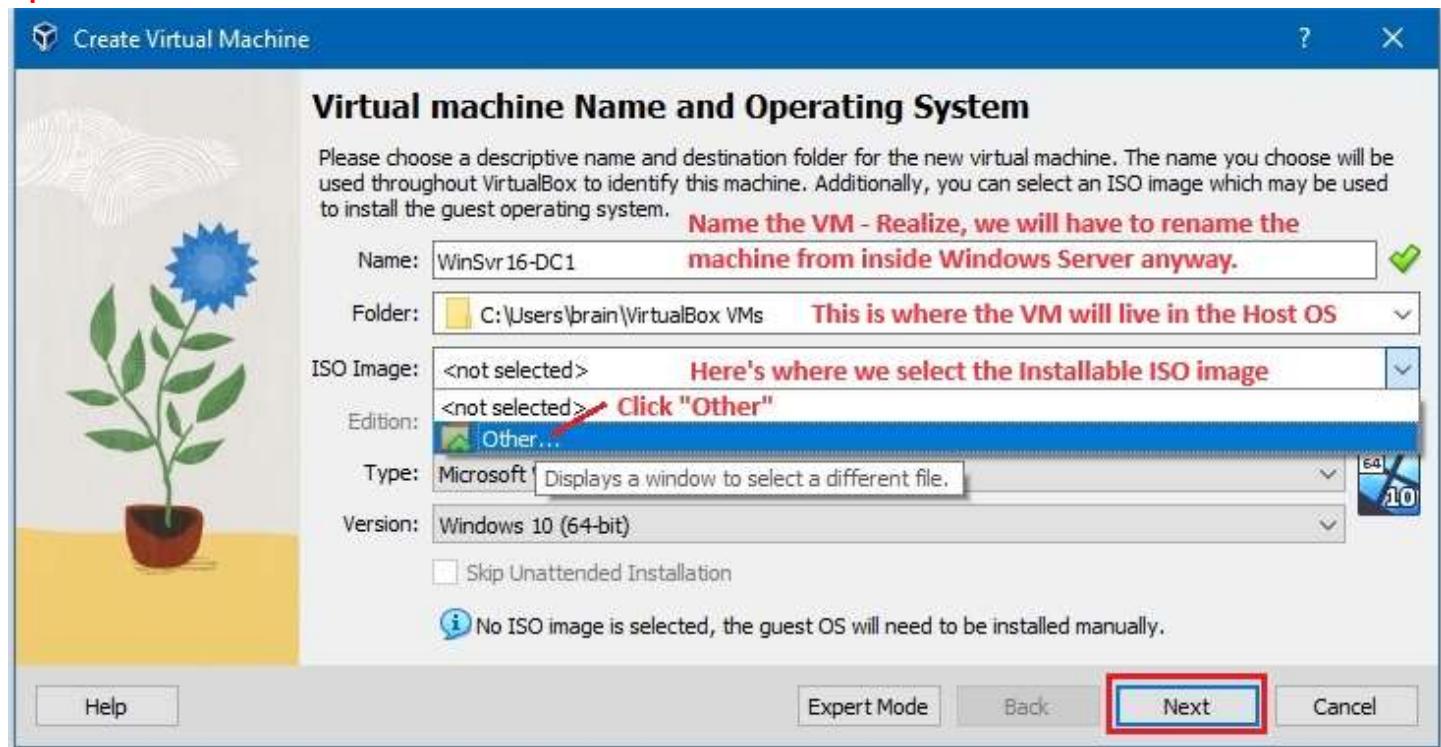
When installing SQL Server Failover Cluster, or adding SQL Nodes to a Cluster – we will HAVE to uninstall the Virtual Box Guest Additions program. There will be a point where we are prompted to provide a SQL Server Network Name, and if Vbox Guest Additions is installed at that point – the install will fail with a specific message that the network name is invalid. **I think we can re-install Vbox Guest Additions after the SQL Server install completes.**

Update on "Losing the Mouse" It's not that we lose the mouse, it's that the Virtual Machine goes into a mode that doesn't allow the "Mouse Integration". The mode we want is where when the mouse goes over and into the Virtual Machine – the mouse is seen as "in" the windows server machine. When the mouse leaves the window – it goes back to talking to the host. Hover back into the machine – and the mouse is now playing with the guest OS. This is called "mouse integration" – and as we go back and forth, and from machine to machine – sometimes it goes out of that mode. TO GET BACK mouse integration – hover on the menu item for "Input" – and the second item in the dropdown, below the option where we issue the keyboard commands (like for CTRL-ALT-DEL) – is the Mouse Integration toggle. In most cases where the mouse stops working with the guest OS, clicking this toggle to turn on Mouse Integration will work, making it so the mouse "left click" button works as normal again. Another option is to use the RIGHT CTRL button (aka the "host" button) and press C. This toggles the Scaled Mode, and pressing RIGHT CTRL-C again – brings us back – and the Mouse Integration toggle will probably work again.

Step 4) Create the first Windows Server 2022 Virtual Machine

In VirtualBox, click Add a new Virtual Machine:

Update this



We have to tell it where to find the ISO file for the operating system we want: Windows Server 2022:

Find it in: C:\VM Files

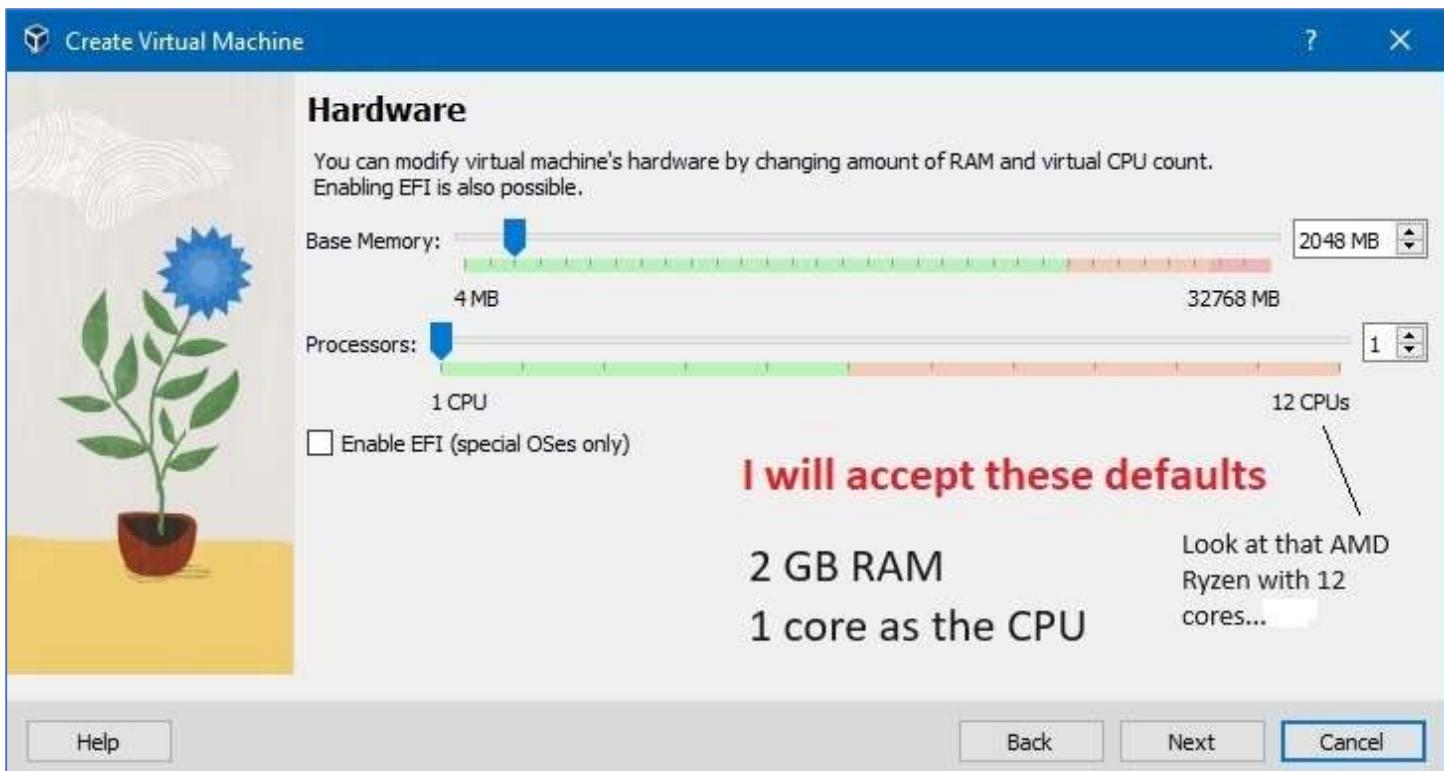
Check the box for:

Ignore Unattended Install.

If you do an unattended install, you will not get the chance to accept the Microsoft License Terms of Service (EULA). Even though the templates for VirtualBox unattended installs have that checked to "true" - The install will ignore those. If you do an unattended install, you'll get to a point where the virtual Windows Server begins a Setup - and will warn you that it can't find the terms of service. The only option will be to click "OK" - and it will re-start, complaining about the same thing. Unattended install is documented starting at page 57 of the VirtualBox user manual.

For this demo - we're not going to use that Unattended install.

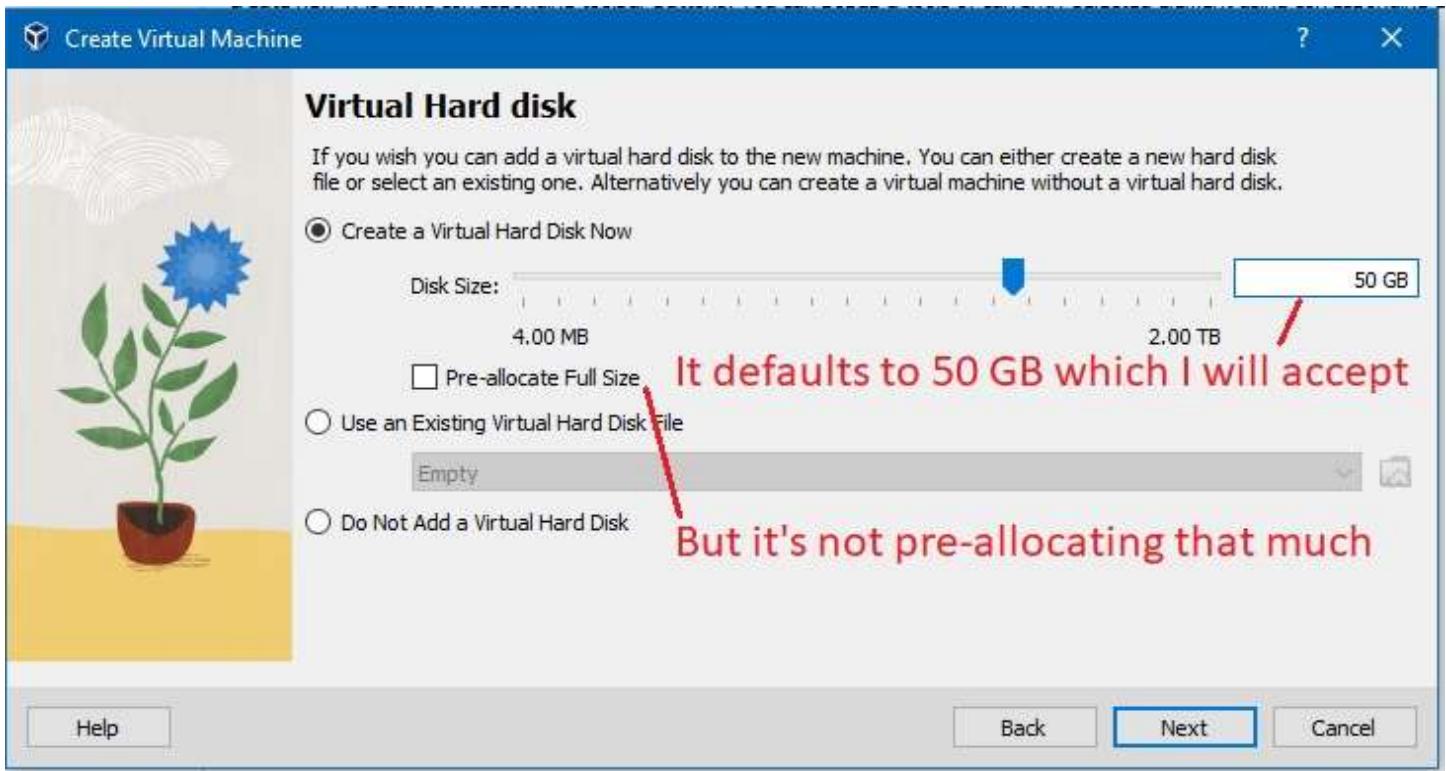
Specify how much memory and cores you want allocated to this Virtual Machine:



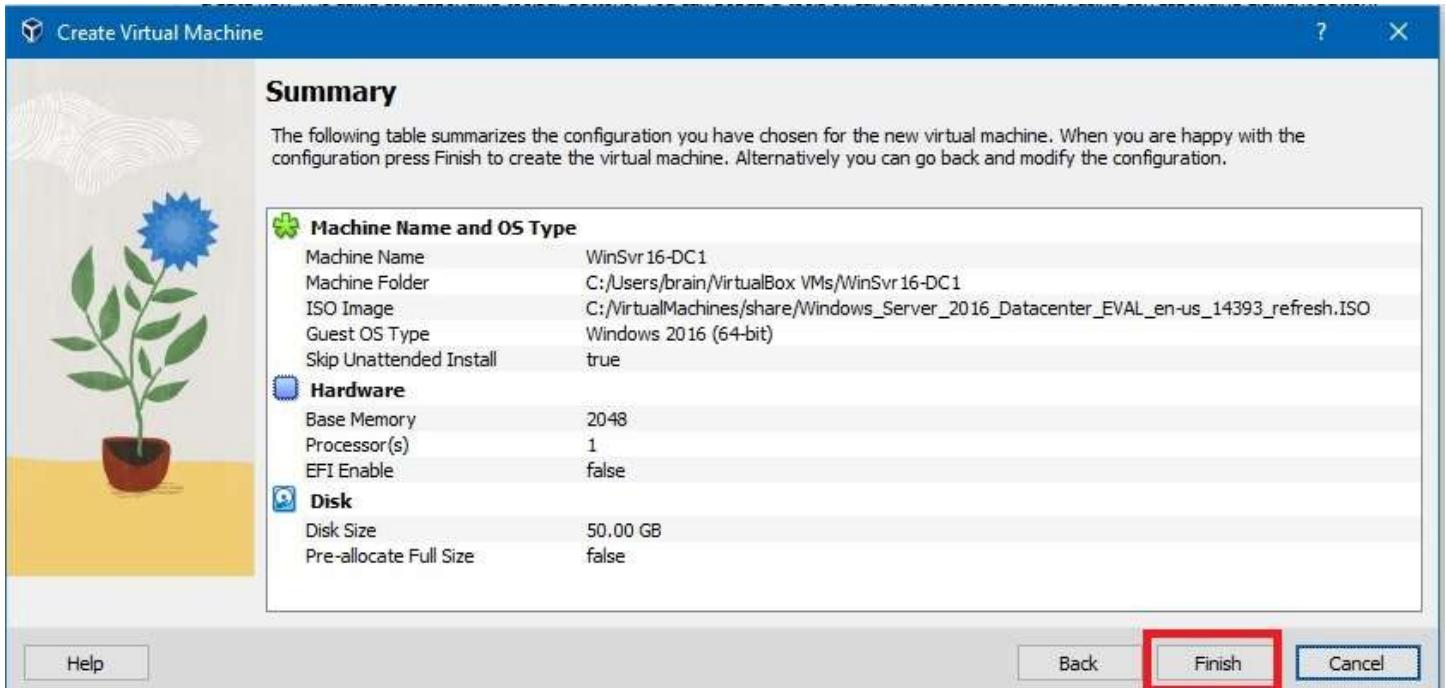
Recently, I have been giving them 3GB = 3097 MB. They never approach that utilization, so 2GB is probably fine.

I've been giving them 2 processors, to see if this prevents the Mouse Locking problem. It doesn't seem to be related to this.

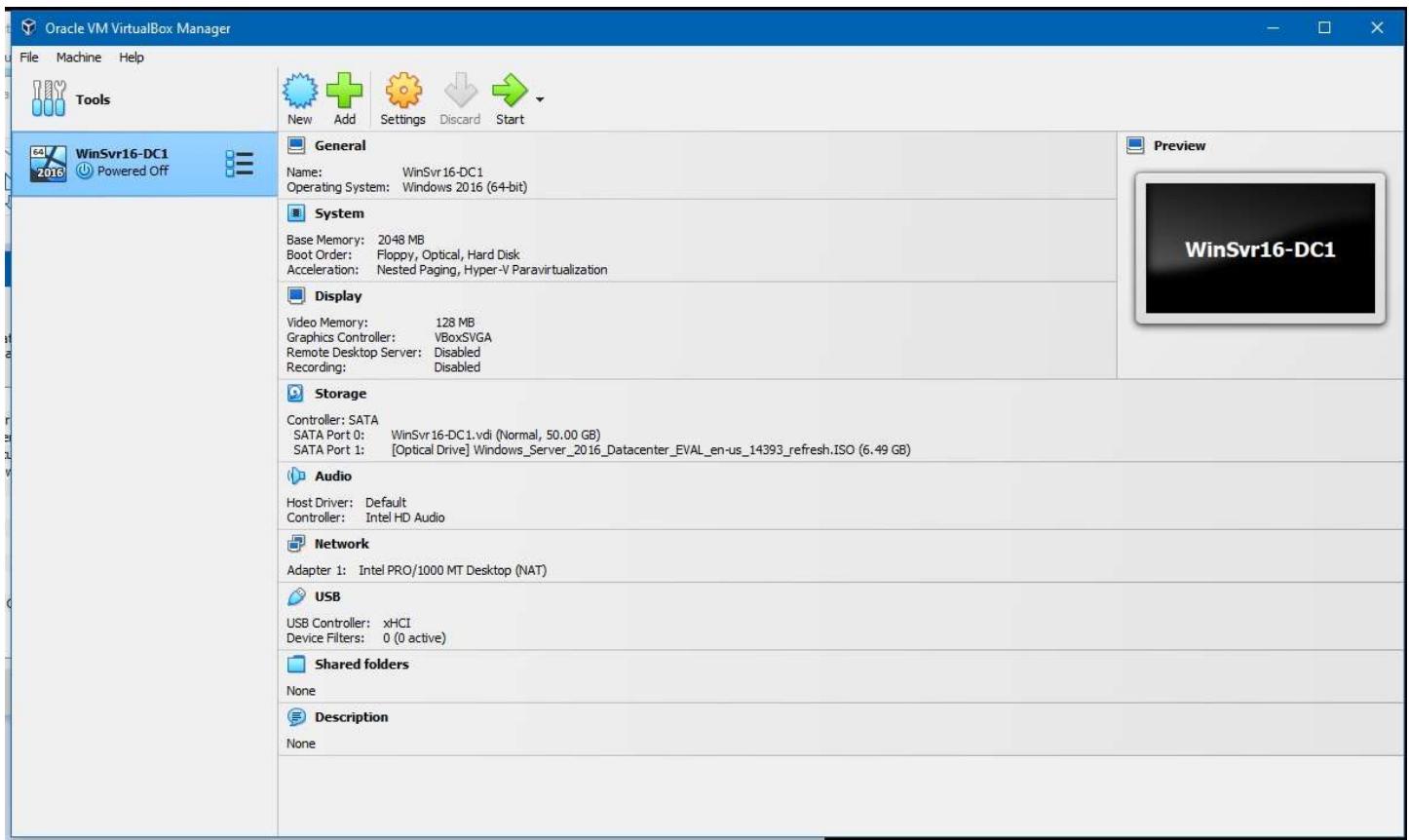
And how much drive space it will allocate. I'm not going to pre-allocate this though.



Summary



Click on Settings to see how the VM looks:

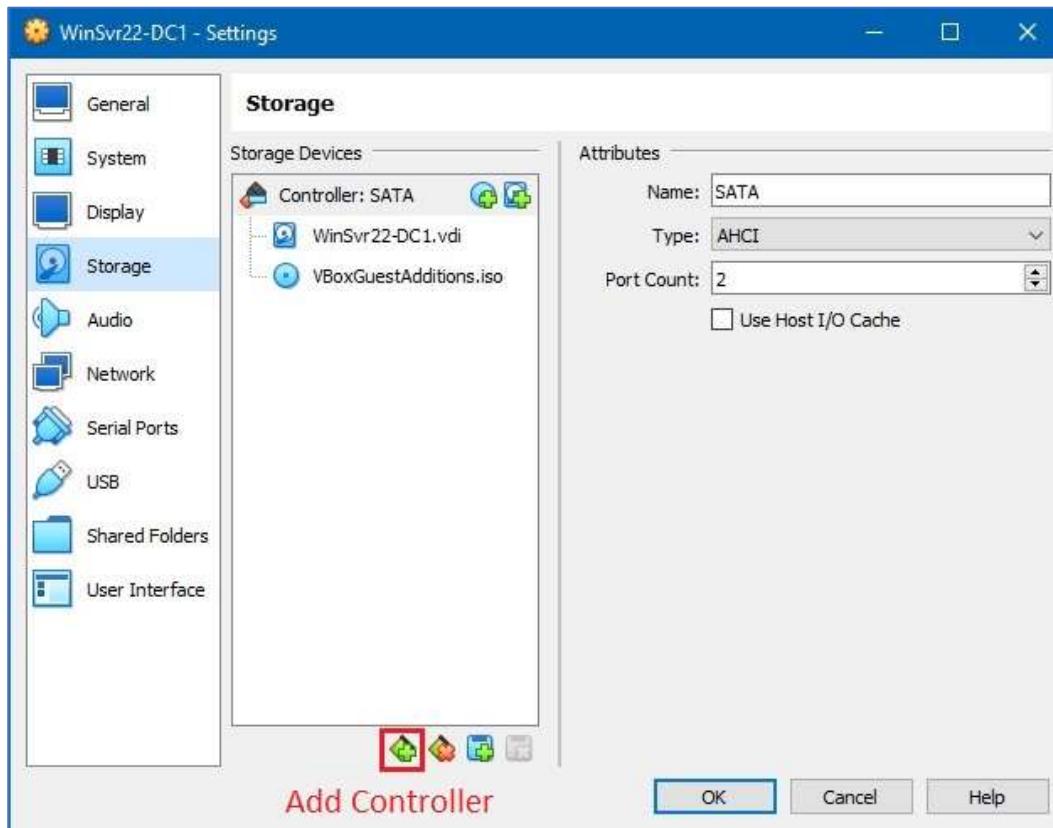


Step 5) Create some shared storage.

We are going to create two drives that later are going to be mounted as iSCSI targets, and be visible to the computers we will later create on the domain. They will be machines running instances of SQL Server in a failover cluster, so their data files need to be on shared storage. In a corporate environment, this might be SAN or NAS. We will be using the iSCSI tools to emulate that in this laboratory environment.

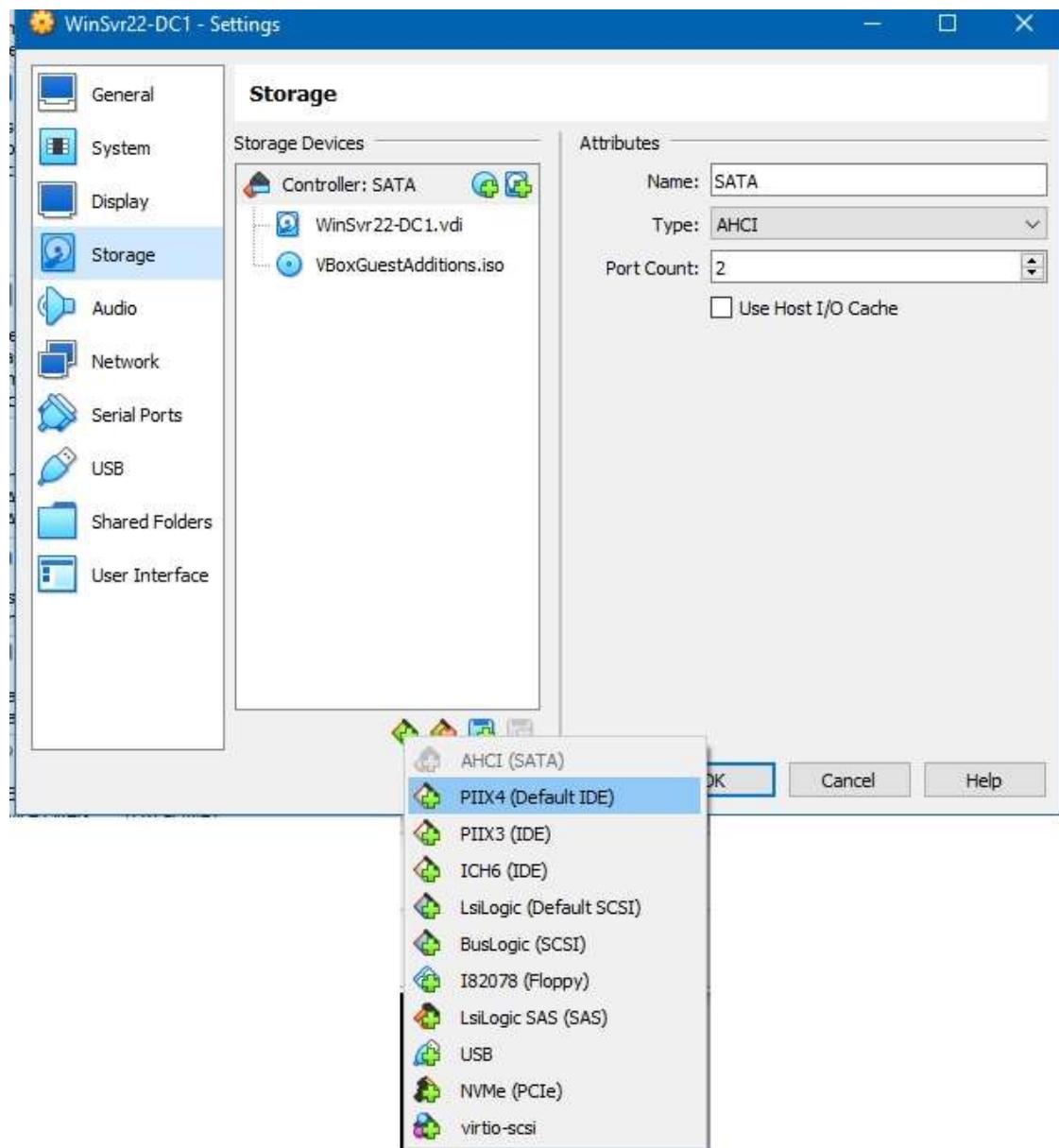
We will create these virtual hard drives off of a new IDE controller we will create first.

Click the "Add Controller" at the bottom of the Storage – Settings screen:

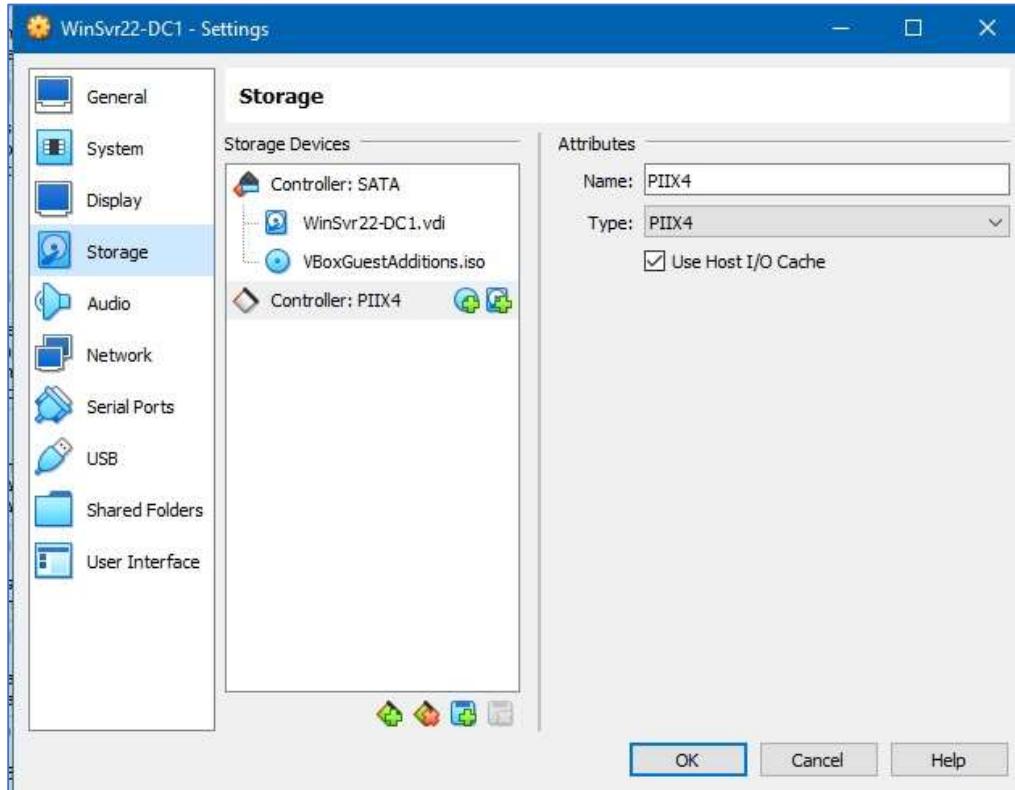


I read somewhere that some people think the IDE controller is better than SATA for iSCSI devices. Not sure about that – but I'm choosing IDE for the "SAN" drives we'll create

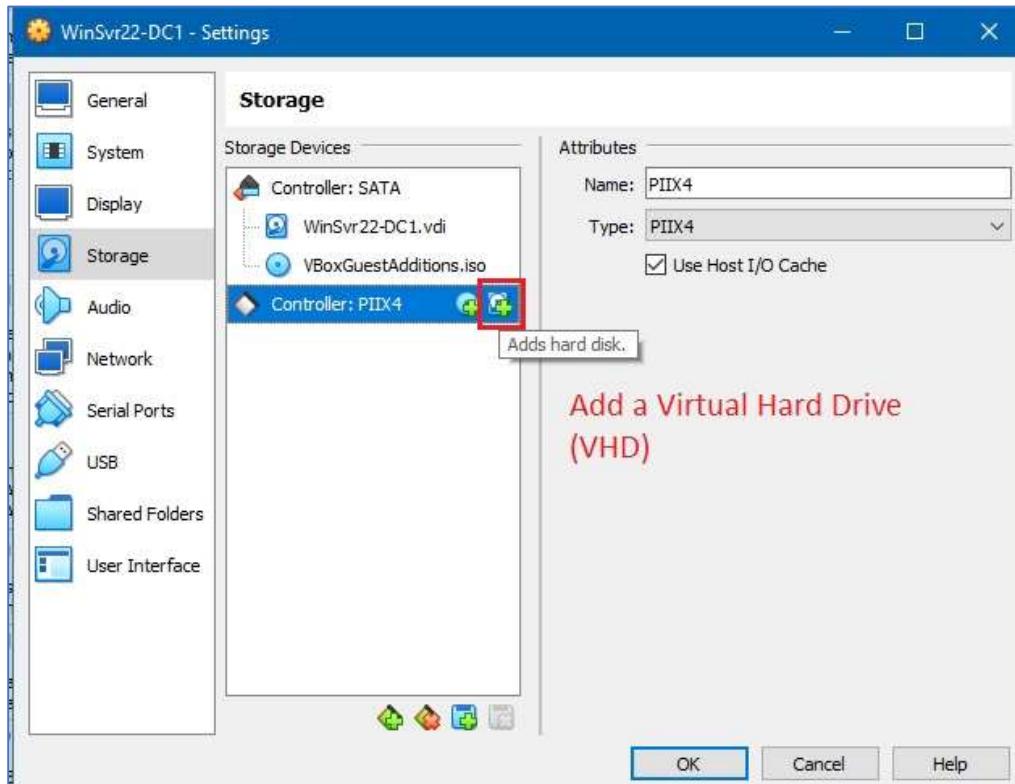
Choose the first one listed: PIIX4 (Default IDE)



Now we have an IDE controller



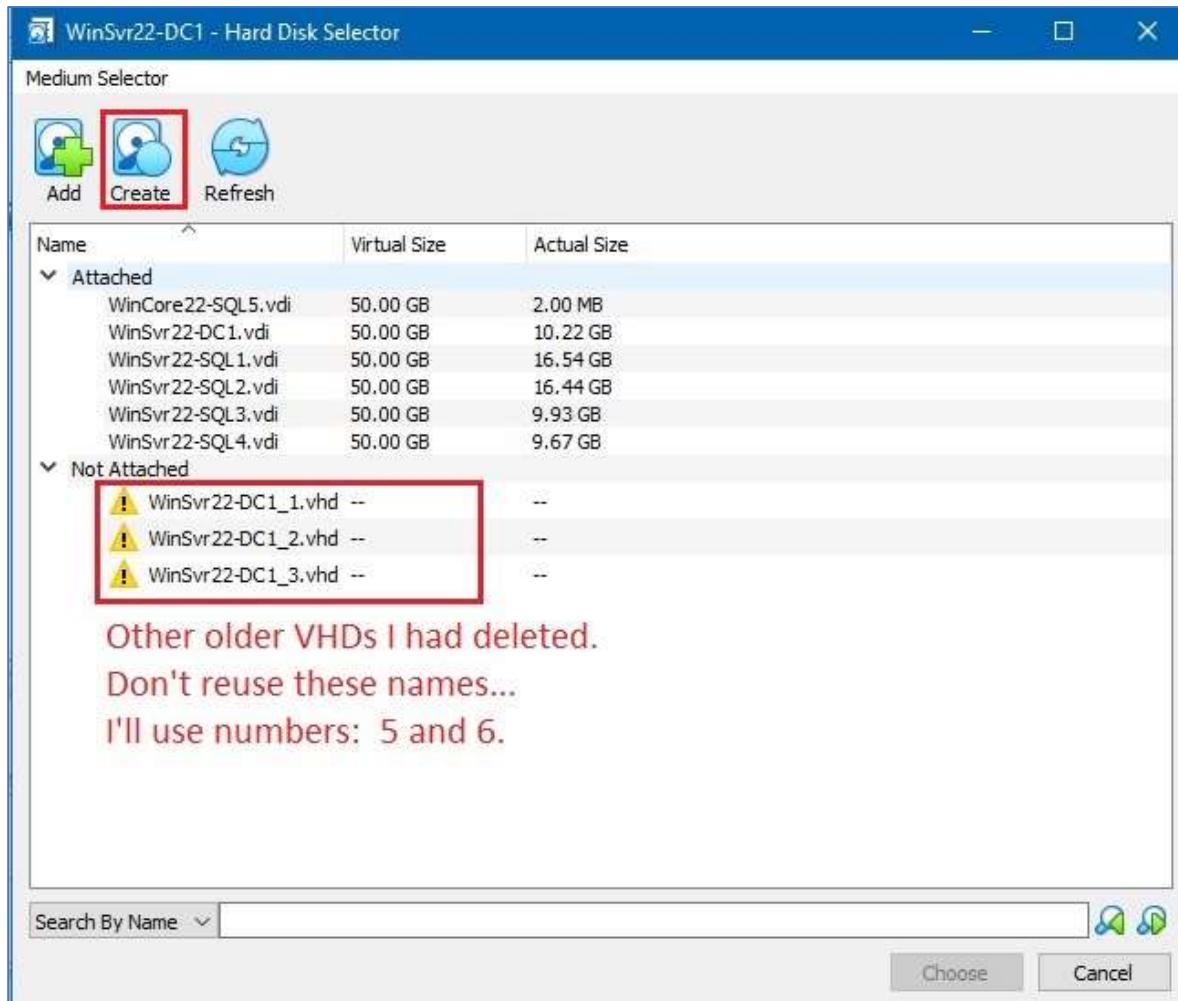
Add a Virtual Hard Drive



It will show the existing Virtual Hard Drives of this, and any other VMS you have already.

If this machine, WinSrv22-DC1 is the first machine you have set up, then you will only see the 50 GB one allocated for the base machine, in the Attached section.

I had removed some files – but Virtual Box still remembers them. I will not choose those VHD names again, even though it will suggest those names to me. Choosing those names will cause an error, since I physically removed them earlier. Just give the file a name it hasn't seen before.



Click "Create" at the top

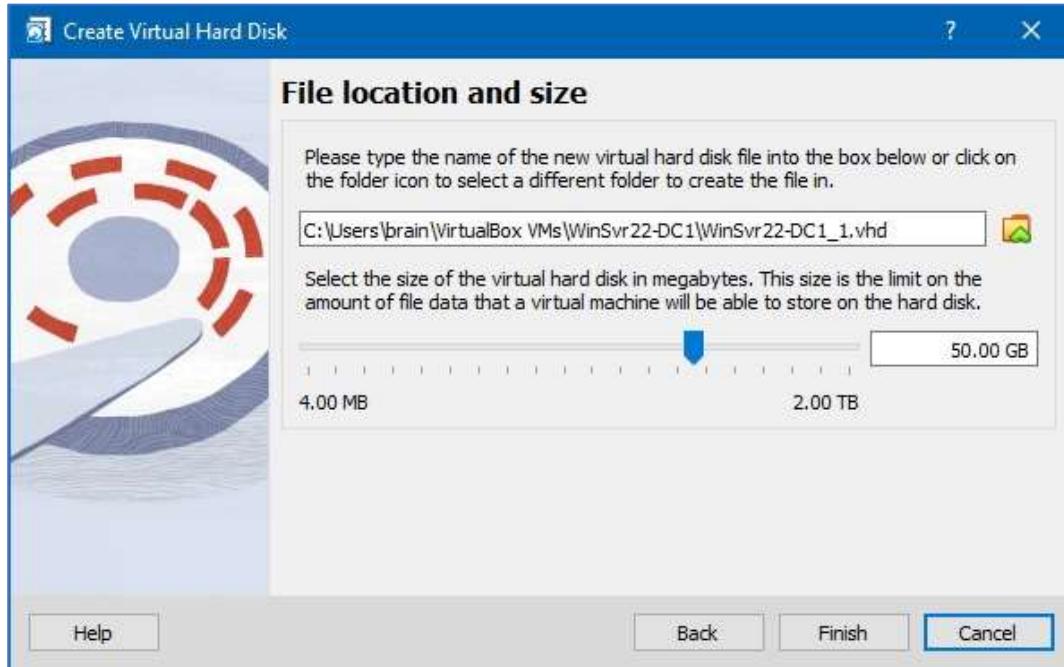


Choose VHD



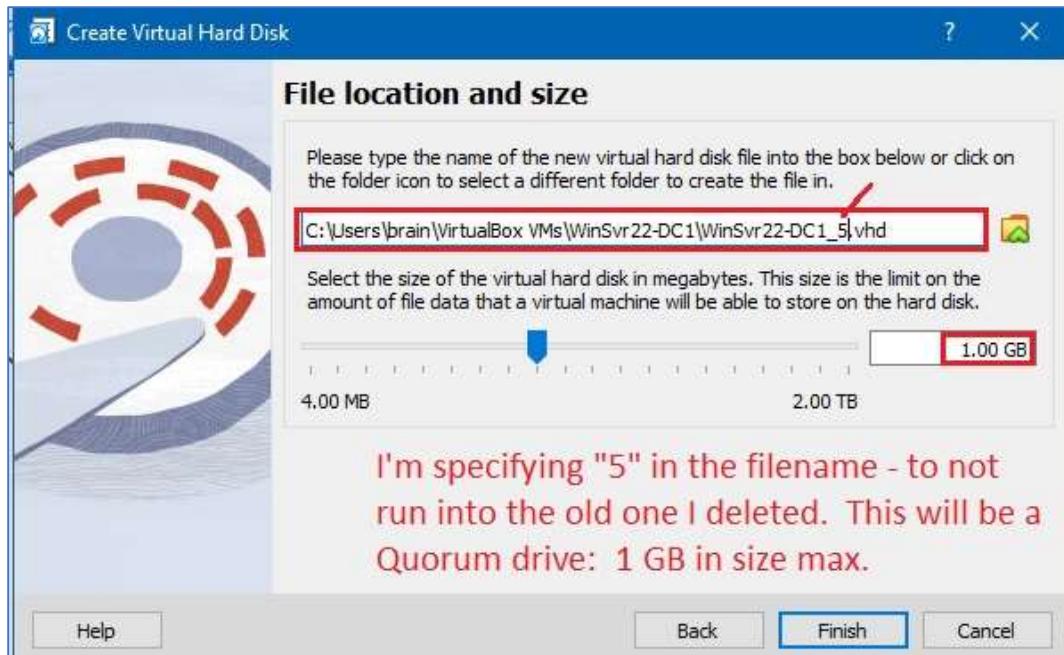
This is where it will suggest the location and filename for the VHD.

It allows needs to know the size to allow.



This is where I'm overriding the suggested filename, since I want it to be a filename Virtual Box hasn't seen before.

This is going to be our Quorum drive on the cluster, and can be small. Give it 1 GB.



And now we see the Virtual Hard Drive file, as "not attached"

Name	Virtual Size	Actual Size
WinCore22-SQL5.vdi	50.00 GB	2.00 MB
WinSvr22-DC1.vdi	50.00 GB	10.22 GB
WinSvr22-SQL1.vdi	50.00 GB	16.54 GB
WinSvr22-SQL2.vdi	50.00 GB	16.44 GB
WinSvr22-SQL3.vdi	50.00 GB	9.93 GB
WinSvr22-SQL4.vdi	50.00 GB	9.67 GB
WinSvr22-DC1_1.vhd	--	--
WinSvr22-DC1_2.vhd	--	--
WinSvr22-DC1_3.vhd	--	--
WinSvr22-DC1_5.vhd	1.00 GB	4.00 KB

Create a second VHD, this one will be for our Storage drive

I'm allowing it to have up to 200 GB of my C: drive. This will be dynamically allocated, so it won't take that space yet, and only if we use it. This is going to be for our SQL Server databases.

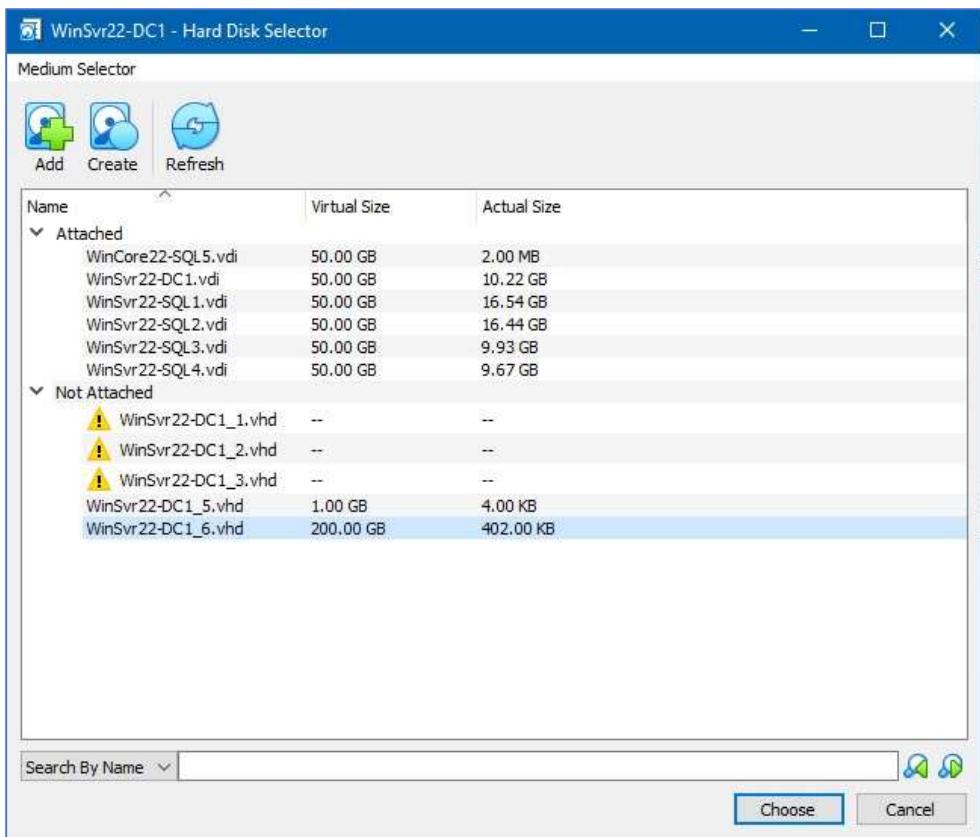
Please type the name of the new virtual hard disk file into the box below or click on the folder icon to select a different folder to create the file in.

C:\Users\brain\VirtualBox VMs\WinSvr22-DC1\WinSvr22-DC1_6.vhd

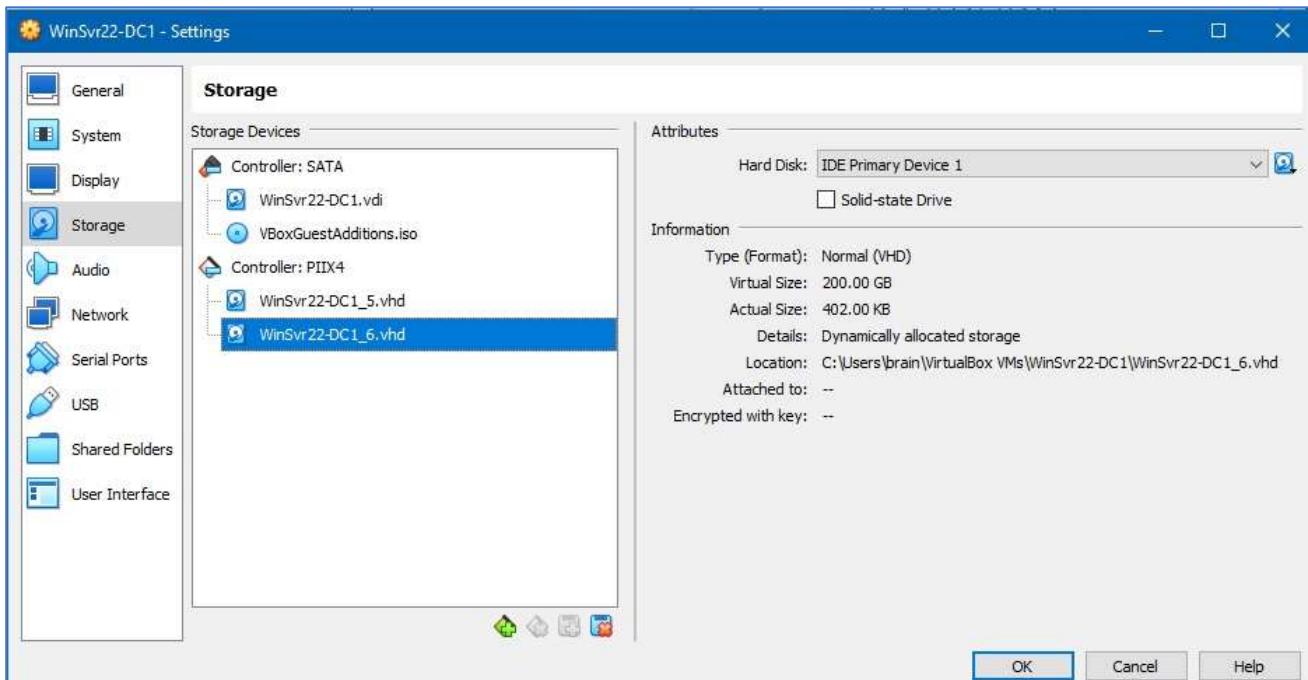
Select the size of the virtual hard disk in megabytes. This size is the limit on the amount of file data that a virtual machine will be able to store on the hard disk.

200.00 GB

4.00 MB 2.00 TB



Hilight each of those new drives at the bottom and click the "Chose" button. This will associate them with the controller on this virtual machine.



Now they are part of this machine.

Step 6) Start the Virtual Machine for the first time

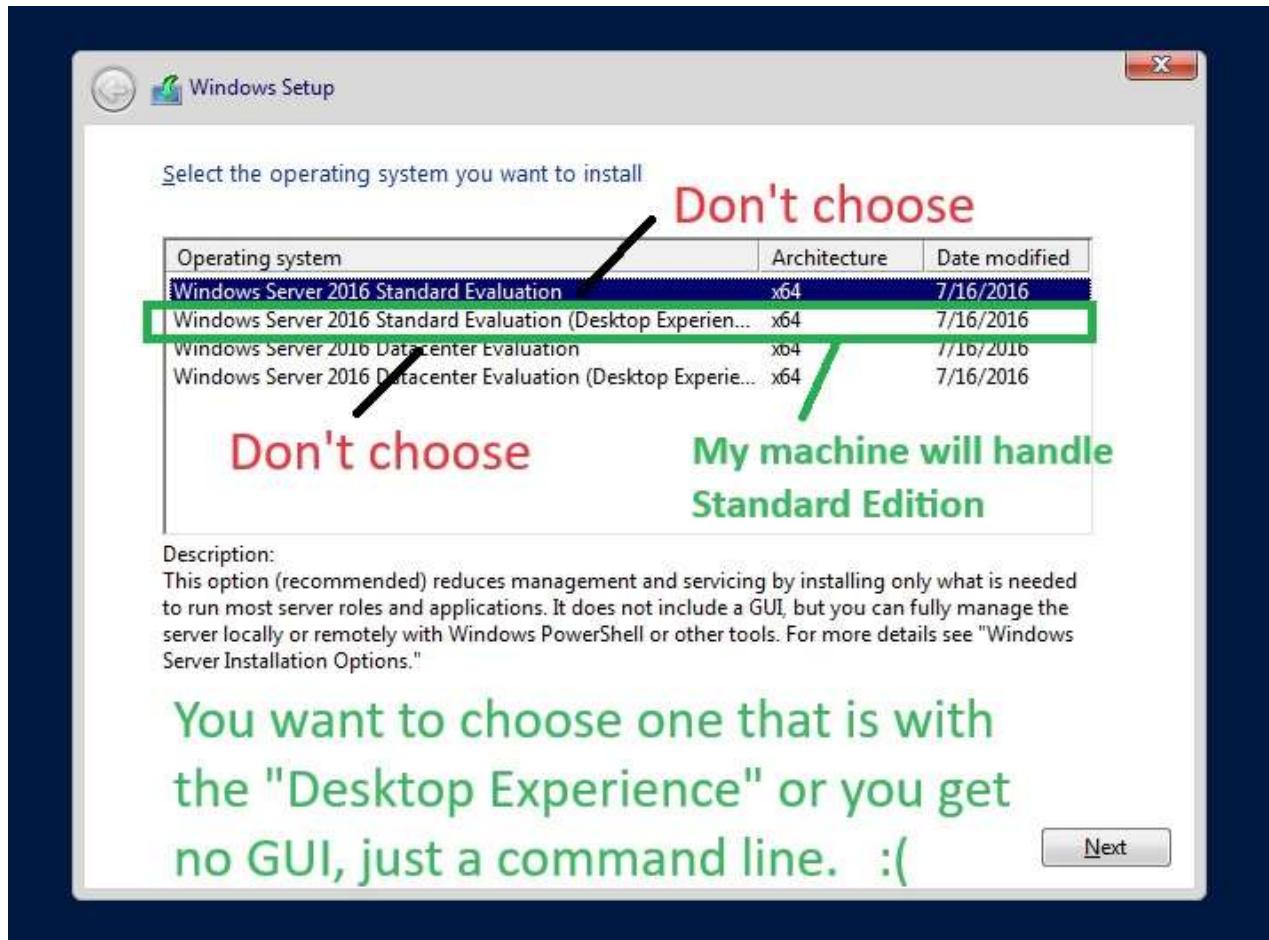
It will now go into the Installation of Windows Server 2022.

First it confirms your language and timezone Update this to be the 2022 image...



Select the version of this operating system you want to install

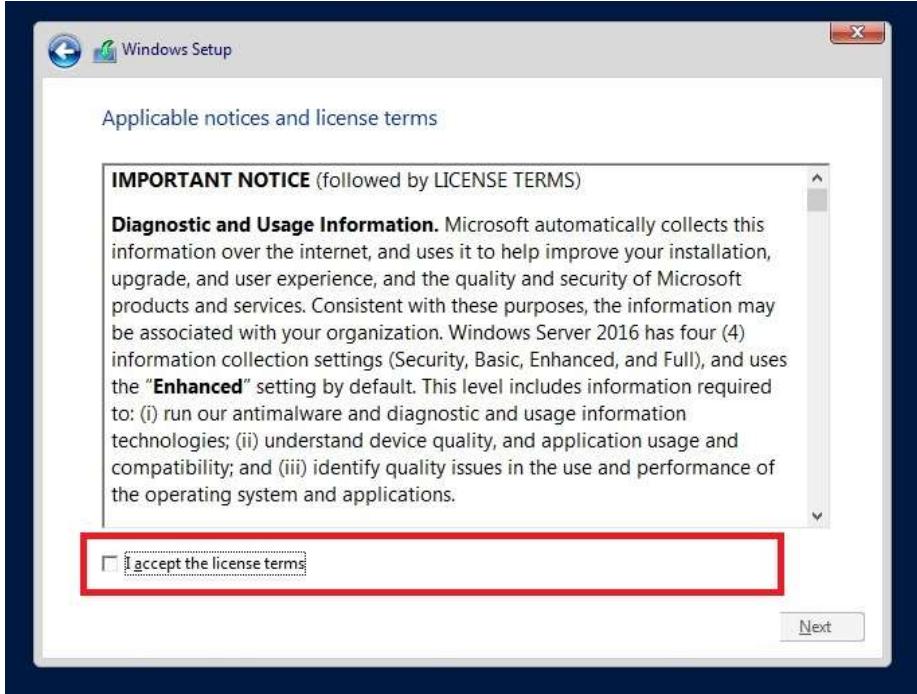
UPDATE THIS



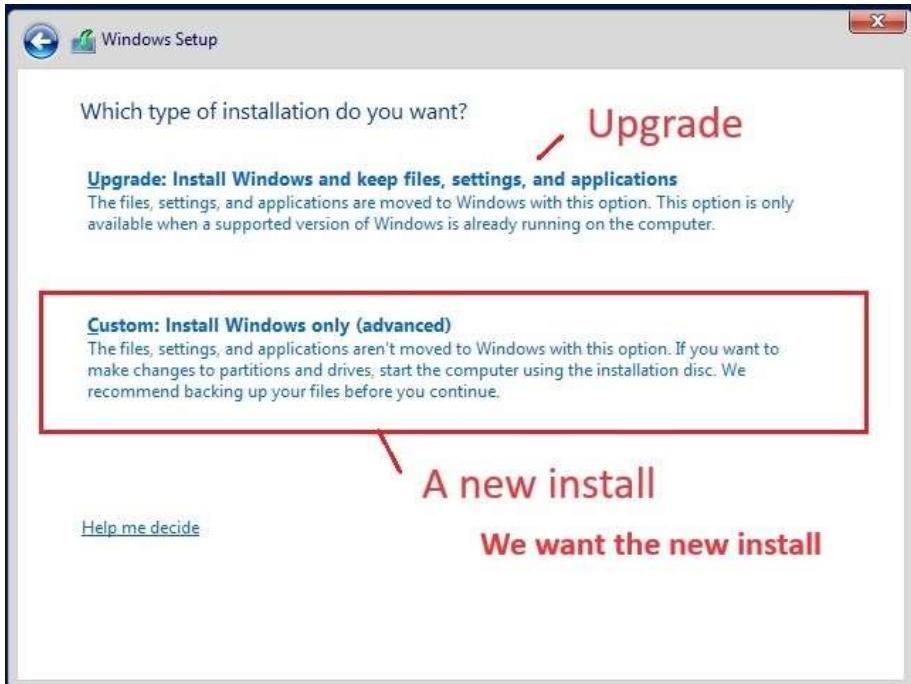
We will choose **Windows Server 2022 Standard Edition (Desktop Experience)**

If you do not choose the "Desktop Experience", you get a Core installation (aka headless), where you don't have a Windows GUI, but administer the machine from a command line. While this may be how most administrators are managing hundreds of machines at a time, it requires in-depth knowledge of the command line statements.

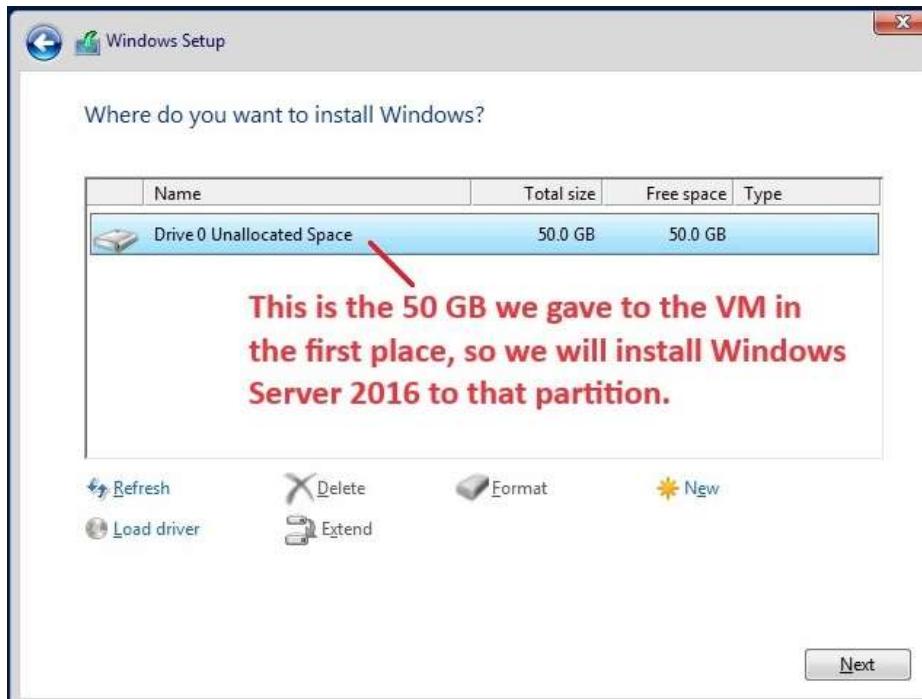
Accept the Licensing Terms.



Upgrade or Custom Install only.



Choose the second one. Full install on new machine.



It will now continue with the installation of Windows Server:

Copying Windows

Getting files ready for installation

Installing features

Installing updates

Finishing up



Windows will re-start automatically

When it re-starts Windows, you will get a "DOS" style window that prompts:

Press any key to start from CD or DVD ← Don't do that.

The reason it's asking is because in the "CDROM" of the Virtual Machine – is still mounted with the Windows Server installation ISO. If we hit a key in those 3 seconds that it waits – it will give us the choice to either re-install or repair Windows. We don't want to do that. Up until a few moments ago, we needed that ISO file on the CDROM. But no longer. better to un-mount the ISO file from that SATA drive in Virtual Box after it re-boots.

Things to do on all machines

Turn off Firewall: Server Manager – Firewall - turn off for Local, Domain, and Public

Allow network discovery: Control Panel – Networking – Advanced Options – Allow network discovery on all 3 of Local, Domain and Public.

Power and Sleep (or Screen Lock Timeout settings) from 10 min (default) to Never.

Step 7) Install VBoxGuestAdditions.iso

You want this. This makes it so you can set up a folder on the Host machine, and have it visible to the Guest operating system. It also supplies various drivers you may need, and fixes some annoyances with the VMs "capturing" your mouse. Install Vbox Guest Additions on each machine

It comes as an ISO file with the installation of VirtualBox.

In Virtual Box on this Virtual Machine: WinSrv22-DC1, go to Details - Storage.

It will show that the "CD/DVD" (of which we only get one), is currently set to the Windows Server 2022 ISO image. Remove the current mapping, and change it to this file:

C:\Program Files\Oracle\VirtualBox\VBoxGuestAdditions.iso

Then, after the "CDROM" is re-mounted to this ISO file, go back into the Virtual Machine and open the File Manger. It should now show D: as

CD Drive (D:) VirtualBox Guest Additions

Open this, and in the main folder, find the file inside it that is VBox Guest Additions Windows as an Application.

(It won't show it as a .exe unless you change the Windows Explorer setting to show the extensions of known file types - but that's not necessary at this point. You can run this from that mounted ISO.

It will do the install of the utility.

It will ask where to install the program. Accept its default.

At the end of the run, it may say that its changing your display settings to be "scaled" (or something like that). This will change your user experience with respect to the Virtual Machine

It has now mapped those two shared folders for us, but it seems to have ignored our drive mappings, and made them:

Z: is \VM Files

You may want to re-map the Storage for SATA1, the CD ROM back to the ISO image for Windows Server – or just remove it completely. We won't need anything from ISO's after this.

Realize though that if that Windows Server 2022.ISO is the CD ROM - Every time Windows boots, you will have a small prompt for a few seconds that says "Press Any Key to boot from CD-ROM" - which is not a great annoyance, but could be helpful if you wanted to re-install or repair the OS.

Re-Start the Virtual Machine: WinSvr22-DC1.

Step 8) Configure the Network Adapters in the Virtual Machine

Back in Virtual Box, we had one Network Adapter available on this machine, as type: "Internal Network"

We still may need to make some changes inside Windows Server on that.

Control Panel – Network Settings – Right click the primary Ethernet Adapter
Right Click Ethernet TCP/IP v4 in the list – go to Properties:

Network Connection: Ethernet V6 (TCP/IP) – Un-Check this if you want. We don't need it

Network Connection: Ethernet V4 (TCP/IP) – Properties:

Do not "Obtain IP addresses automatically"

Let's change these to Static IP addresses:

IP Address:	10.10.10.1
Subnet Mask:	255.255.255.0
Default Gateway:	leave empty
Preferred DNS:	127.0.0.1 ← There will be no other DNS than this computer
Alternate DNS:	leave empty

Step 9) Server Manager – Change the Name of this Windows Server

Go to Server Manager. Local server - Click the computer name in the upper left hand side.

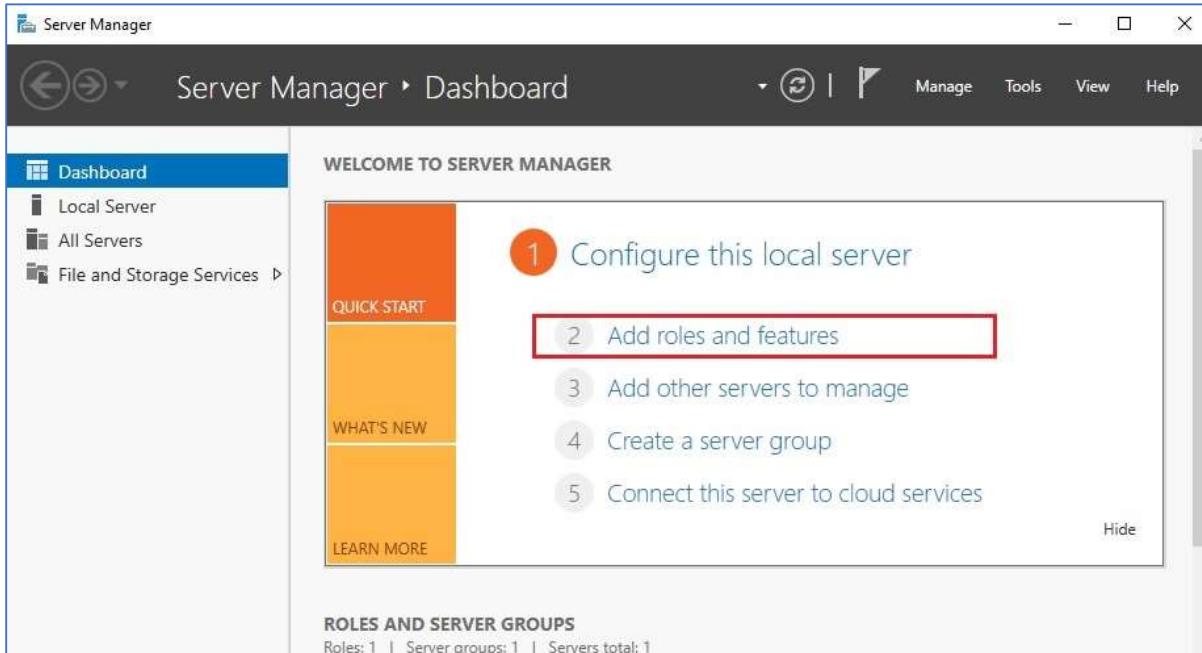
Even though we named it in VirtualBox, Windows gave it a name of its own.

Change the computer name to: **WinSvr22-DC1**

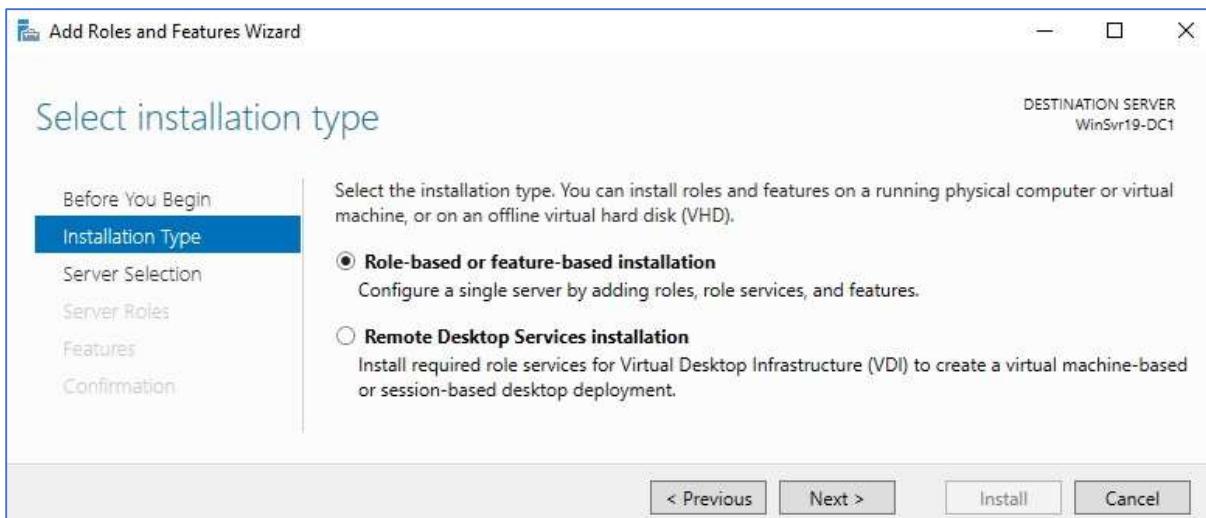
This will require a re-start

Step 10) Make this machine a domain controller:

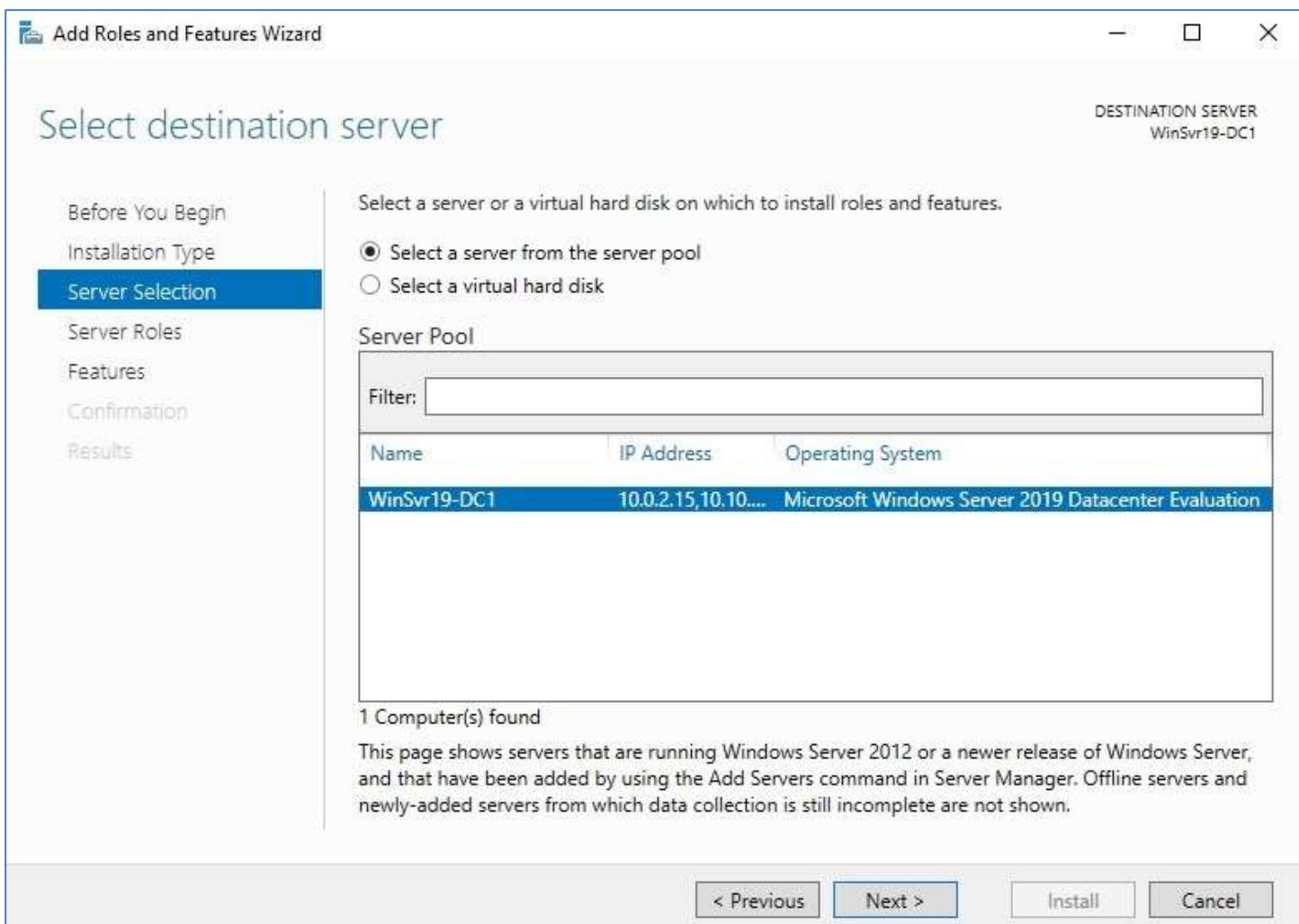
Server Manager: Add roles and features



Choose Role-based or feature-based installation



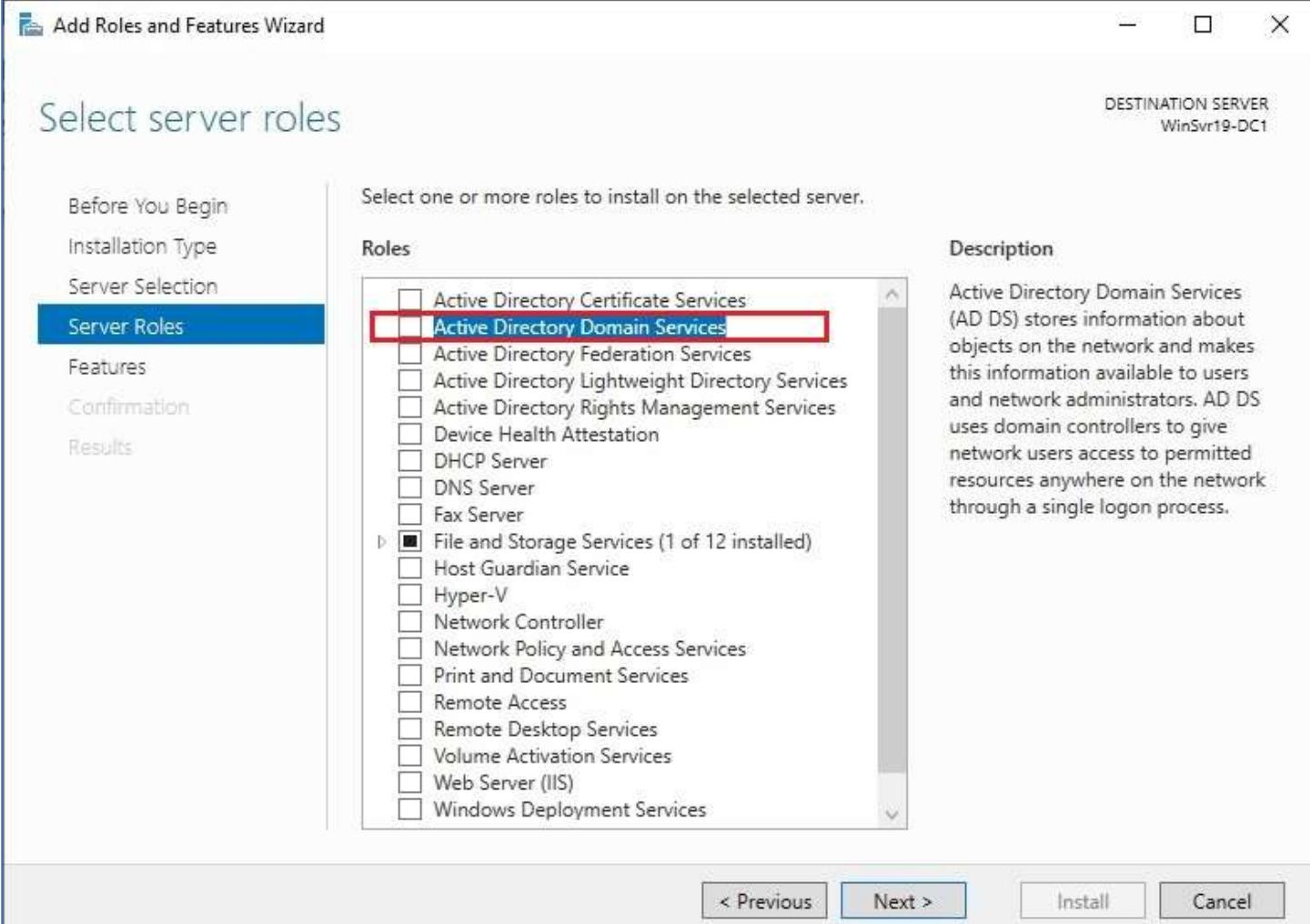
This is probably the only computer available to be the destination:



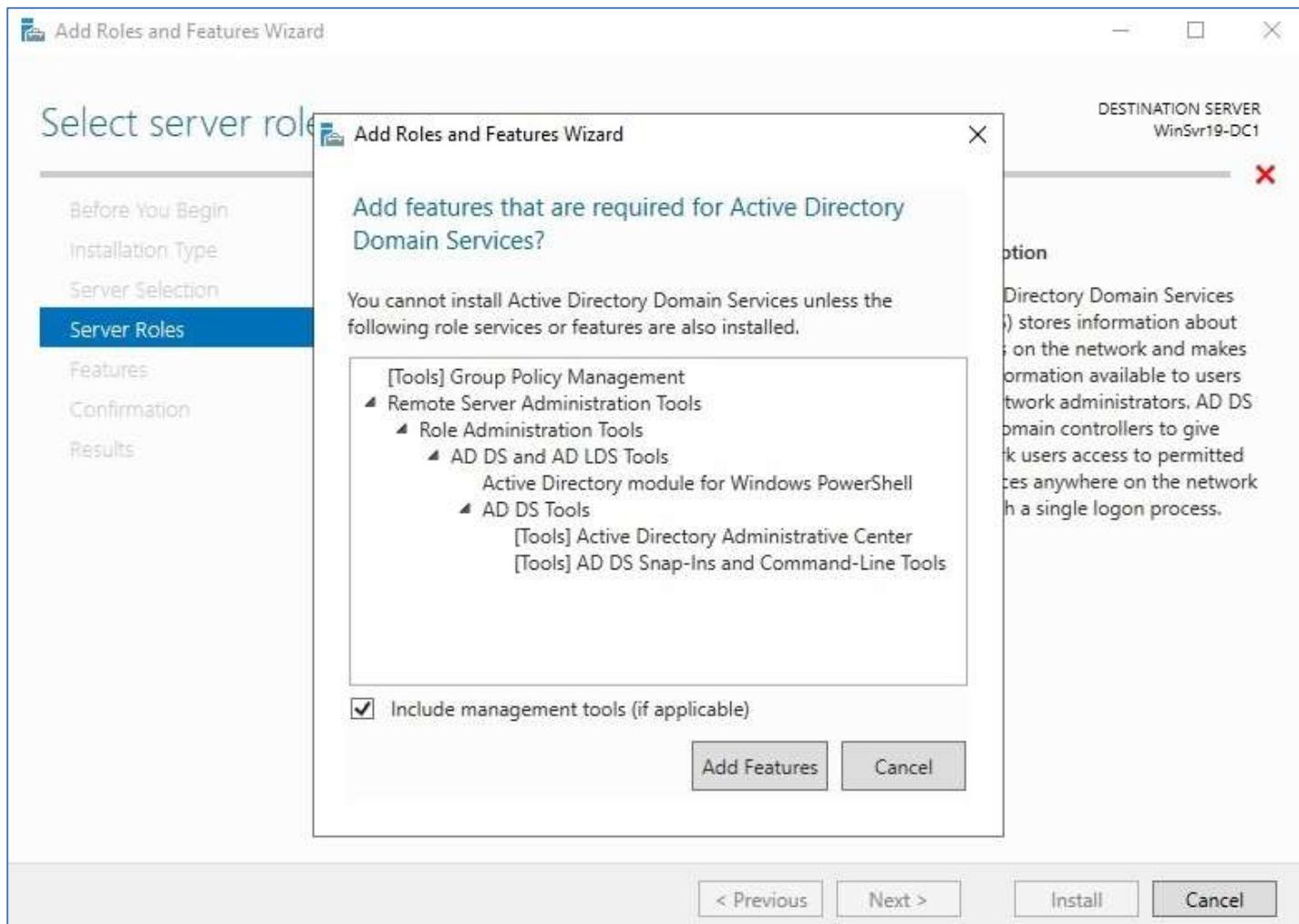
You may notice that in the upper right corner of the rest of these screenshots, it cites the Destination Server as WinSrv19-DC1. That was because these were taken when I was using Windows Server 2022. Further

documentation will show WinSvr22-DC1. I decided to go to Windows Server 2022 after starting this. These screens, however, are identical, and would also match Windows Server 2016 as well.

Check: Active Directory Domain services.



Depending on the Roles and Features being added, there may be other Features that have to be installed as well. Choose Add Features.



Active Directory Domain Services

DESTINATION SERVER
WinSvr19-DCT1[Before You Begin](#)[Installation Type](#)[Server Selection](#)[Server Roles](#)[Features](#)[AD DS](#)[Confirmation](#)[Results](#)

Active Directory Domain Services (AD DS) stores information about users, computers, and other devices on the network. AD DS helps administrators securely manage this information and facilitates resource sharing and collaboration between users.

Things to note:

- To help ensure that users can still log on to the network in the case of a server outage, install a minimum of two domain controllers for a domain.
- AD DS requires a DNS server to be installed on the network. If you do not have a DNS server installed, you will be prompted to install the DNS Server role on this machine.



Azure Active Directory, a separate online service, can provide simplified identity and access management, security reporting, single sign-on to cloud and on-premises web apps.

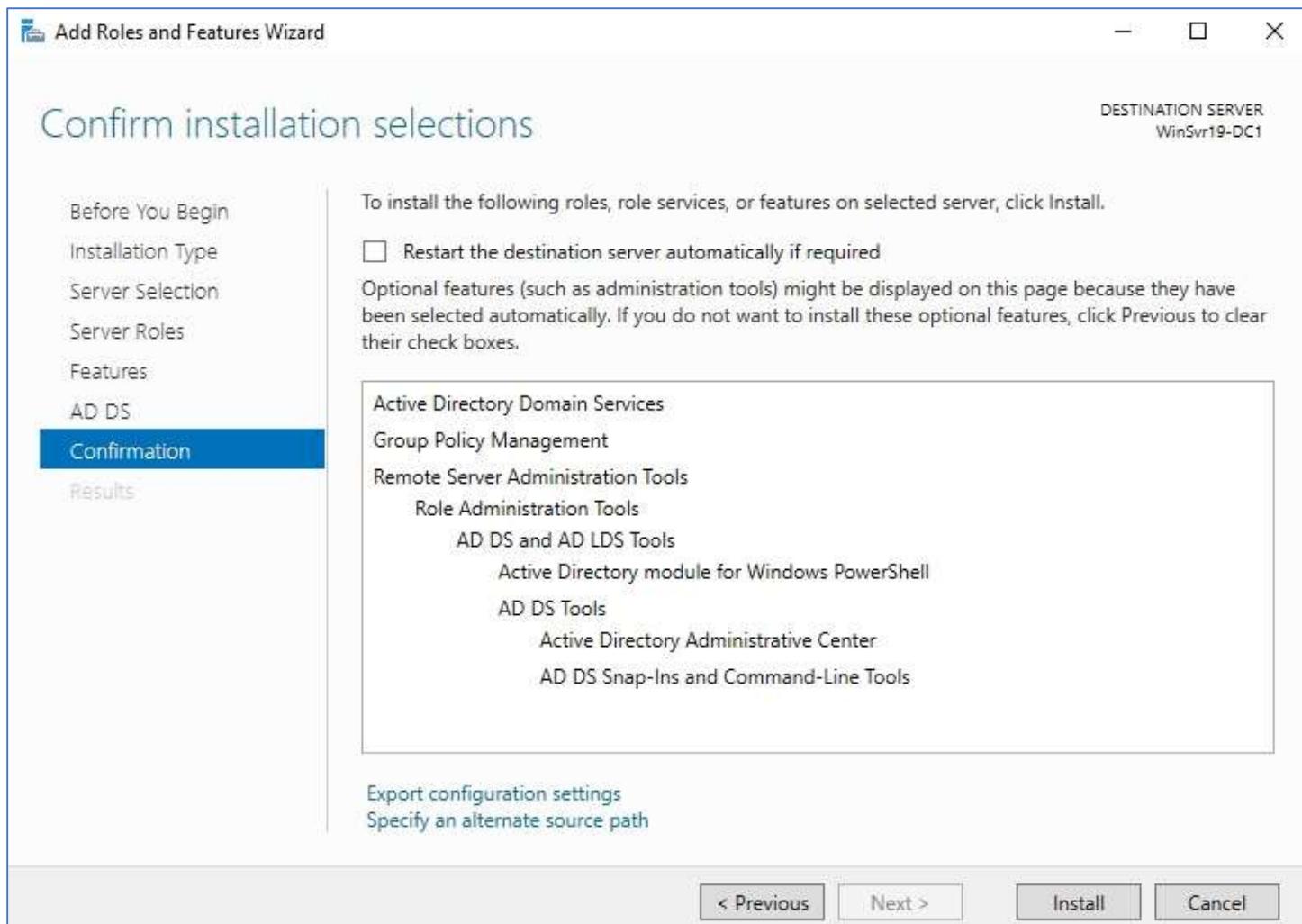
[Learn more about Azure Active Directory](#)

[Configure Office 365 with Azure Active Directory Connect](#)

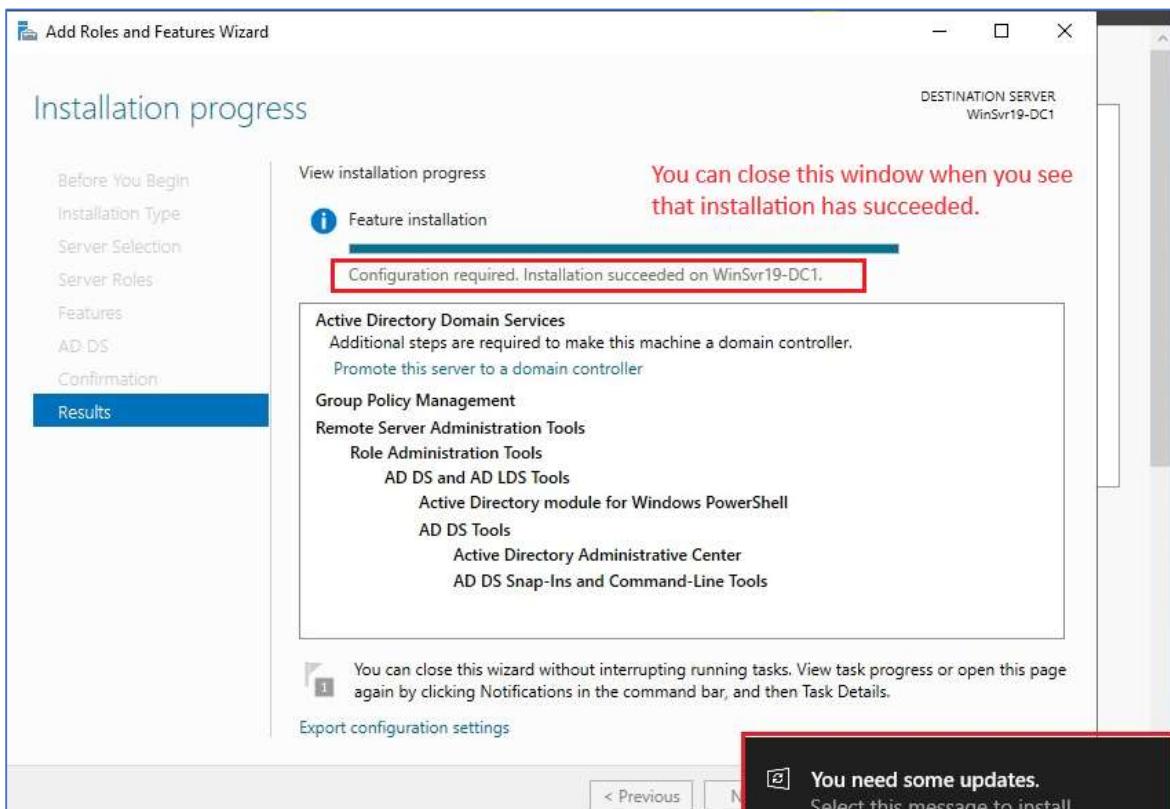
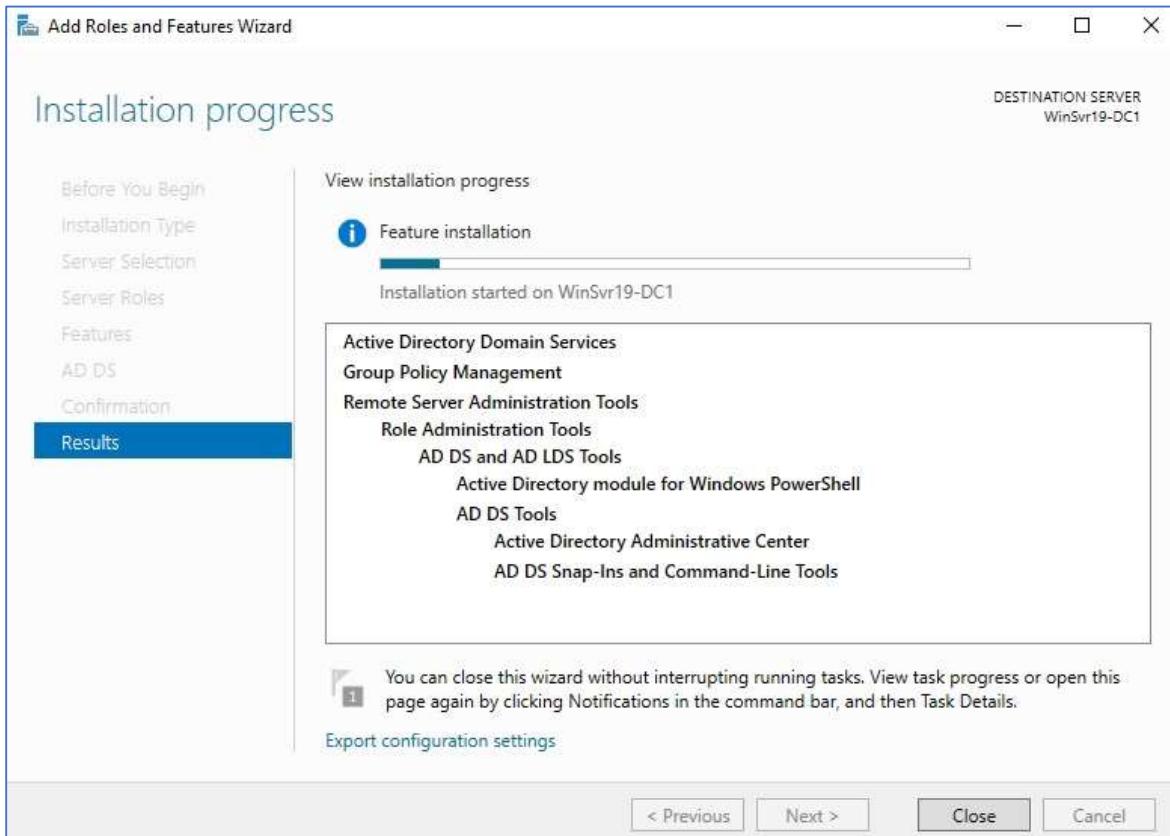
[< Previous](#)[Next >](#)[Install](#)[Cancel](#)

You will get a final confirmation on what will be installed:

Click "Install"

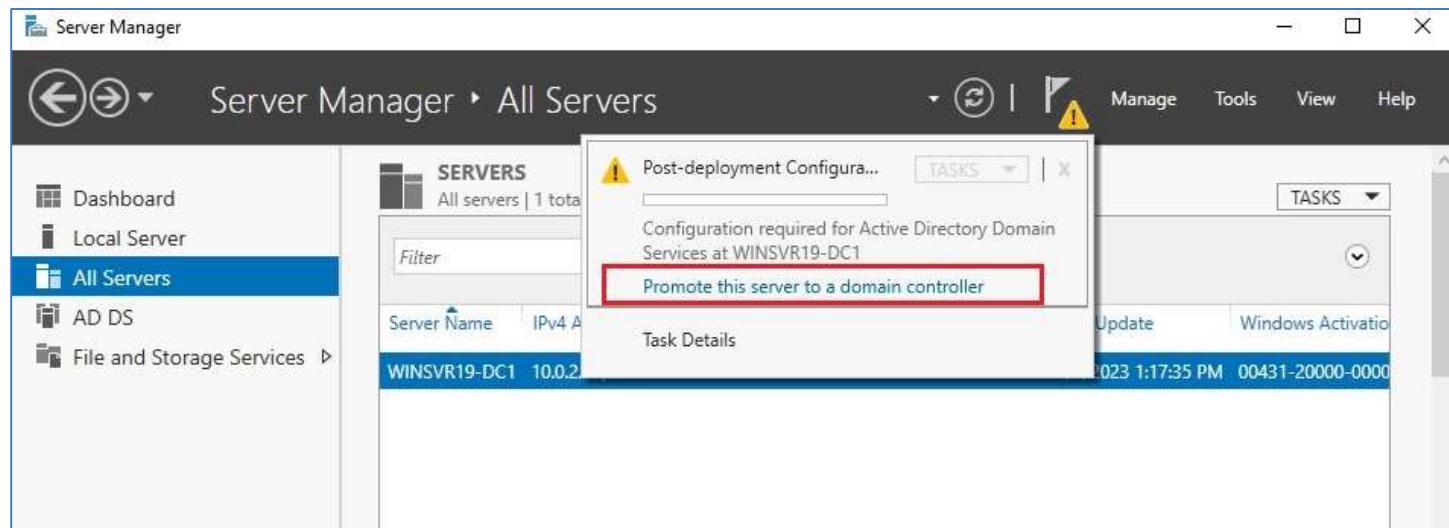
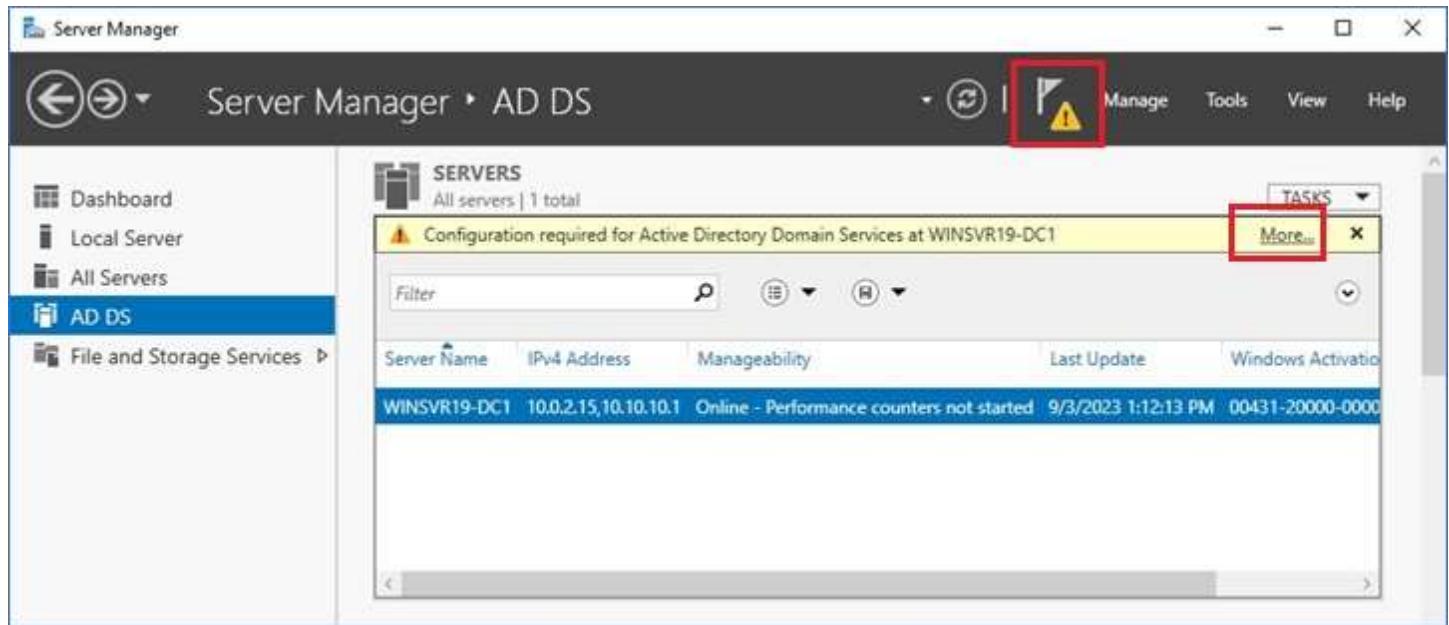


It shows the progress of the install....



Back at Server Manager it will warn you that you need to do one more thing to this computer:

Either click the yellow triangle next to the Alerts flag...



Or right click the "More..." link in the title of the message.

All Servers Task Details

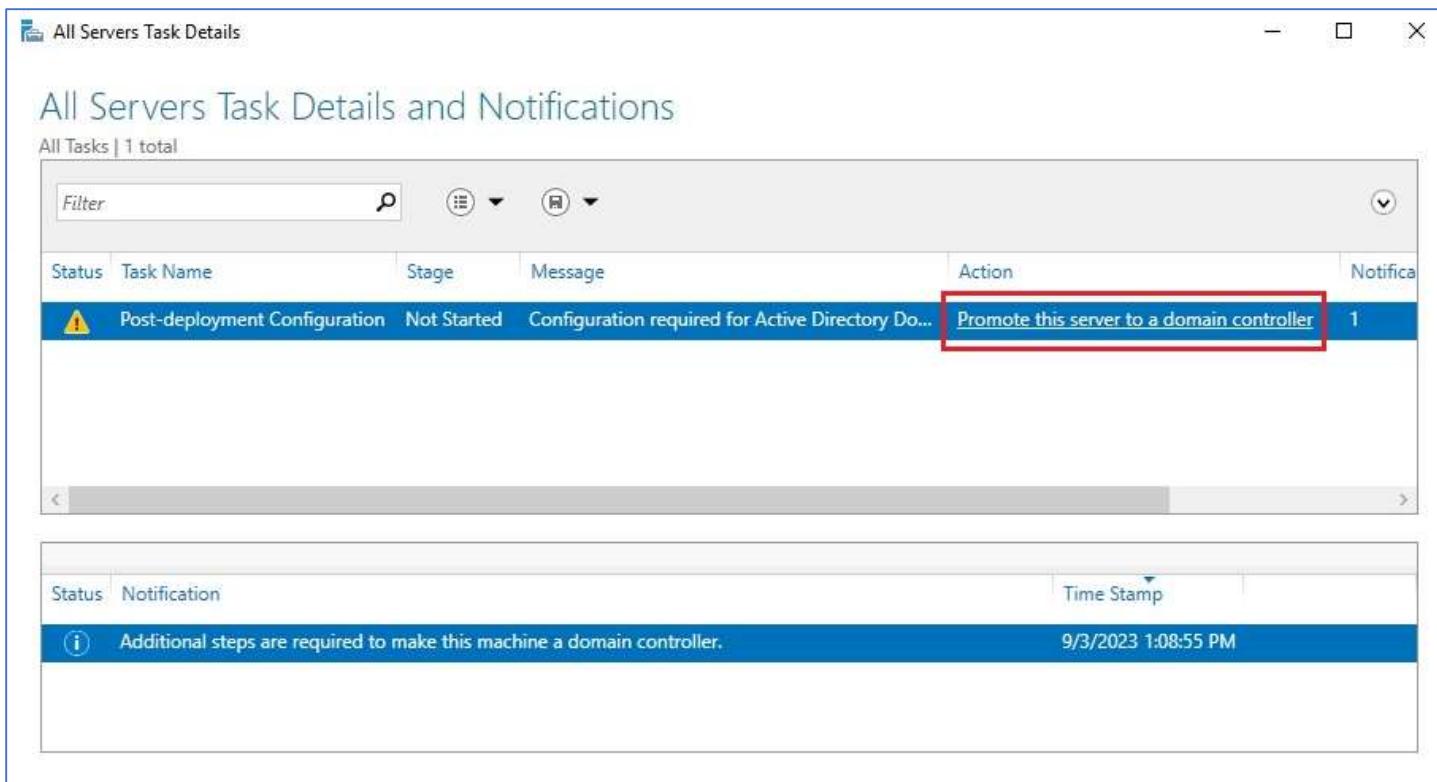
All Servers Task Details and Notifications

All Tasks | 1 total

Status	Task Name	Stage	Message	Action	Notifications
!	Post-deployment Configuration	Not Started	Configuration required for Active Directory Do...	Promote this server to a domain controller	1

! Additional steps are required to make this machine a domain controller.

Time Stamp: 9/3/2023 1:08:55 PM



They will both take you to this screen: It will take a moment to refresh. Then click "Add a new forest"

Active Directory Domain Services Configuration Wizard

Deployment Configuration

TARGET SERVER
WinSrv19-DC1

Deployment Configuration

- Domain Controller Options
- Additional Options
- Paths
- Review Options
- Prerequisites Check
- Installation
- Results

Select the deployment operation

Add a domain controller to an existing domain

Add a new domain to an existing forest

Add a new forest

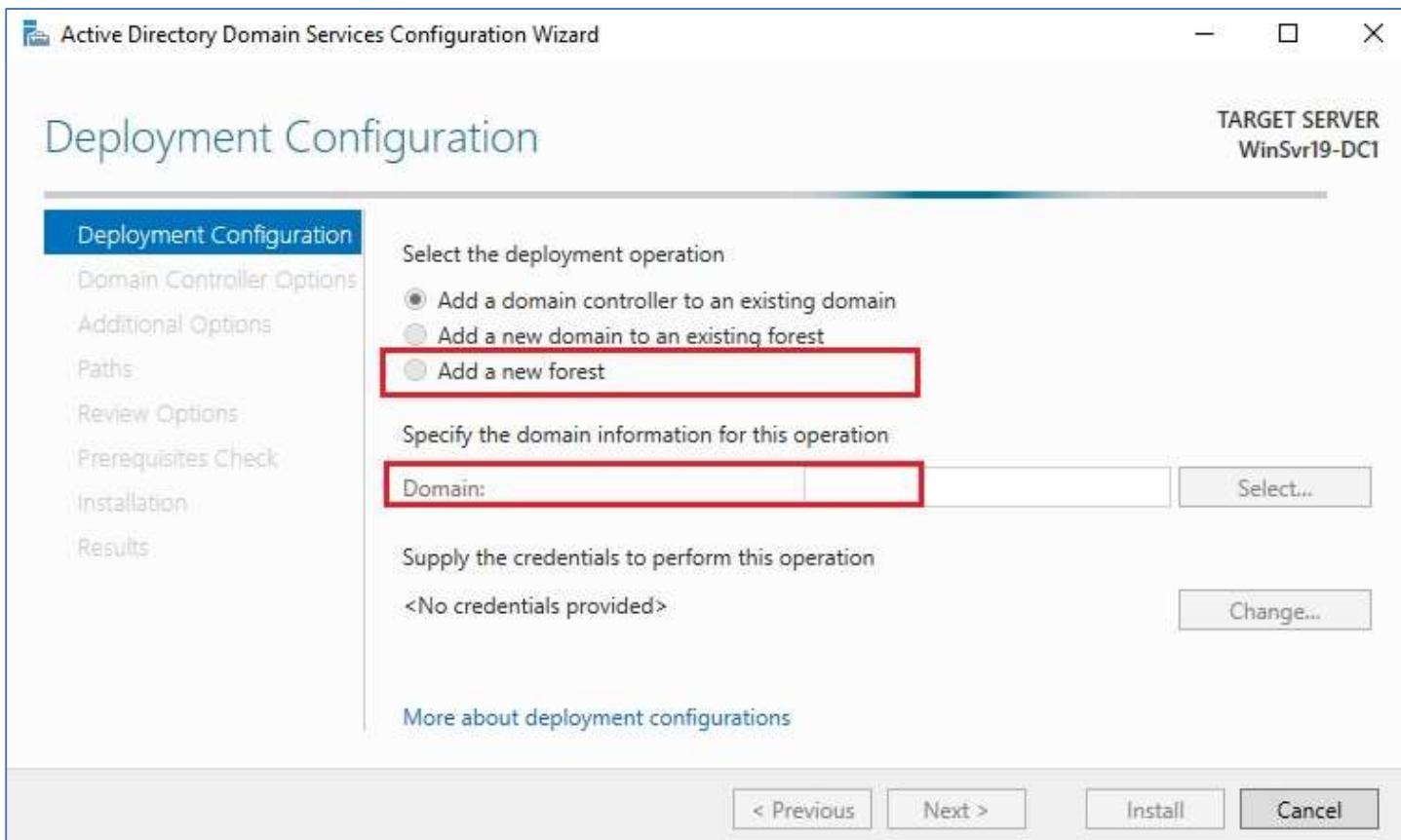
Specify the domain information for this operation

Domain: Select...

Supply the credentials to perform this operation

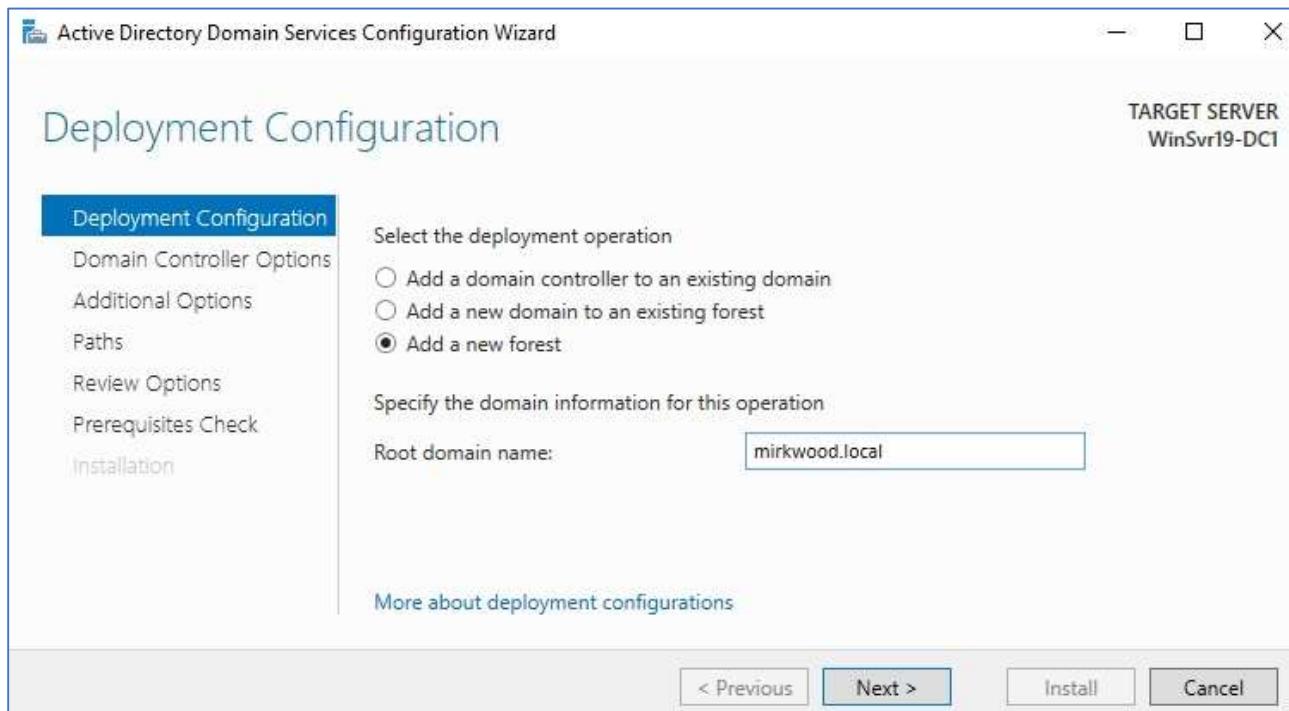
<No credentials provided>

More about deployment configurations

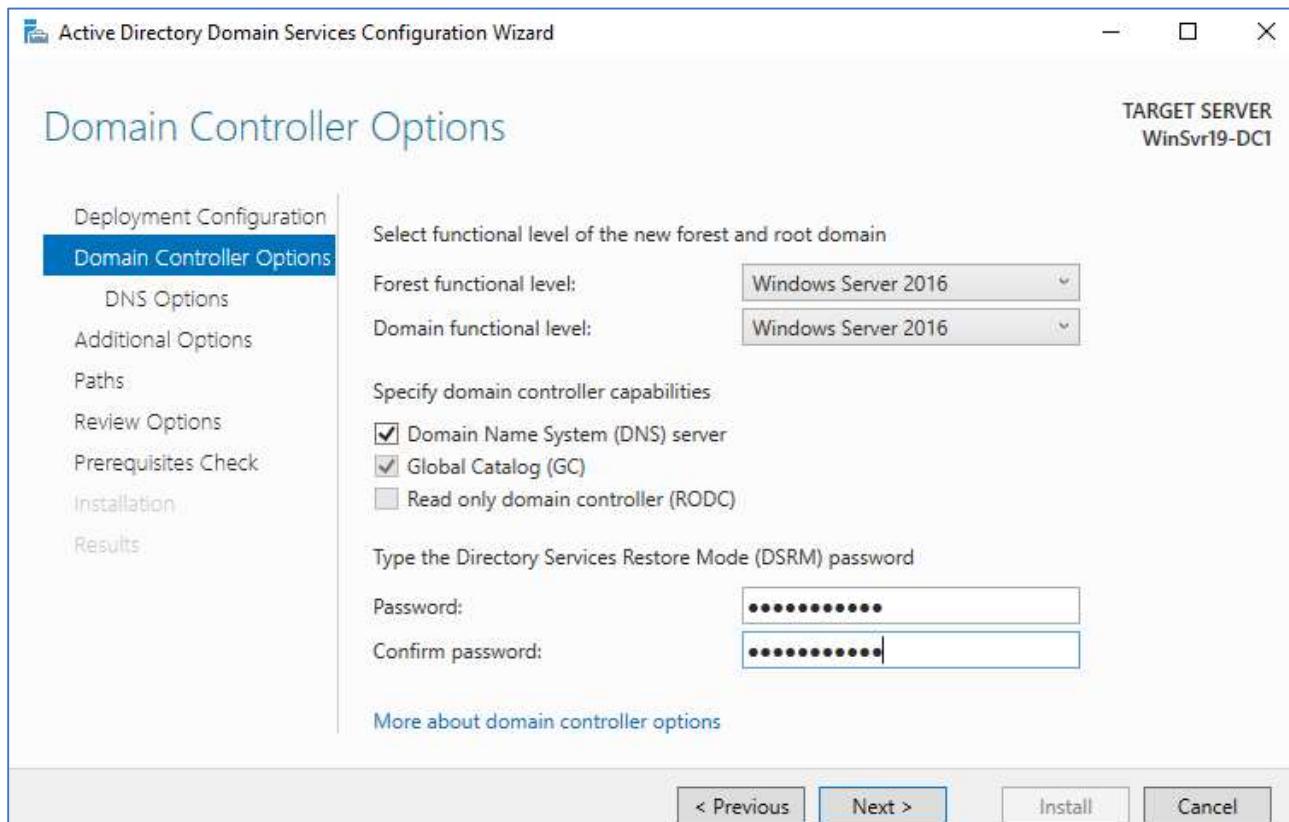


And choose a domain name. Since we are not connected to the internet, I will use a .local extension.

My domain name will be: mirkwood.local

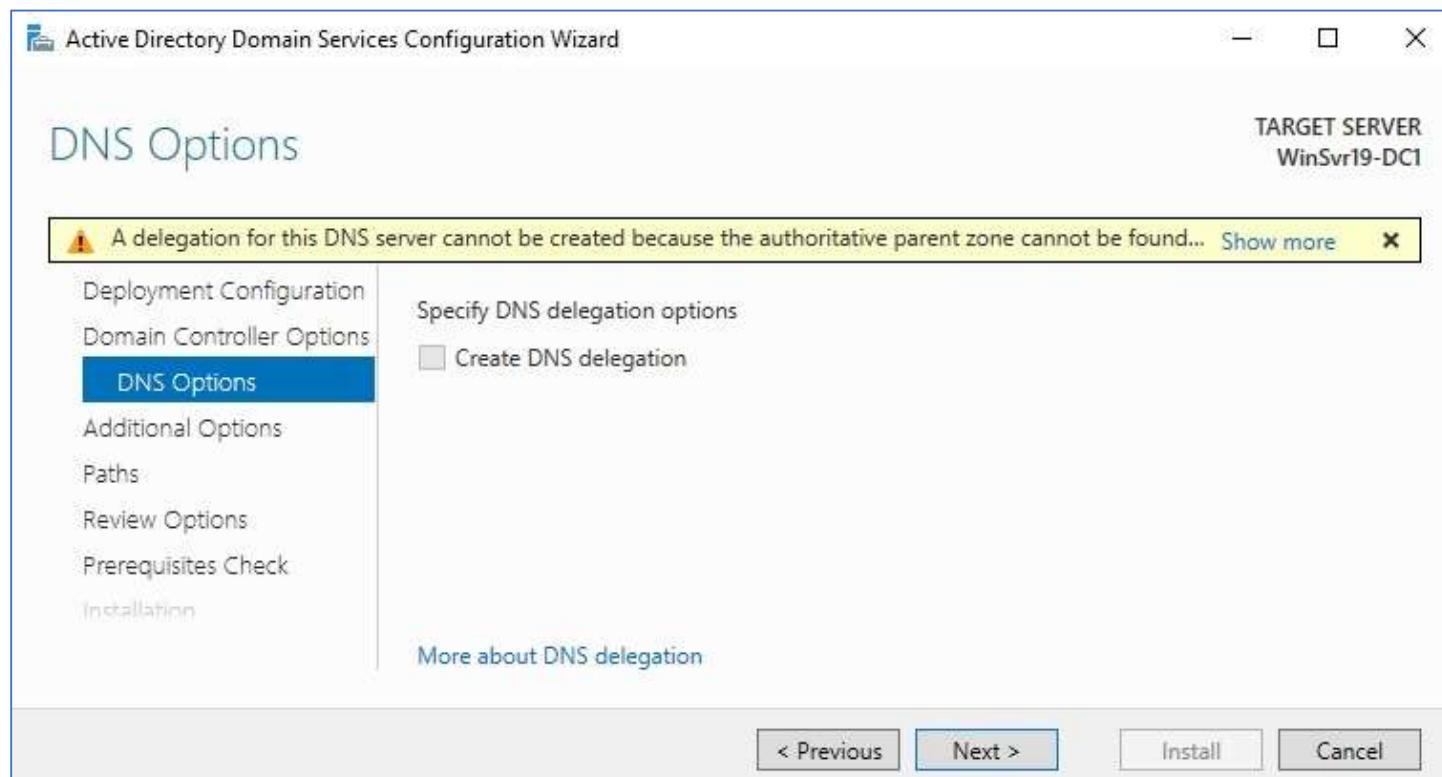


Now, confirm the Functional Level and supply a Restore Mode password

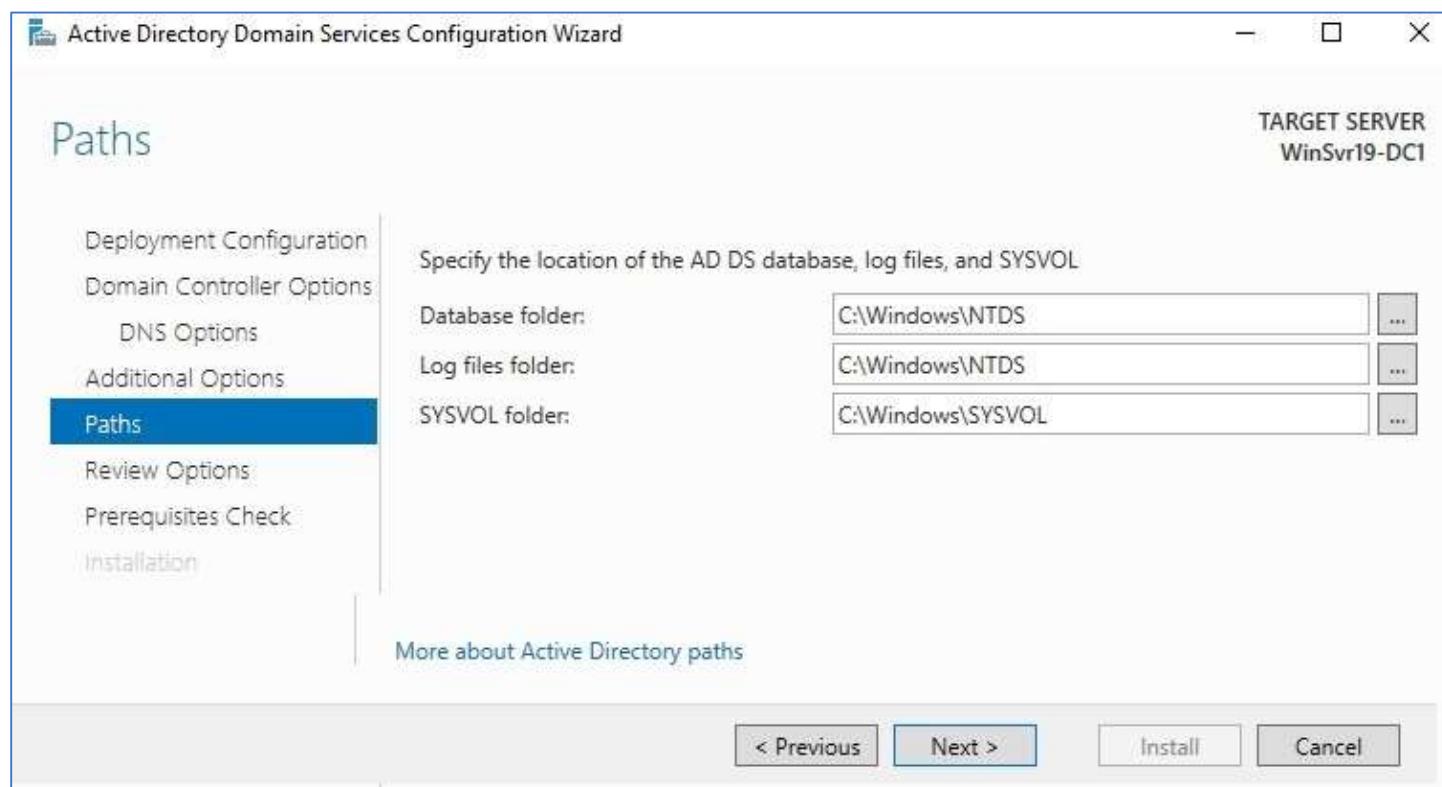


The functional level of the domain being 2016 is correct, even for Windows Server 2019 and 2022.

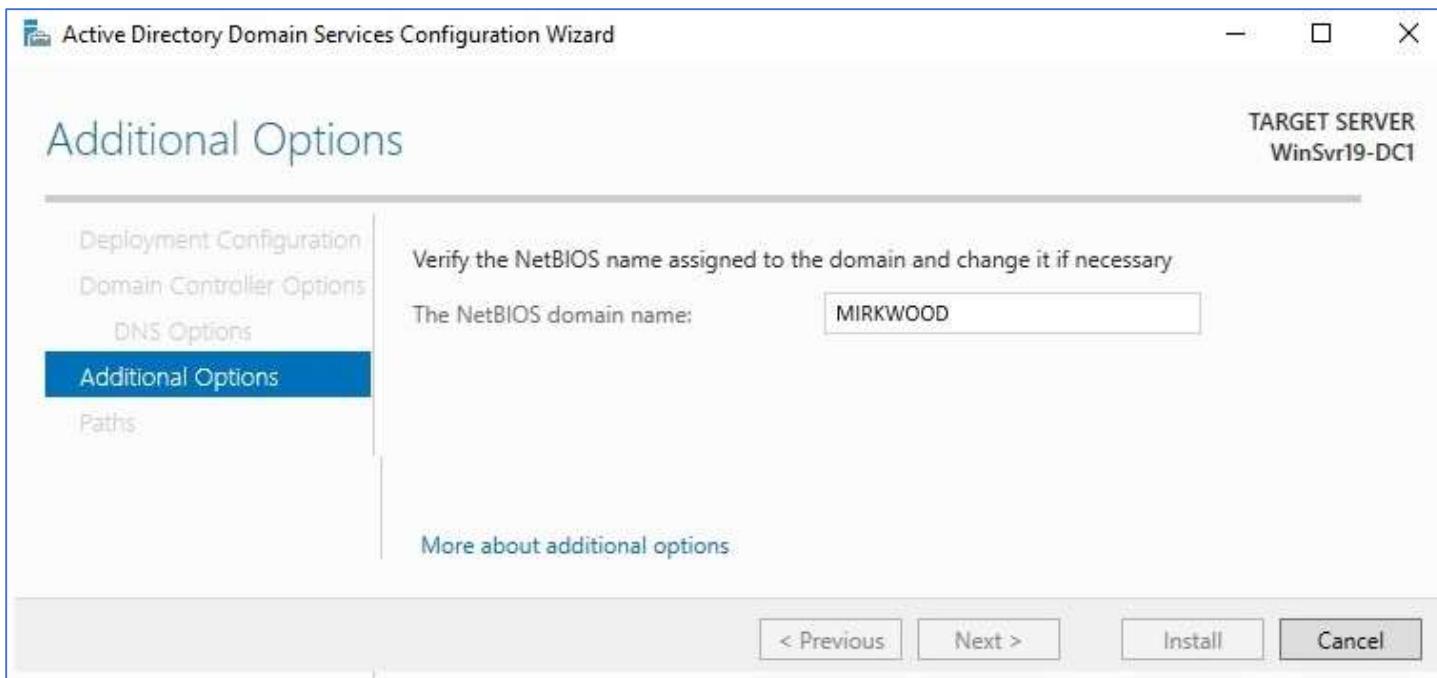
It will complain about not being able to create a DNS Delegation. Skip past this:



Accept the default directories for the AD DS:

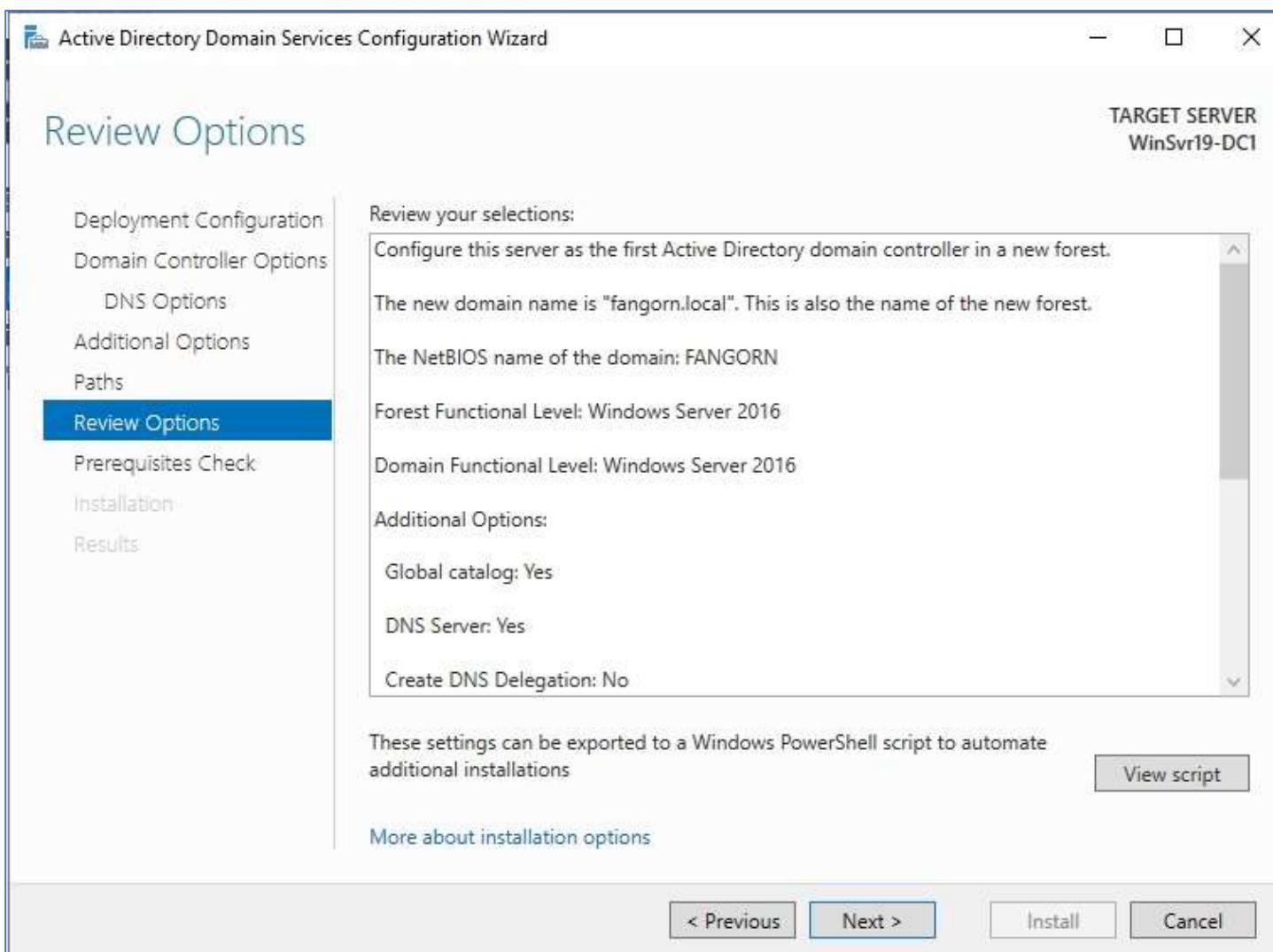


Next, it will figure out a NetBIOS name for the domain. This may take a moment. When it comes back, click Next.

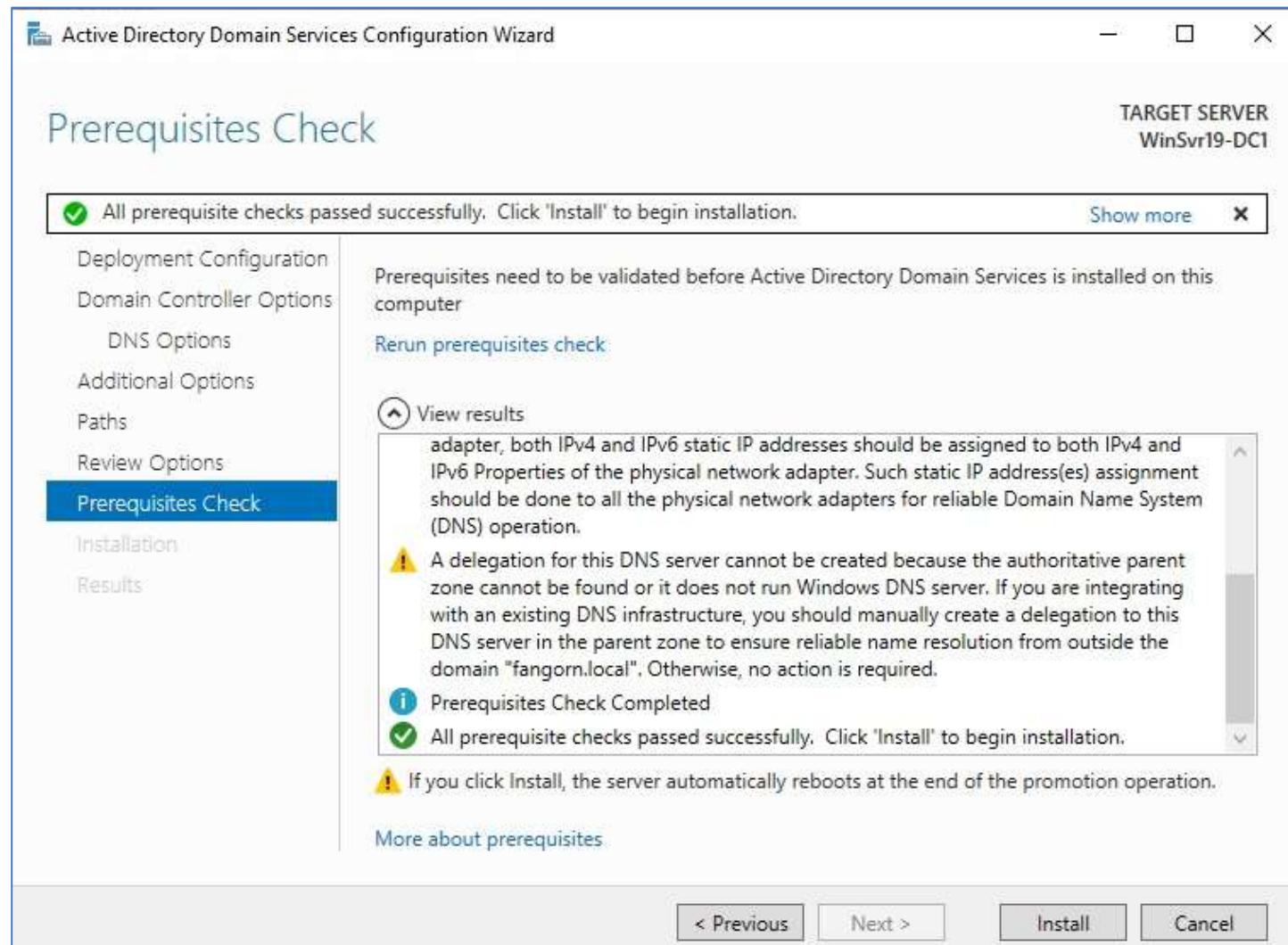


You can now review the entries before continuing:

(In this screenshot the domain was fangorn.local)

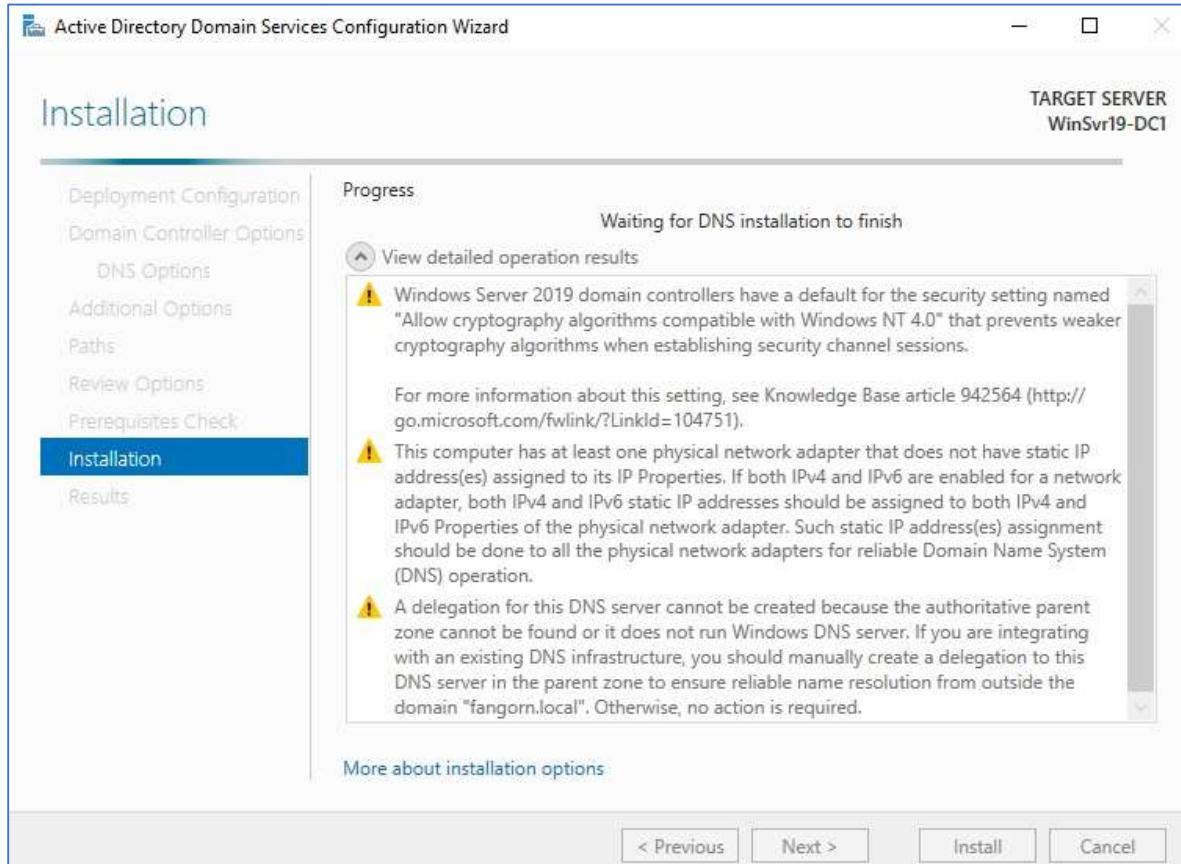


It will do a Prerequisites Check

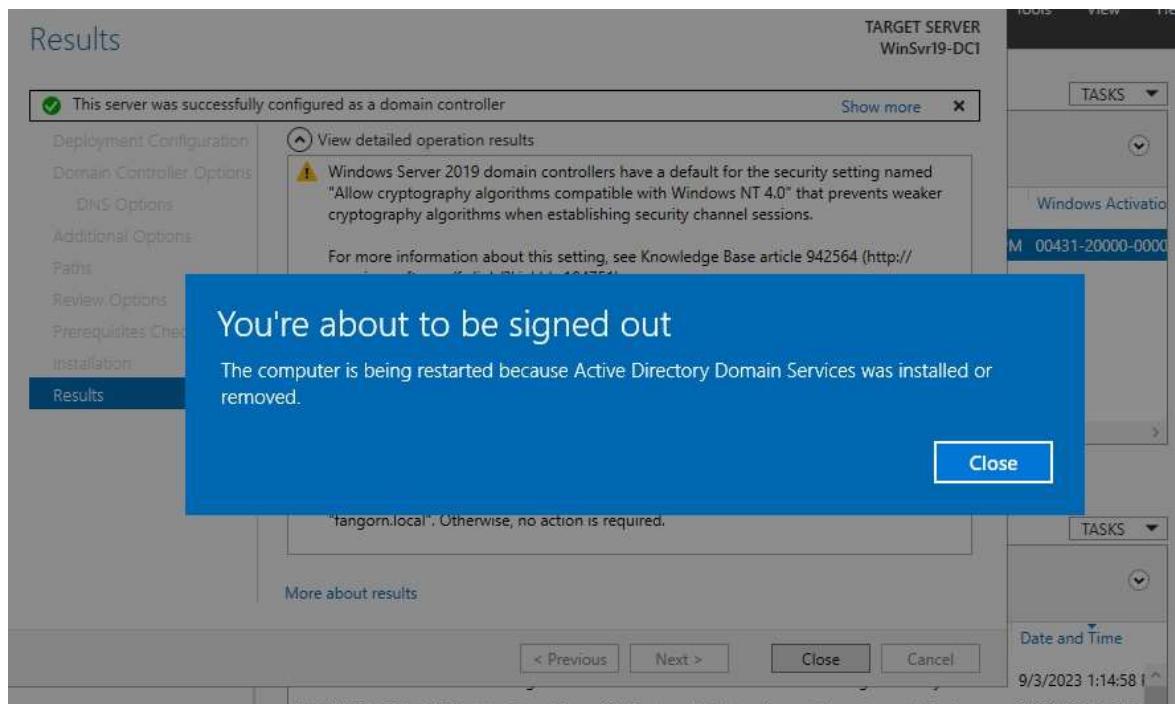


Click Install

Here is the Install occurring:

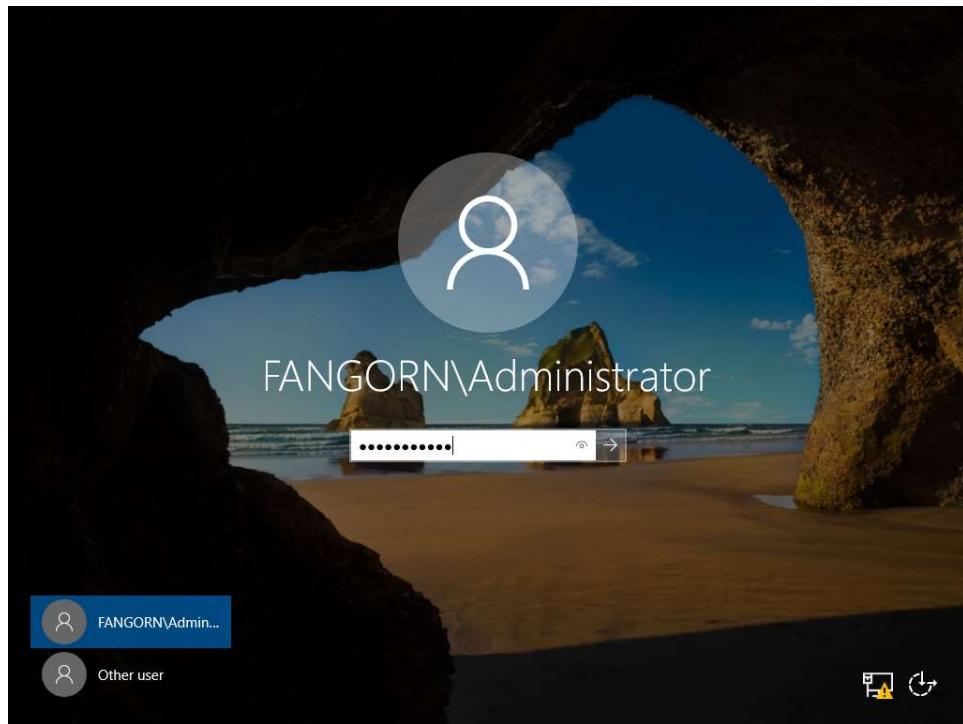


It now needs to re-start



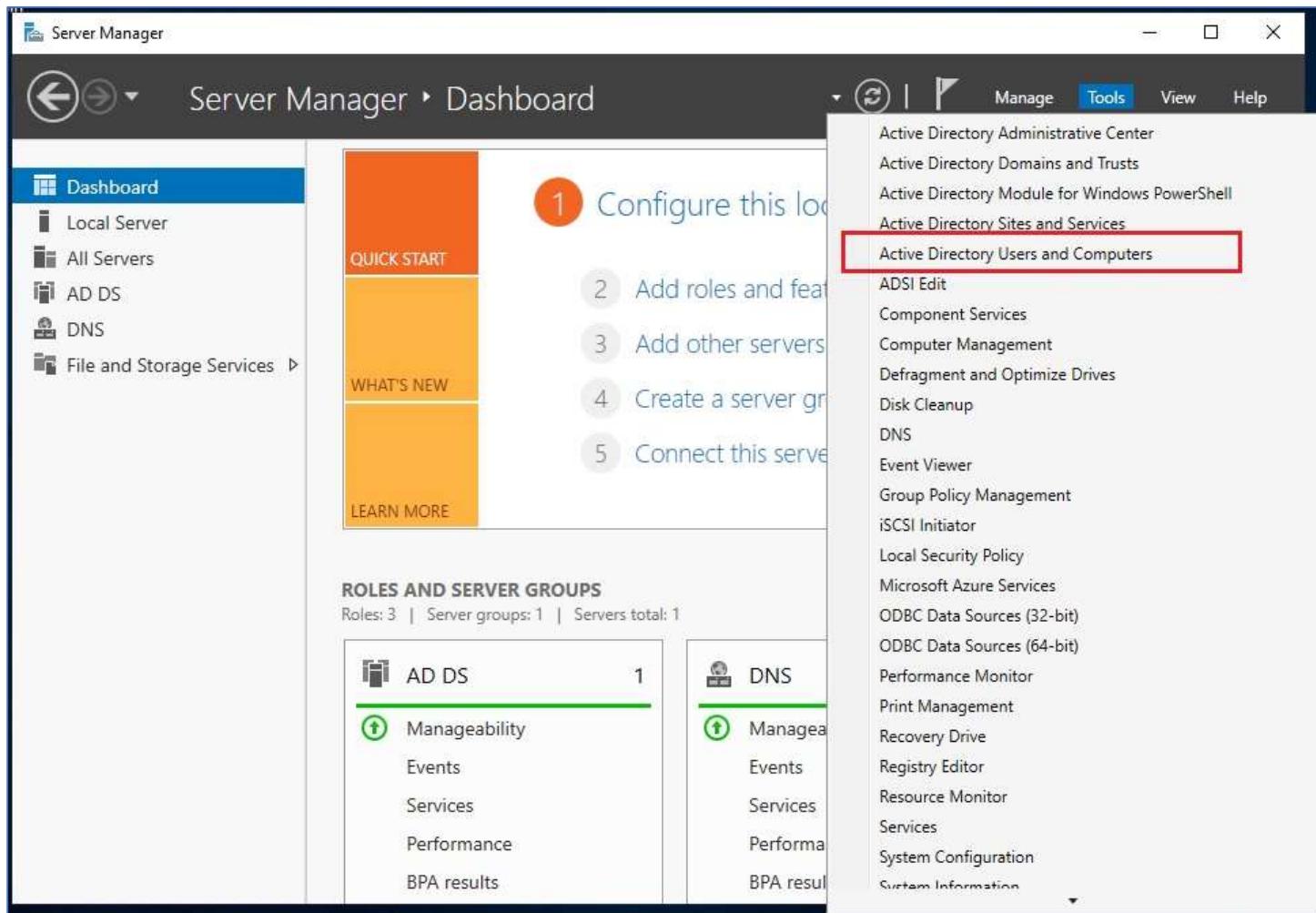
When you log in the next time – you will be logging in to the Domain, as Administrator

FANGORN\Administrator



Step 11) Add an Active Directory domain user account.

Server Manager – Tools – Active Directory Users and Computers

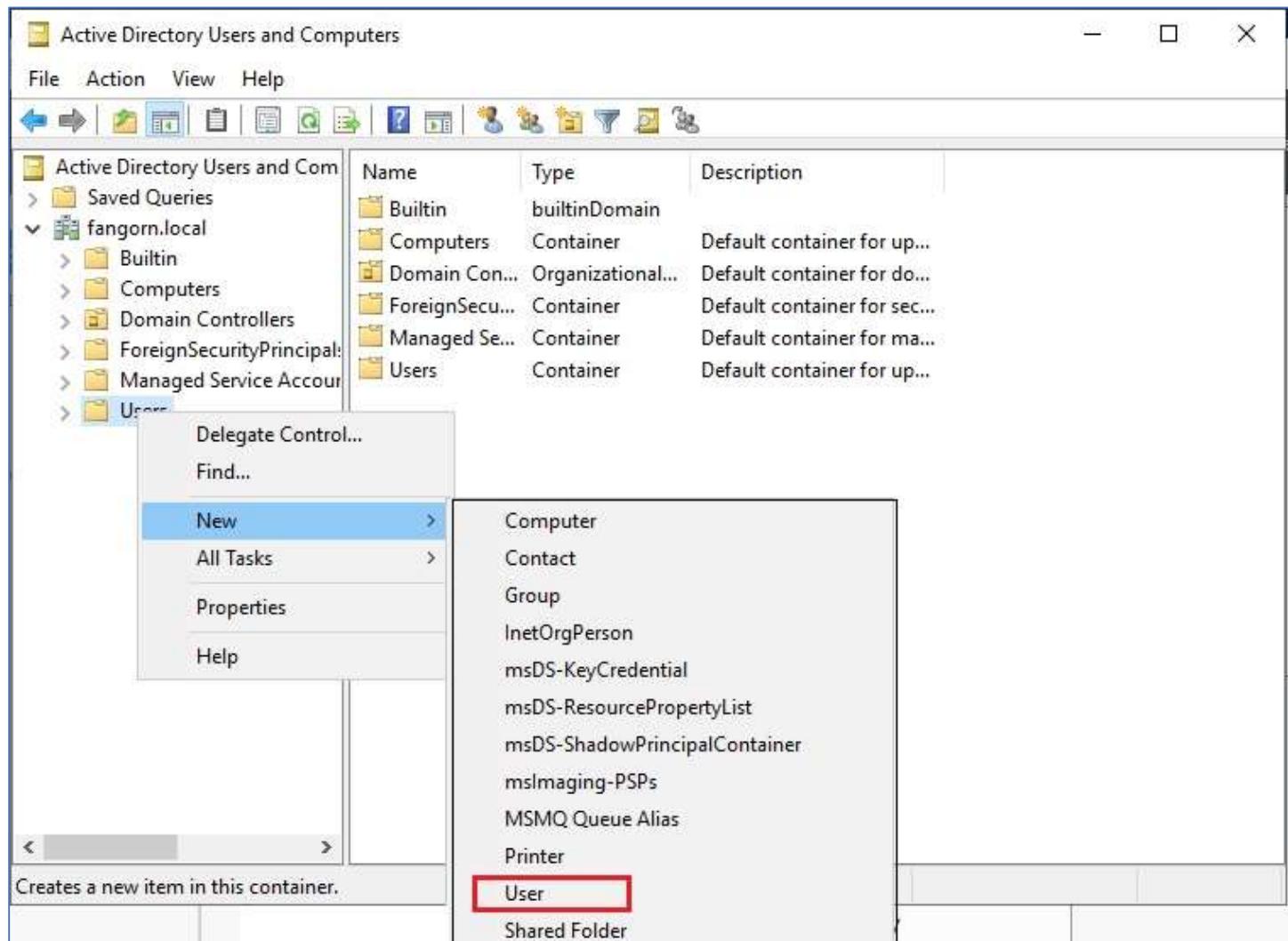


Use the panel by expanding our domain node:

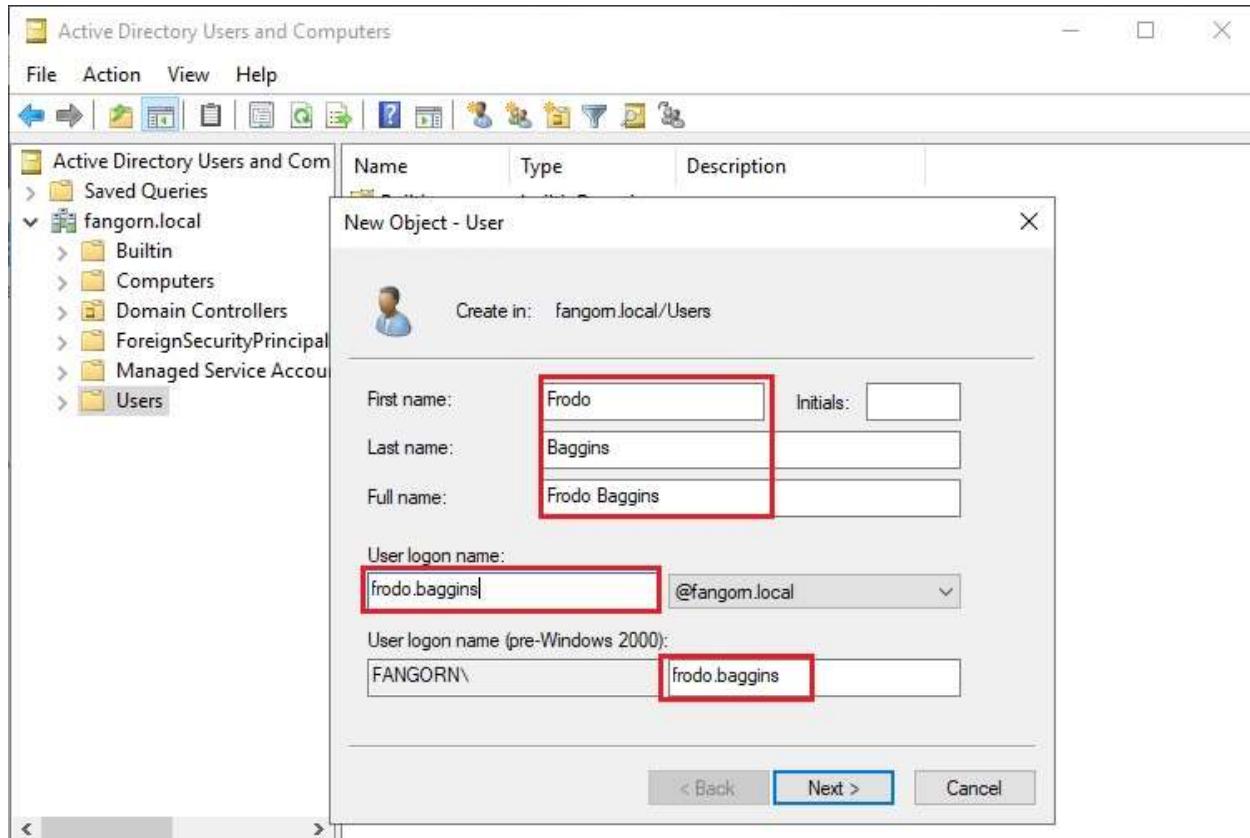
This screenshot shows the 'Active Directory Users and Computers' management console. The left sidebar shows a tree view with 'Active Directory Users and Computers' expanded, revealing 'Saved Queries' and 'fangorn.local'. A red box and arrow point to the 'fangorn.local' node with the text 'Expand by clicking'. The main pane displays a table with columns 'Name', 'Type', and 'Description'. It shows two entries: 'Saved Queries' (Type: Folder) with the description 'Folder to store your favo...', and 'fangorn.local' (Type: Domain).

Name	Type	Description
Saved Queries	Folder	Folder to store your favo...
fangorn.local	Domain	

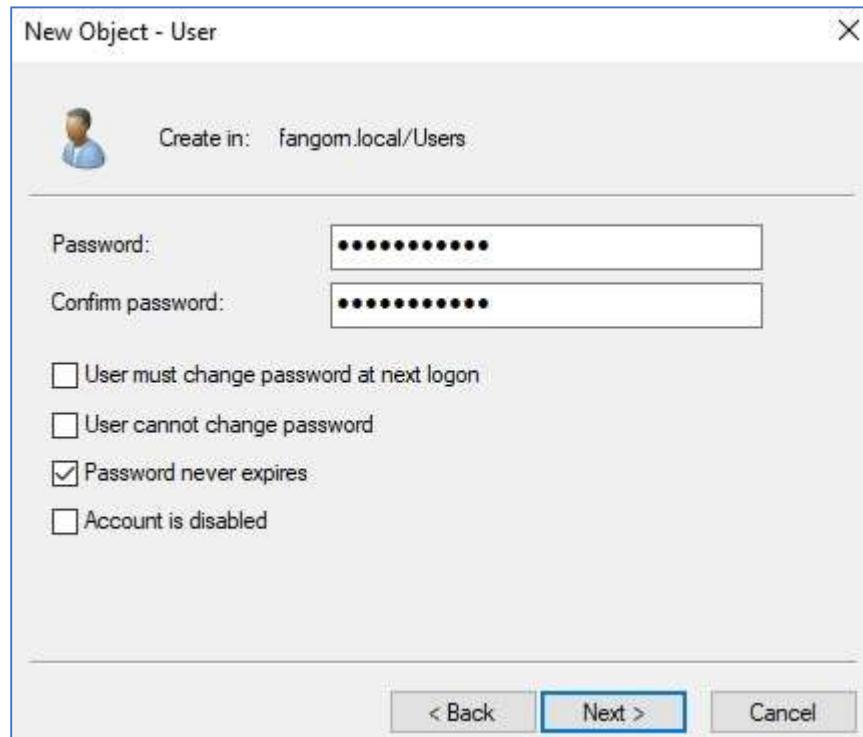
Right Click Users – New - User



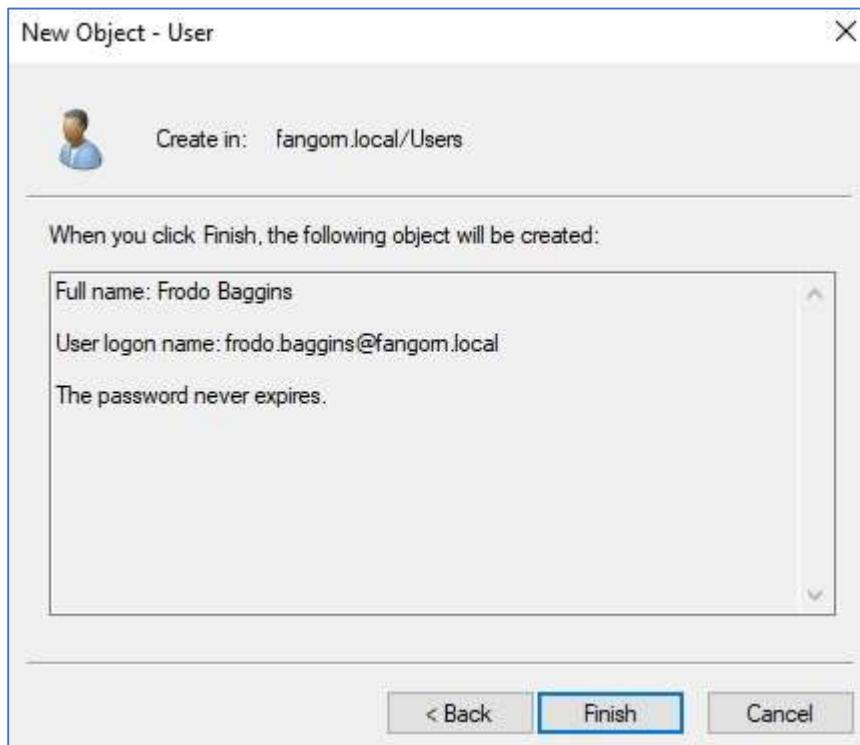
Let's create user Frodo Baggins:



Establish a Password and Password Policy:



Confirm the new User:



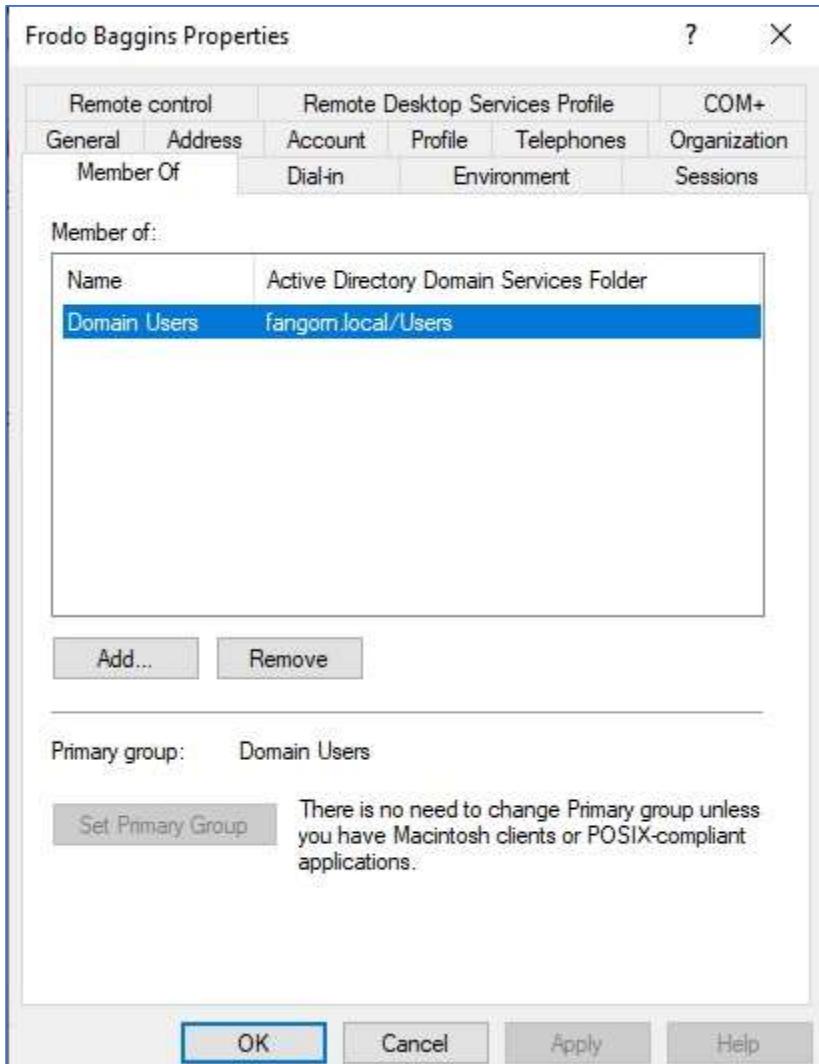
And see that he shows up in the Users and Computers list:

Name	Type	Description
Administrator	User	Built-in account for administering t...
Allowed RODC Password Repli...	Security Group...	Members in this group can have the...
Cert Publishers	Security Group...	Members of this group are permitte...
Cloneable Domain Controllers	Security Group...	Members of this group that are do...
Denied RODC Password Replic...	Security Group...	Members in this group cannot have...
DnsAdmins	Security Group...	DNS Administrators Group
DnsUpdateProxy	Security Group...	DNS clients who are permitted to p...
Domain Admins	Security Group...	Designated administrators of the do...
Domain Computers	Security Group...	All workstations and servers joined t...
Domain Controllers	Security Group...	All domain controllers in the domain
Domain Guests	Security Group...	All domain guests
Domain Users	Security Group...	All domain users
Enterprise Admins	Security Group...	Designated administrators of the en...
Enterprise Key Admins	Security Group...	Members of this group can perform...
Enterprise Read-only Domain ...	Security Group...	Members of this group are Read-On...
Frodo Baggins	User	Frodo is welcome in Fangorn forest.
Group Policy Creator Owners	Security Group...	Members in this group can modify ...
Guest	User	Built-in account for guest access to ...
Key Admins	Security Group...	Members of this group can perform...
Protected Users	Security Group...	Members of this group are afforded...
RAS and IAS Servers	Security Group...	Servers in this group can access rem...

Step 12) Add this User to the Domain Admins group.

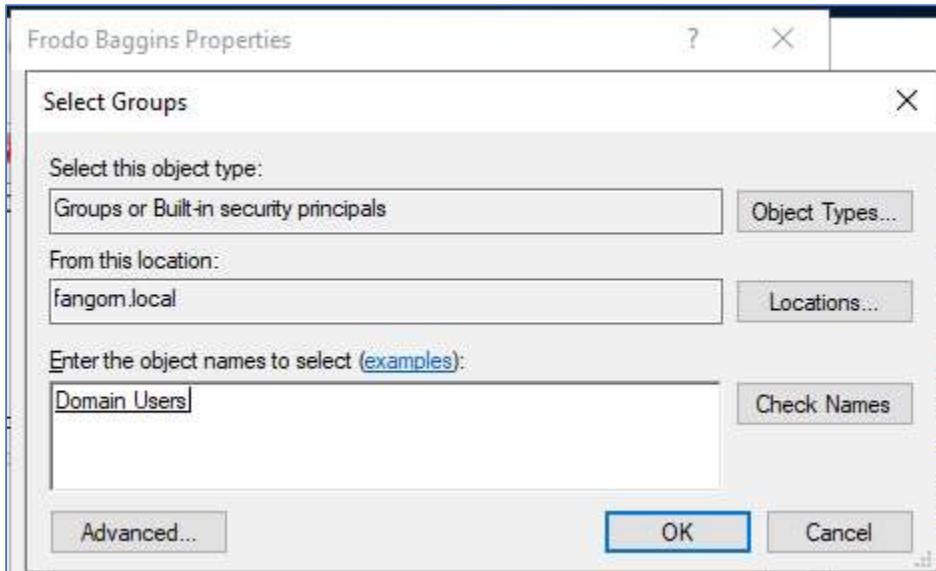
You can Right click on the user and click Properties, which allows you to change anything on them.

The tab "Member Of" lets us add and remove them to groups.



Or we could right click on the user and choose Add / Remove Groups

Either of them takes us here:



By clicking in the big box, we type the names of groups, and then the "Check Names" button, which locates the exact ones for us. We can already see that he is in the Domain Users group.

Now add Frodo Bagins to some more groups. Type in the following into the "Enter the object names to select" text box, and click Check Names:

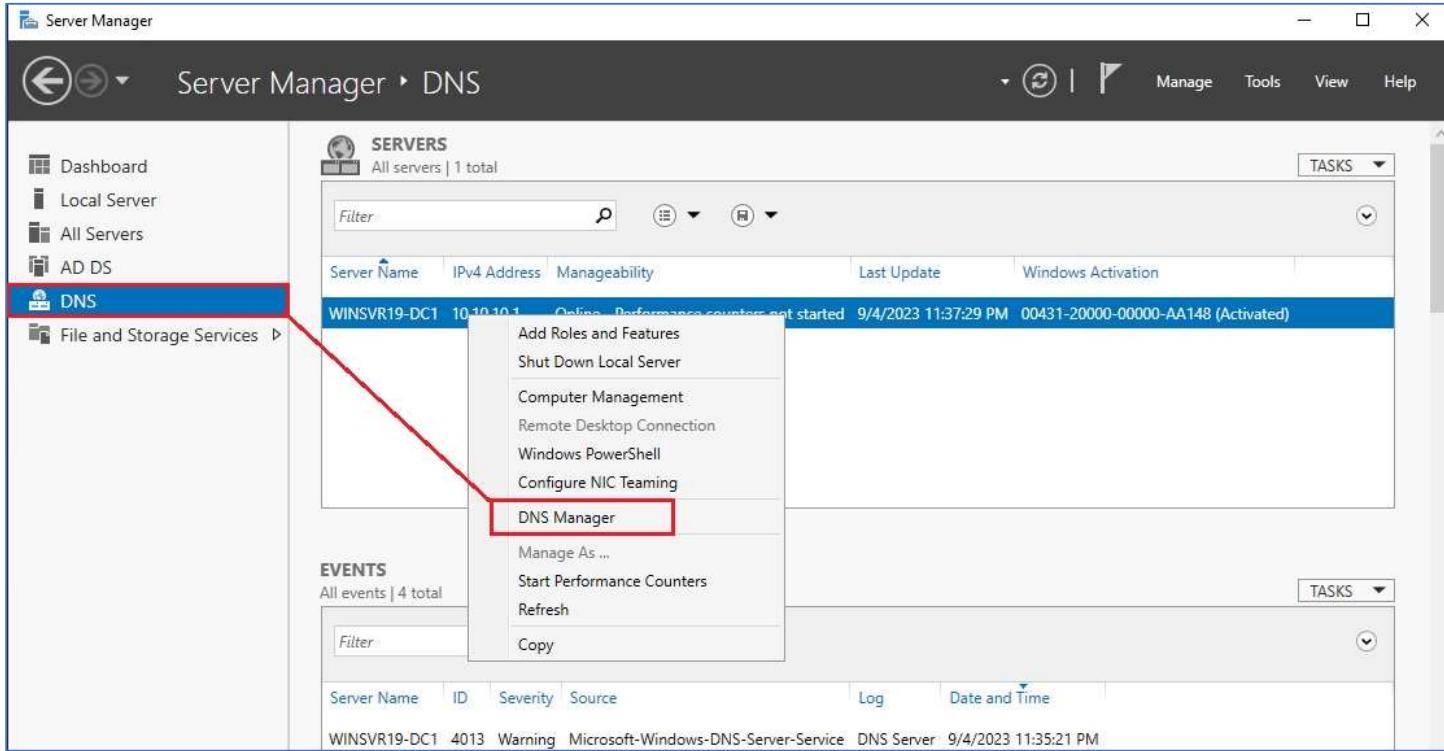
Administrator; Domain Admins; Enterprise Admins; Schema Admins; Group Policy Creator Owners

Note these 3 additional groups are separated by semicolons, so you can add him to more than one group at a time.

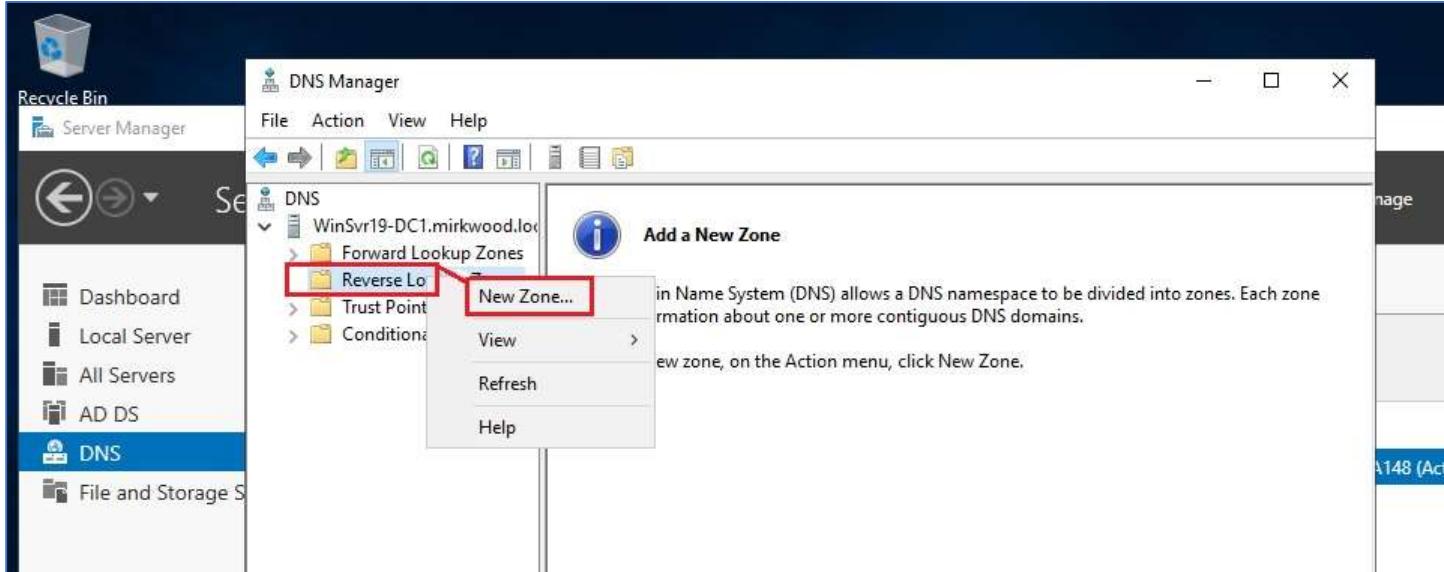
Step 13) Create a DNS Reverse Lookup Zone on the Domain Controller

Log in as the Domain admin we just set up: FBaggins

Server Manager – DNS – DNS Server



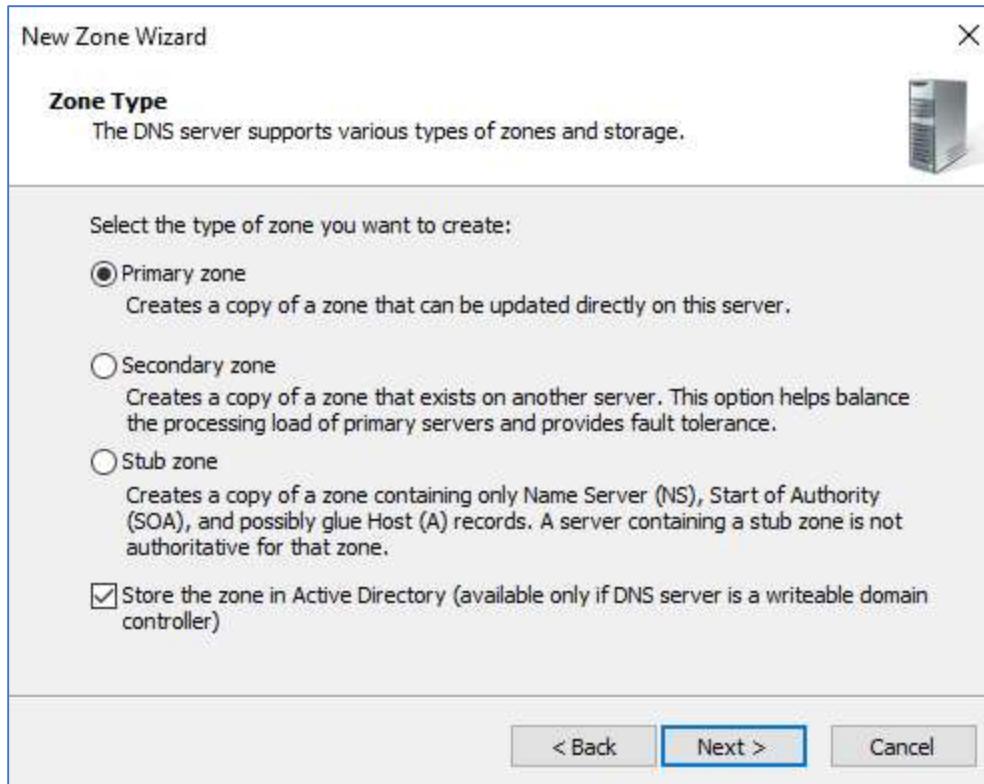
DNS Manager – right click Reverse Lokup Zone – New Zone



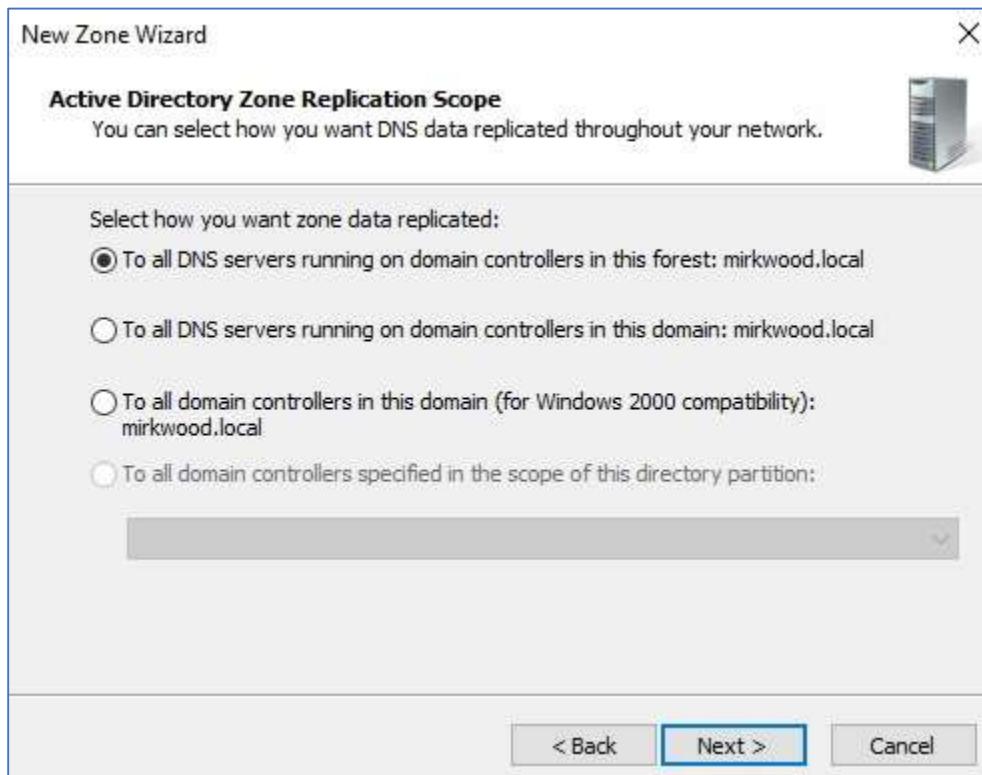
New Zone Wizard



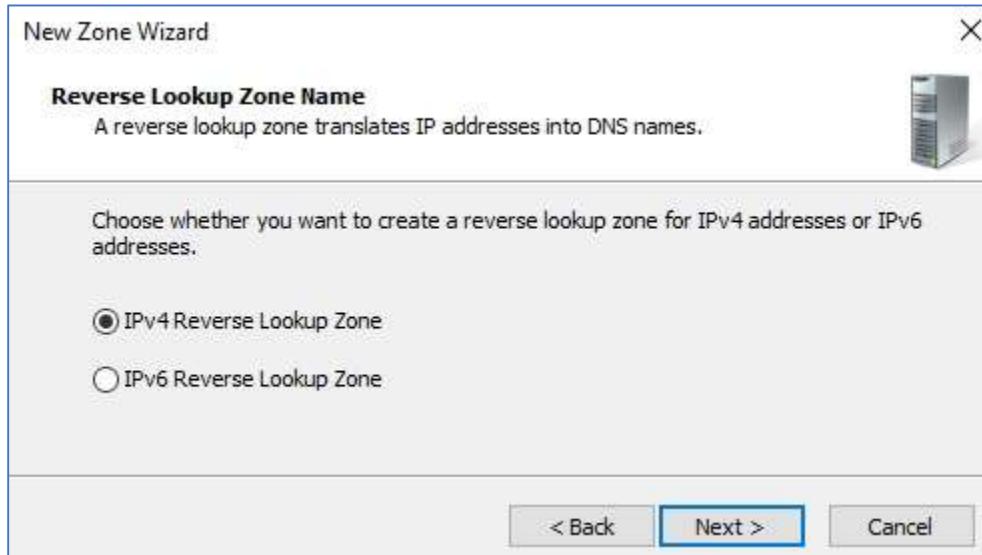
Primary Zone



DNS Servers running Domain Controllers on the Forest



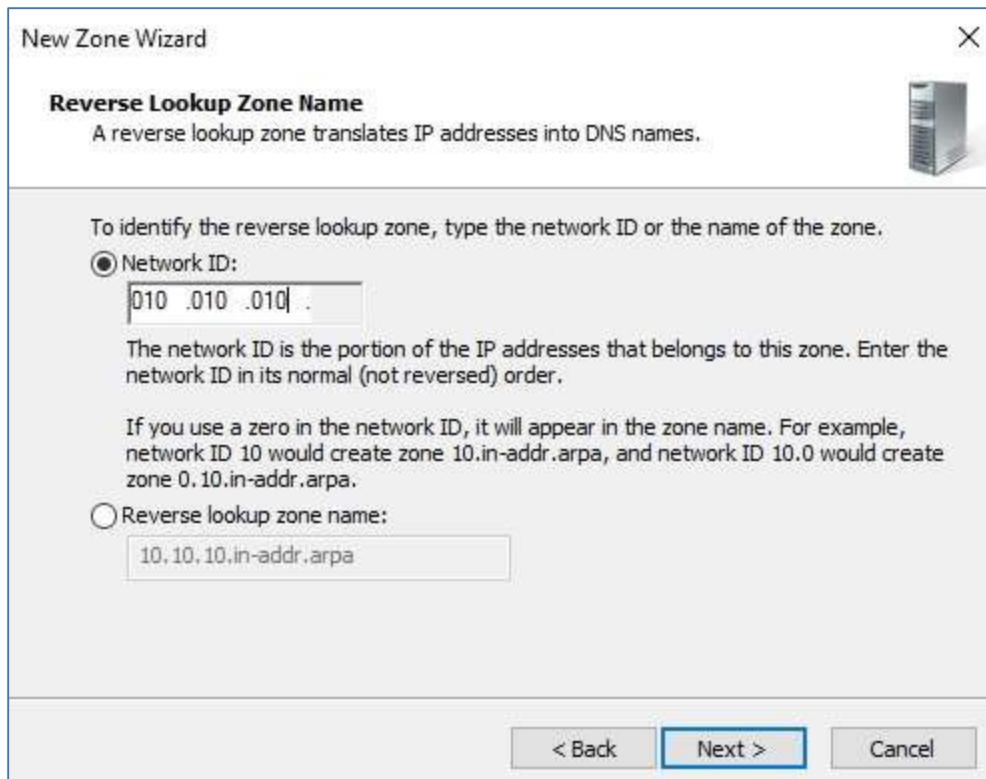
IPV4 Reverse Lookup Zone



Specify the network

Ours is going to be a very small network. Only the last octet will differentiate the hosts on it.

Our network is: 10.10.10



Allow both nonsecure and secure dynamic updates

New Zone Wizard X

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.

[< Back](#) [Next >](#) [Cancel](#)

New Zone Wizard X

Completing the New Zone Wizard

You have successfully completed the New Zone Wizard. You specified the following settings:

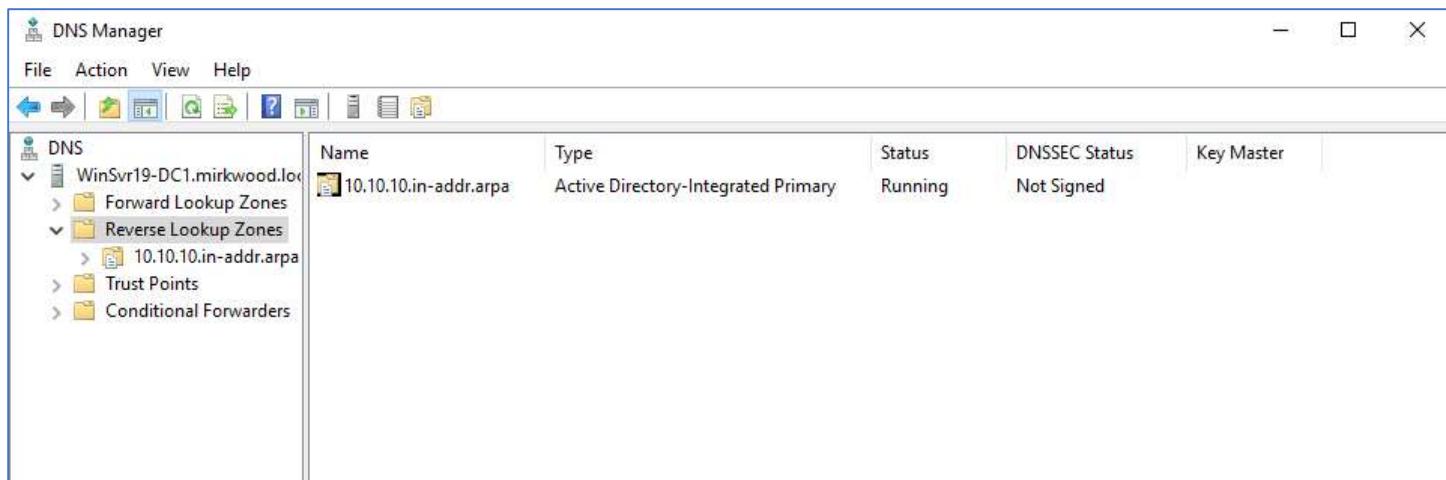
Name:	10.10.10.in-addr.arpa
Type:	Active Directory-Integrated Primary
Lookup type:	Reverse

Note: You should now add records to the zone or ensure that records are updated dynamically. You can then verify name resolution using nslookup.

To close this wizard and create the new zone, click Finish.

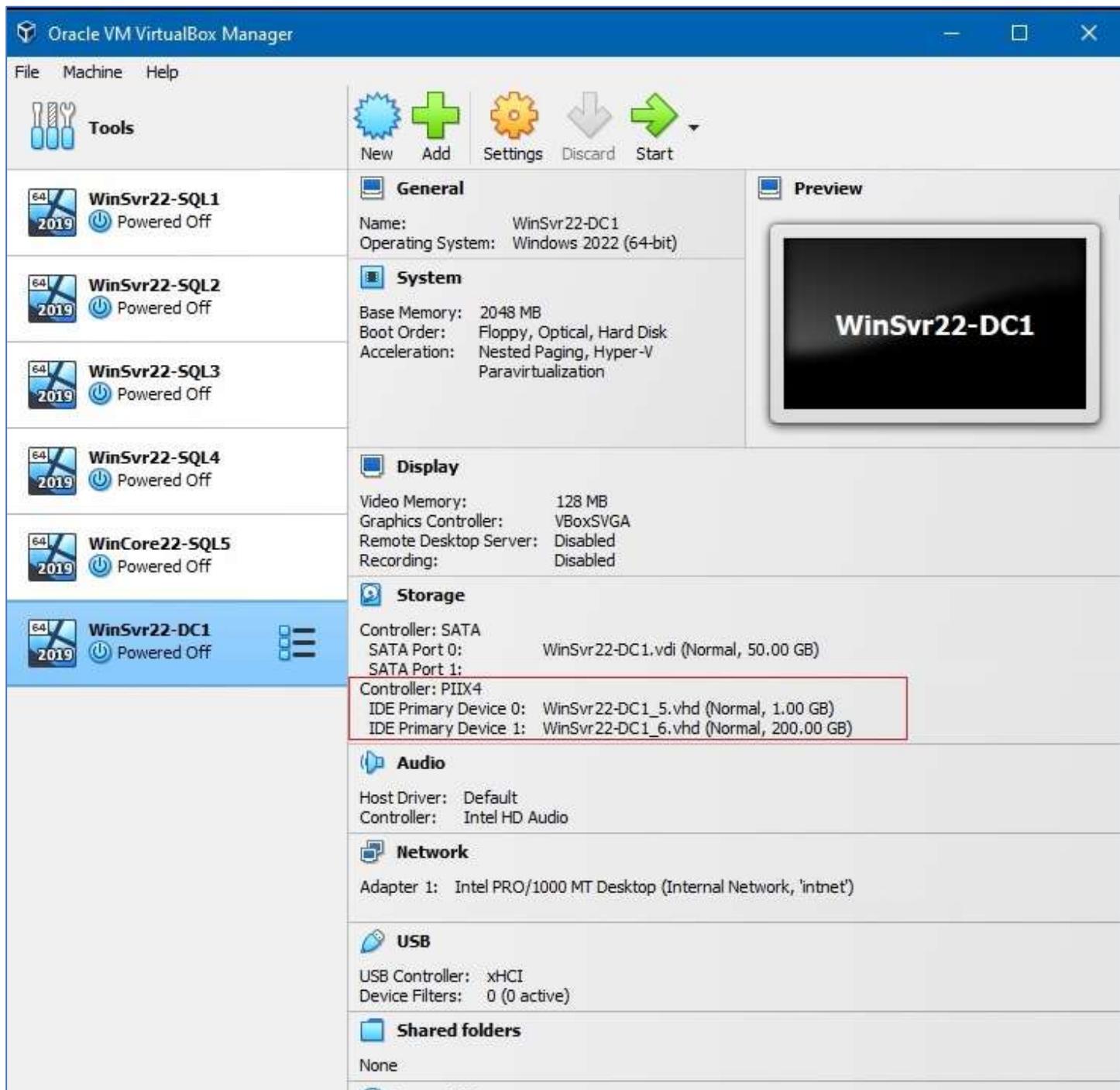
[< Back](#) [Finish](#) [Cancel](#)

DNS Manager shows our new Zone



Step 14) Create iSCSI Storage and Quorum drives

Remember way back at Step 5, when we created an IDE controller on the VM and set up two Virtual Log files of size 1 GB and 200 GB? Now we are ready to set up the iSCSI services that will make these visible as drives for both the Domain Controller and the SQL nodes we will set up later. These are the Storage areas in Virtual Box:



We will be calling the 1 GB virtual hard drive: Q: Quorum

And the 200 GB virtual hard drive as: S: Storage

On Domain Controller - Administrative Tasks – Computer Management – Disk Management

Initially, these disks will probably show in black.

The screenshot shows the Windows Computer Management interface under the Disk Management section. The left navigation pane includes System Tools, Storage (with Disk Management selected), and Services and Applications. The main area displays disk information in a table and a graphical representation of disk partitions.

Table Data:

Volume	Layout	Type	File System	Status
(C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)
(Disk 0 partition 3)	Simple	Basic	NTFS	Healthy (Recovery Partition)
System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)
VBox_GAs_7.0.10 (D:)	Simple	Basic	CDFS	Healthy (Primary Partition)

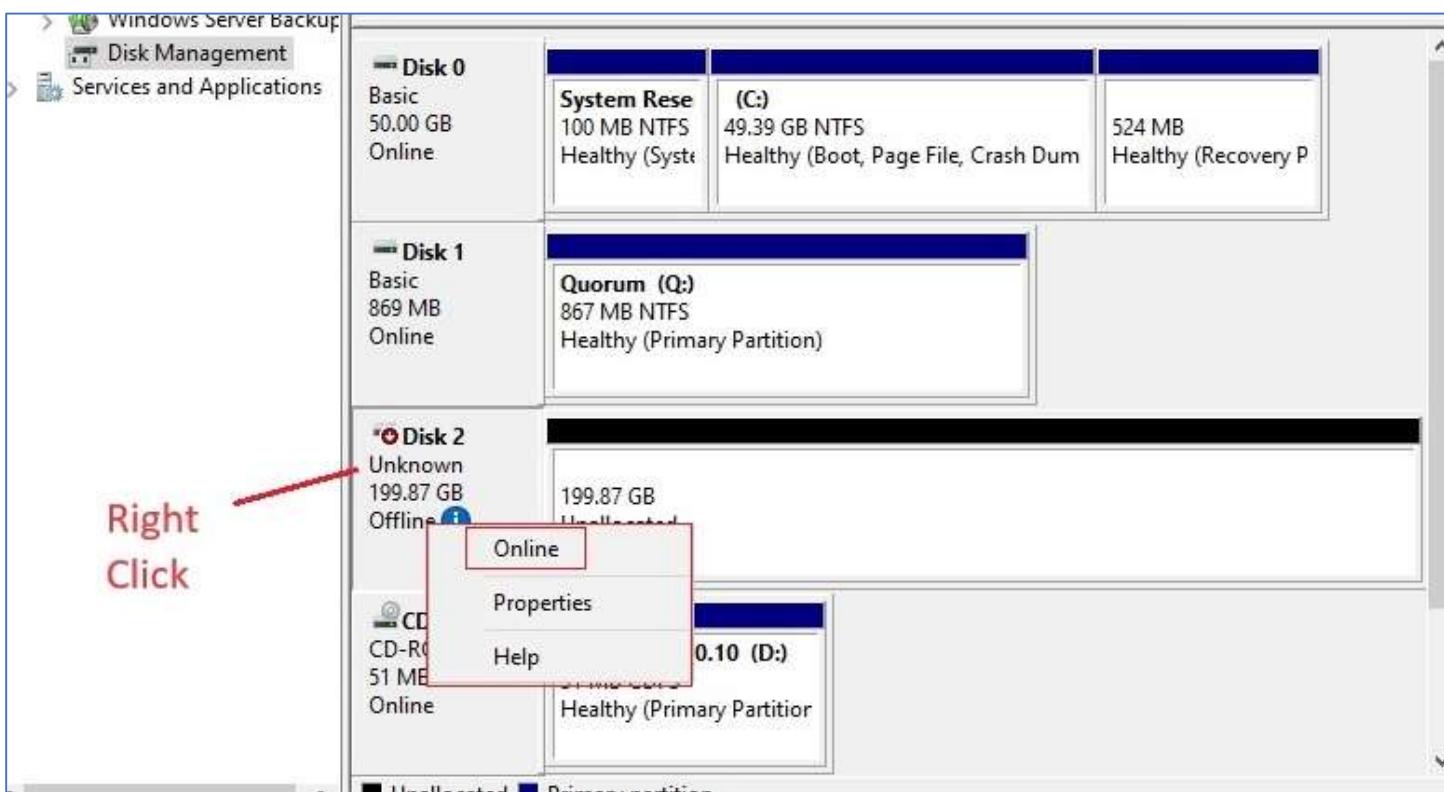
Graphical Representation:

- Disk 0:** Basic, 50.00 GB, Online. Contains:
 - System Reserve (100 MB NTFS, Healthy)
 - (C:) (49.39 GB NTFS, Healthy, Boot, Page File, Crash Dump)
 - 524 MB (Healthy Recovery Partition)
- Disk 1:** Unknown, 870 MB, Offline. Contains: Unallocated (870 MB)
- Disk 2:** Unknown, 199.87 GB, Offline. Contains: Unallocated (199.87 GB)
- CD-ROM 0:** CD-ROM, 51 MB, Online. Contains:
 - VBox_GAs_7.0.10 (D:) (51 MB CDFS, Healthy Primary Partition)
 - Unallocated
 - Primary partition

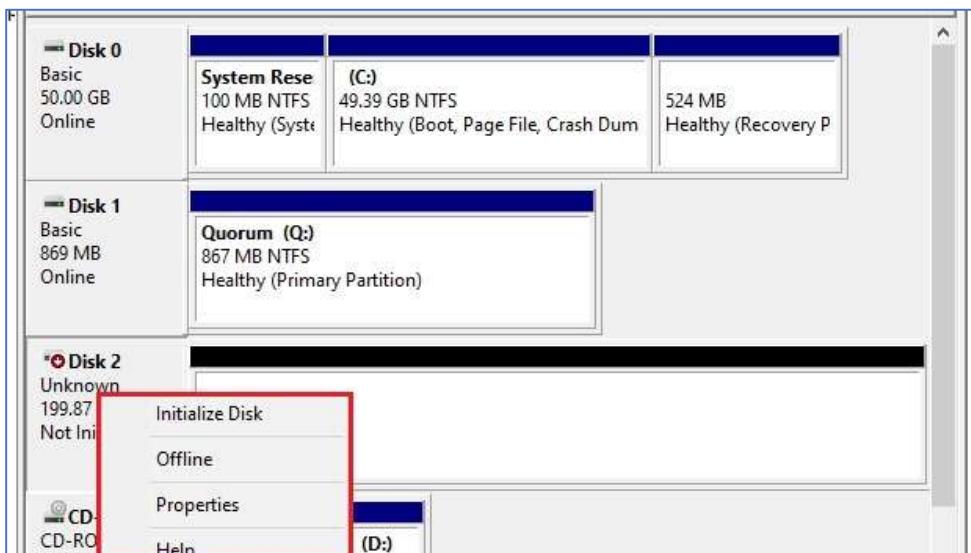
Actions Bar: Disk Management (selected), More Actions.

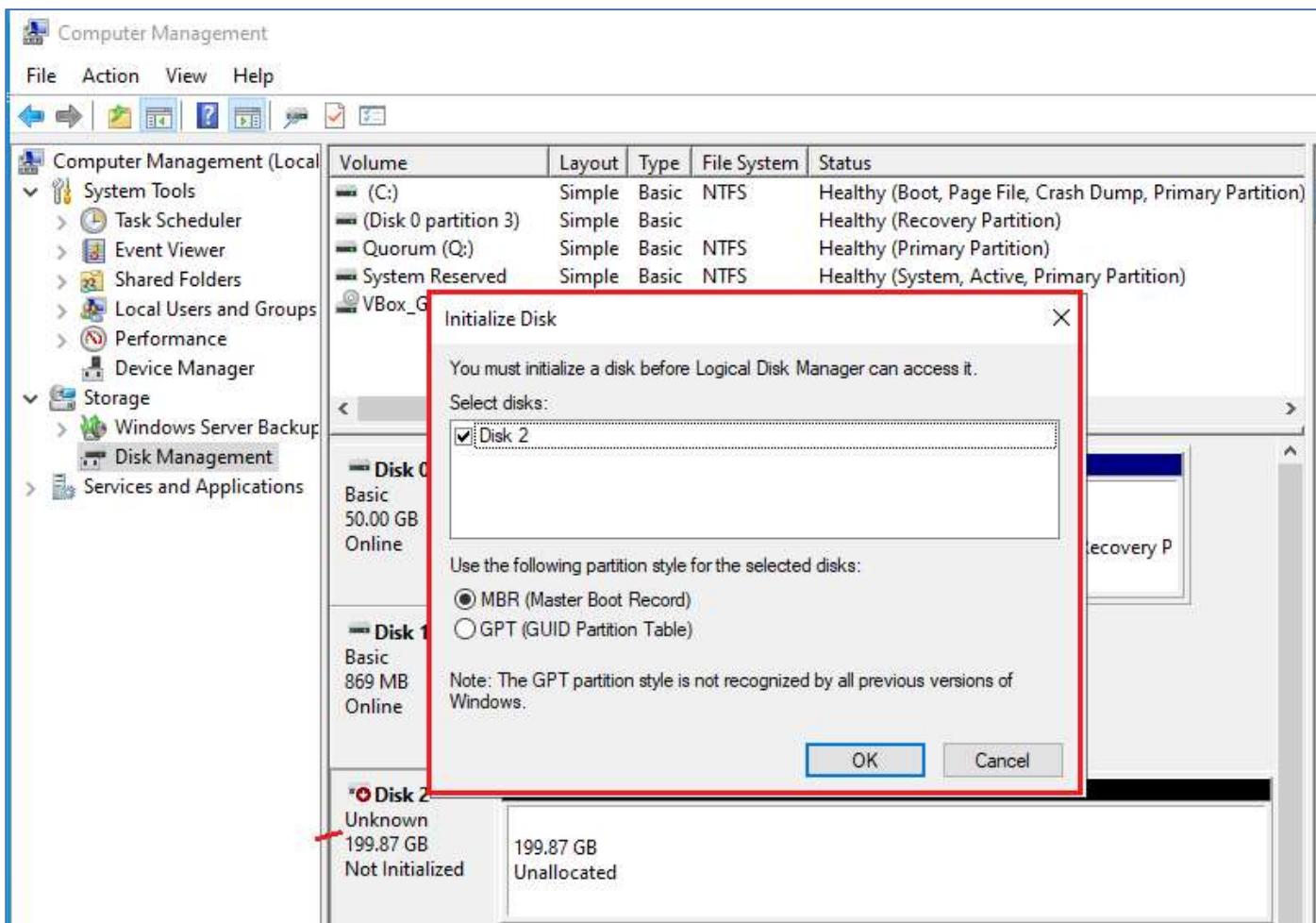
Each of these disks are: Offline, Uninitialized, Offline, and not Formatted - Right Click a disk – I'll do Disk 2, which is the big one, with 200 GB for storage, which will be drive S:

First, bring the disk Online

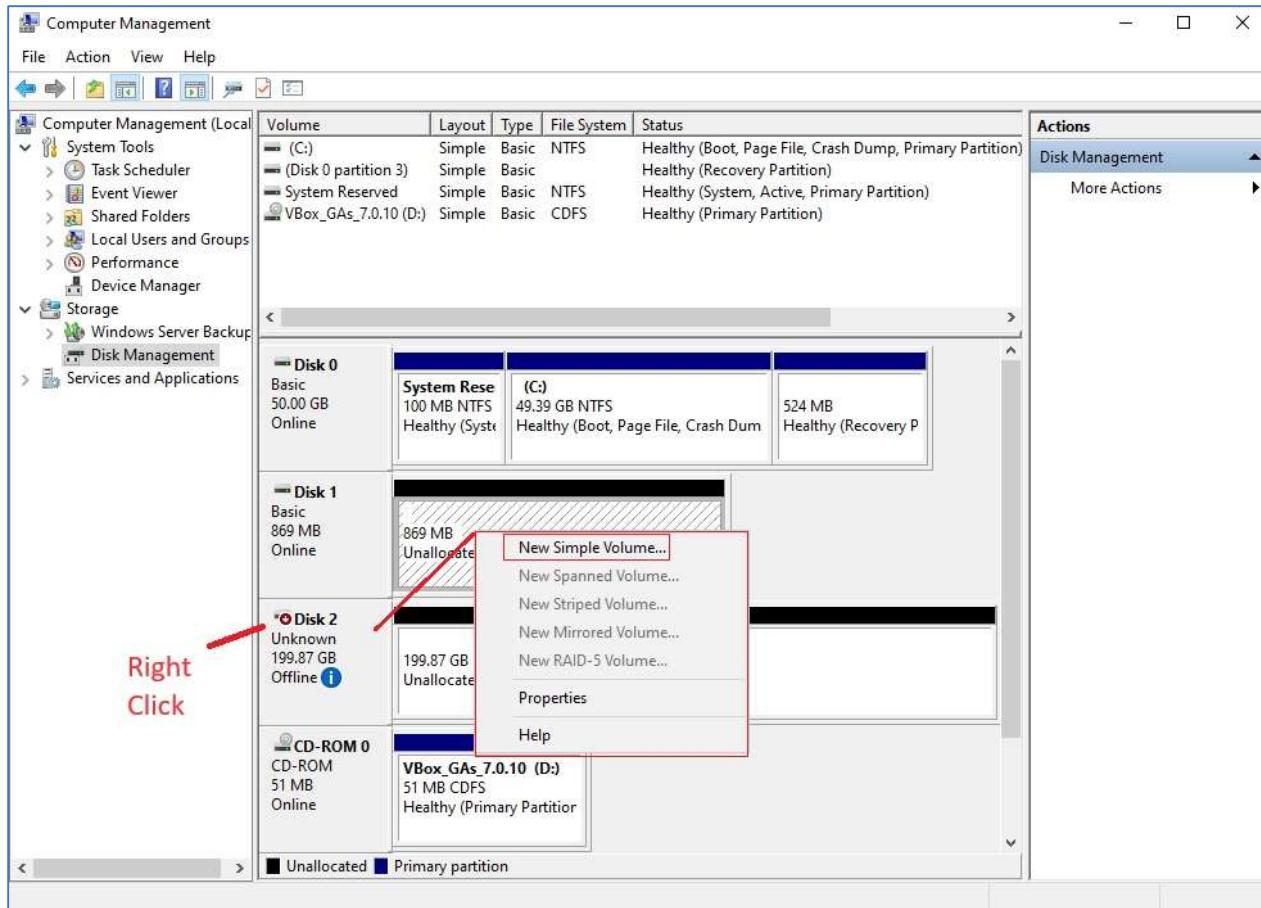


Right click in the same location next to the volume and choose: Initialize Disk





The last step is to format the drive using New Simple Volume wizard

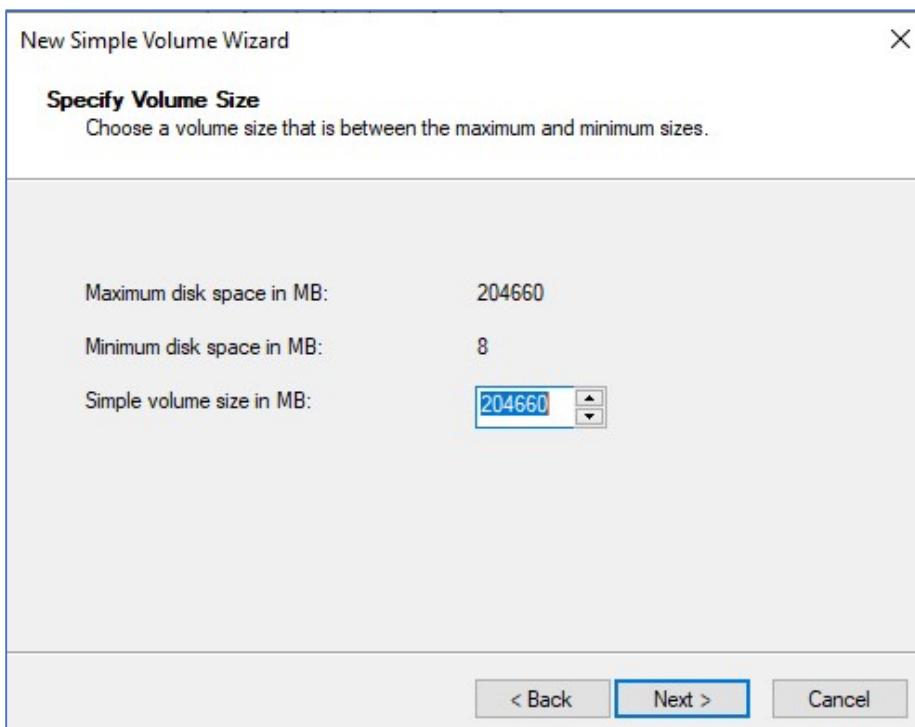


New Simple Volume Wizard

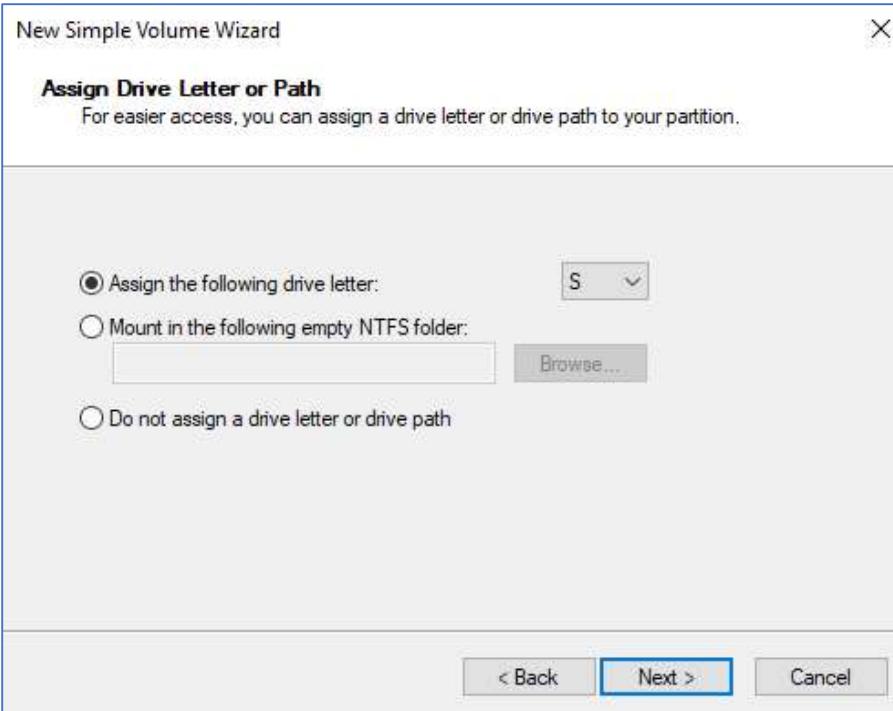


Specify size

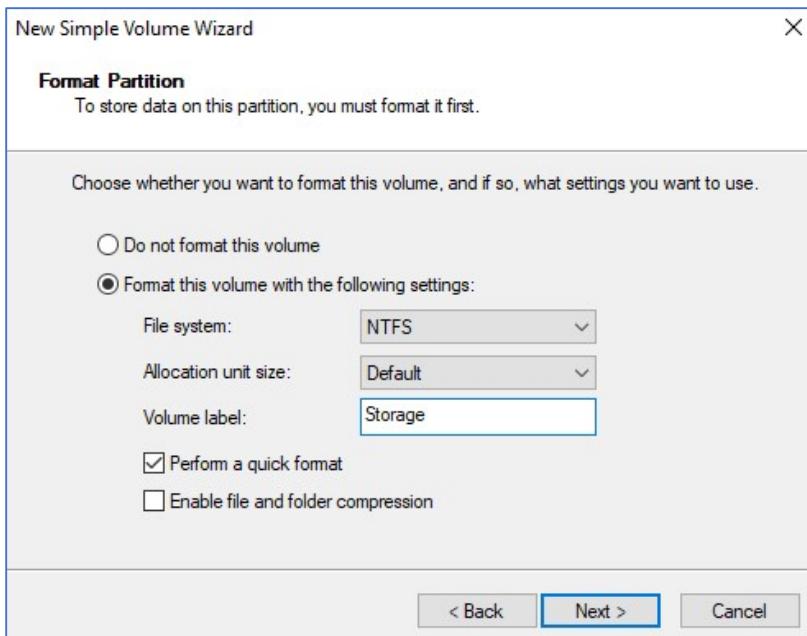
Allocate the maximum available



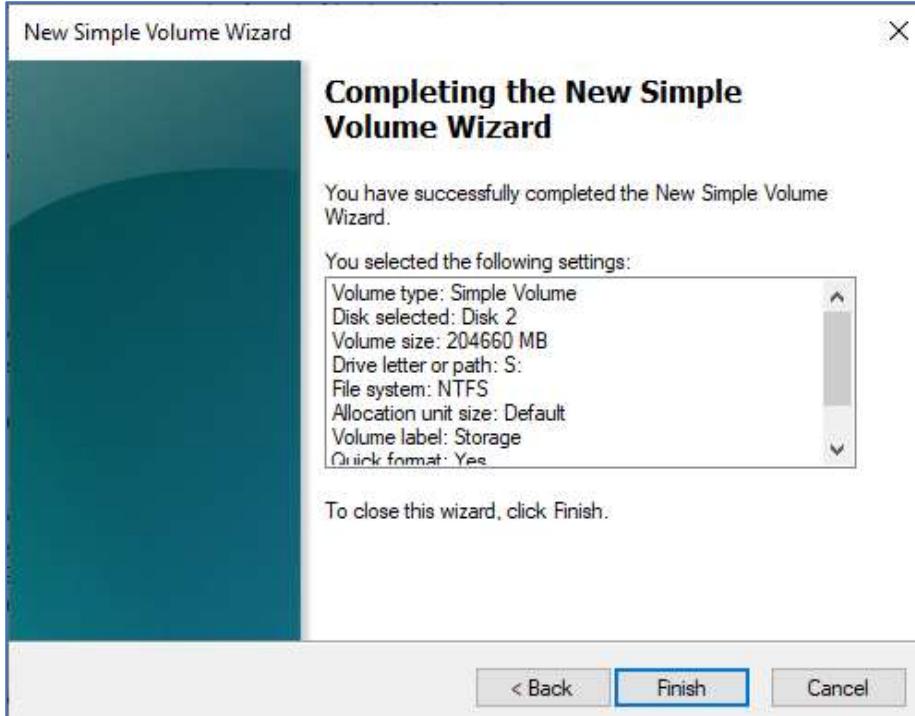
Assign Drive Letter



Assign Volume Label



Confirm



Now do the same thing for the Q: Quorum drive.

Later, when we create the other Virtual Machines and connect them, we won't need to initialize or format the drives, but we will have to adjust the drive letters to Q: and S:

This is what you want it to look like after preparing the storage in Disk Management:

The screenshot shows the Windows Computer Management interface under the Storage section, specifically the Disk Management tool. The left pane lists system tools, storage, and services. The right pane displays disk details:

Volume	Layout	Type	File System	Status
(C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)
(Disk 0 partition 3)	Simple	Basic	NTFS	Healthy (Recovery Partition)
Quorum (Q:)	Simple	Basic	NTFS	Healthy (Primary Partition)
Storage (S:)	Simple	Basic	NTFS	Healthy (Primary Partition)
System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)
VBox_GAs_7.0.10 (D:)	Simple	Basic	CDFS	Healthy (Primary Partition)

Disk 0 details:

Basic 50.00 GB Online	System Rese 100 MB NTFS Healthy (Syste	(C:) 49.39 GB NTFS Healthy (Boot, Page File, Crash Dum	524 MB Healthy (Recovery P
-----------------------------	---	---	-------------------------------

Disk 1 details (highlighted by a red box and callout):

Basic 869 MB Online	Quorum (Q:) 867 MB NTFS Healthy (Primary Partition)	Drive Letter and Volume Labels assigned Healthy
---------------------------	--	--

Disk 2 details:

Basic 199.87 GB Online	Storage (S:) 199.86 GB NTFS Healthy (Primary Partition)
------------------------------	--

CD-ROM 0 details:

CD-ROM 51 MB Online	VBox_GAs_7.0.10 (D:) 51 MB CDFS Healthy (Primary Partition)
---------------------------	--

Legend at the bottom: Unallocated (black square) and Primary partition (blue square).

Now we are going to have to make this storage available through the iSCSI service, so it can be seen by the other computers – which don't exist yet, but will be using this shared storage.

Step 15) Install THREE other Windows Server machines as SQL1, 2, and 3

You're going to need to do Steps 4 though 7 for each of the SQL Servers.

- Set up the VM in Virtual Box. Name them: WinSvr22-SQL1, WinSvr22-SQL2, and WinSvr22-SQL3
- These will have 2 Network Adapters, both of type "Internal Network" (advanced, allow all traffic)
- Install the Operating System, same configurations 3 GB memory, 2 cores, 50 GB drive space.
- Rename the Machines as appropriate through Server Manager – Local server

- e. Set up the first Ethernet adapters, statically routed: 10.10.10.10, 10.10.10.20, and 10.10.10.30 with Netmasks of 255.255.255.0 where the DNS is set to 10.10.10.1 (the domain controller)
- f. Set the second ethernet adapters on: 10.10.20.110, 10.10.20.120, and 10.10.20.130 these will be the heartbeat Ips for the Failover cluster.
- g. Install the Virtual Guest Additions
- h. Make sure that all the nodes can ping each other.

	Domain NIC	Heartbeat NIC	NetMasks
WinSvr22-SQL1	10.10.10. 10	10.10. 20.110	255.255.255.0
WinSvr22-SQL2	10.10.10. 20	10.10. 20.120	255.255.255.0
WinSvr22-SQL3	10.10.10. 30	10.10. 20.130	255.255.255.0

Step 16) Add these computer to the domain

Log back in to WinSvr22-SQ1 and then add this computer to the domain:

Server Manager – Local Server - Click on this server's name: Click "Change"

Member of

(*) Domain
mirkwood.local

OK

You will have to enter the "Administrator" account name and password to authorize joining the domain
It will prompt you for that account name and password.

After clicking OK, this computer should be joined to the domain, and say:

Welcome to the mirkwood.local domain

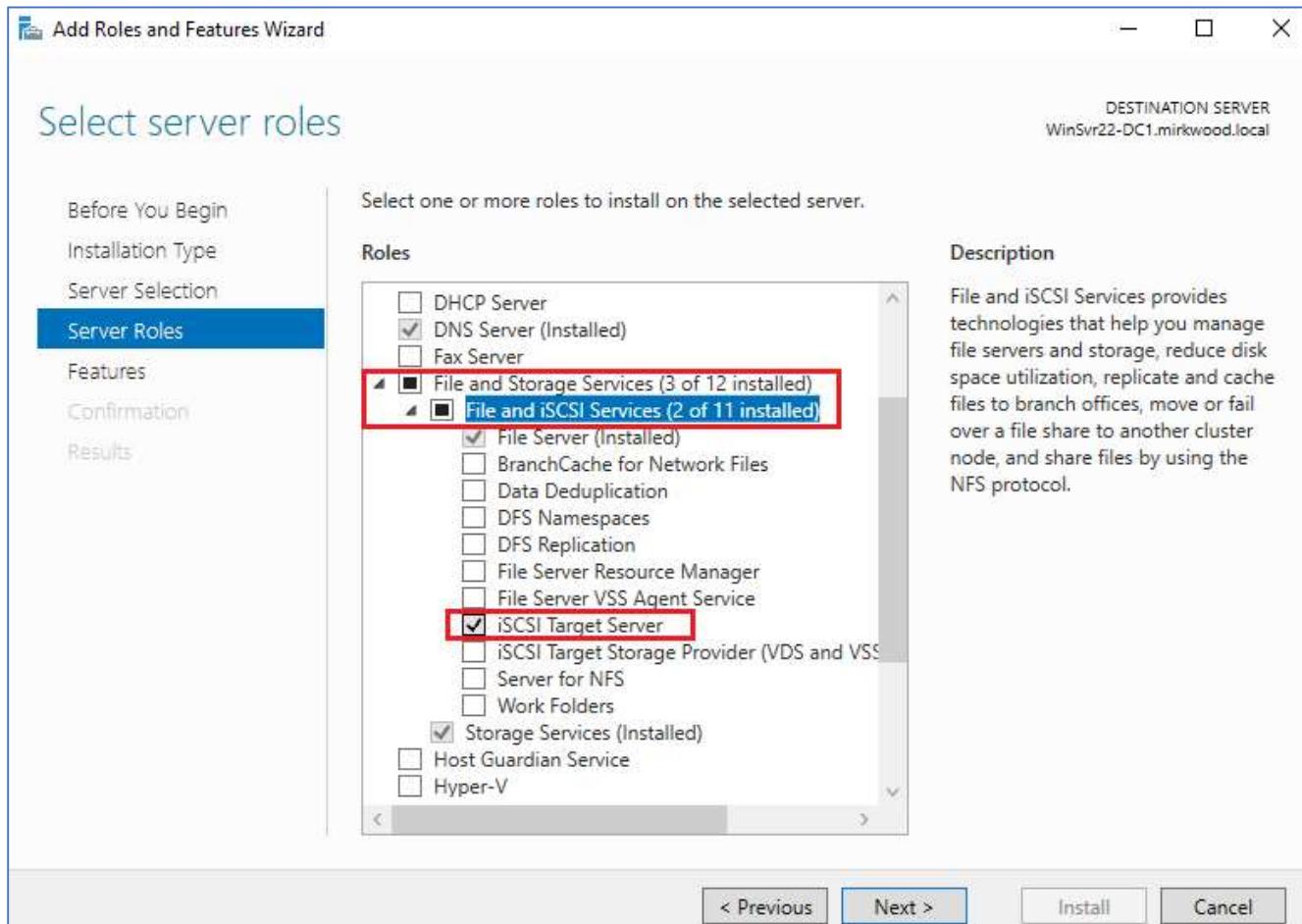
Re-Start this server.

When starting back up, you should log in under the Domain account: :

FBaggins
with whatever password you set up for him

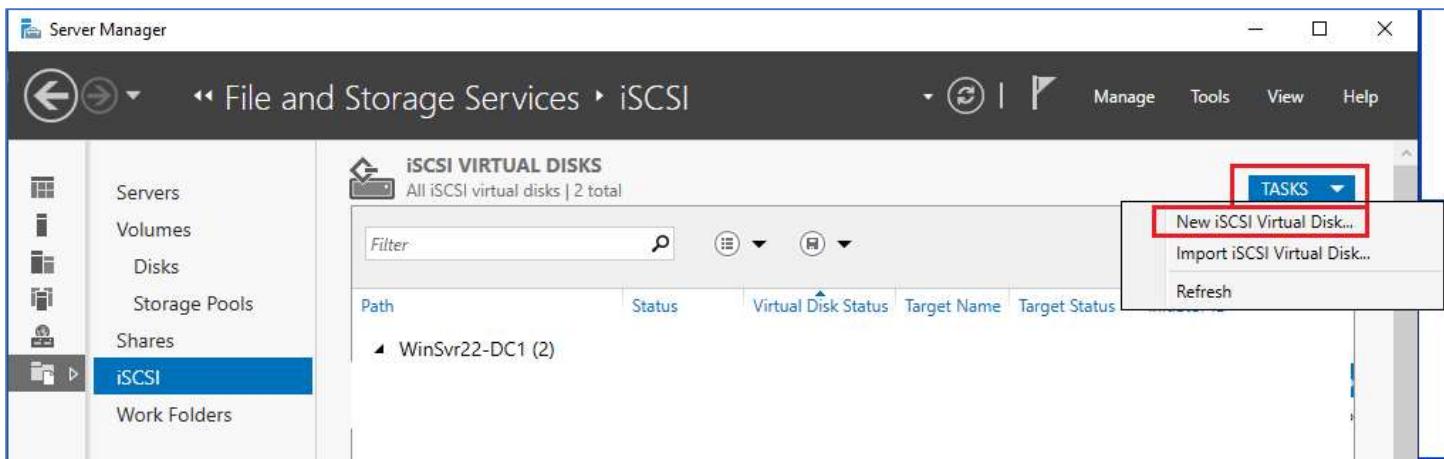
Step 17) Install the iSCSI Target on the Domain Controller WinSvr22-DC1

Server Manager – Add Roles and Features – click next to Features.



Go through the Install as normal.

Server Manager – Files and Storage Services - iSCSI

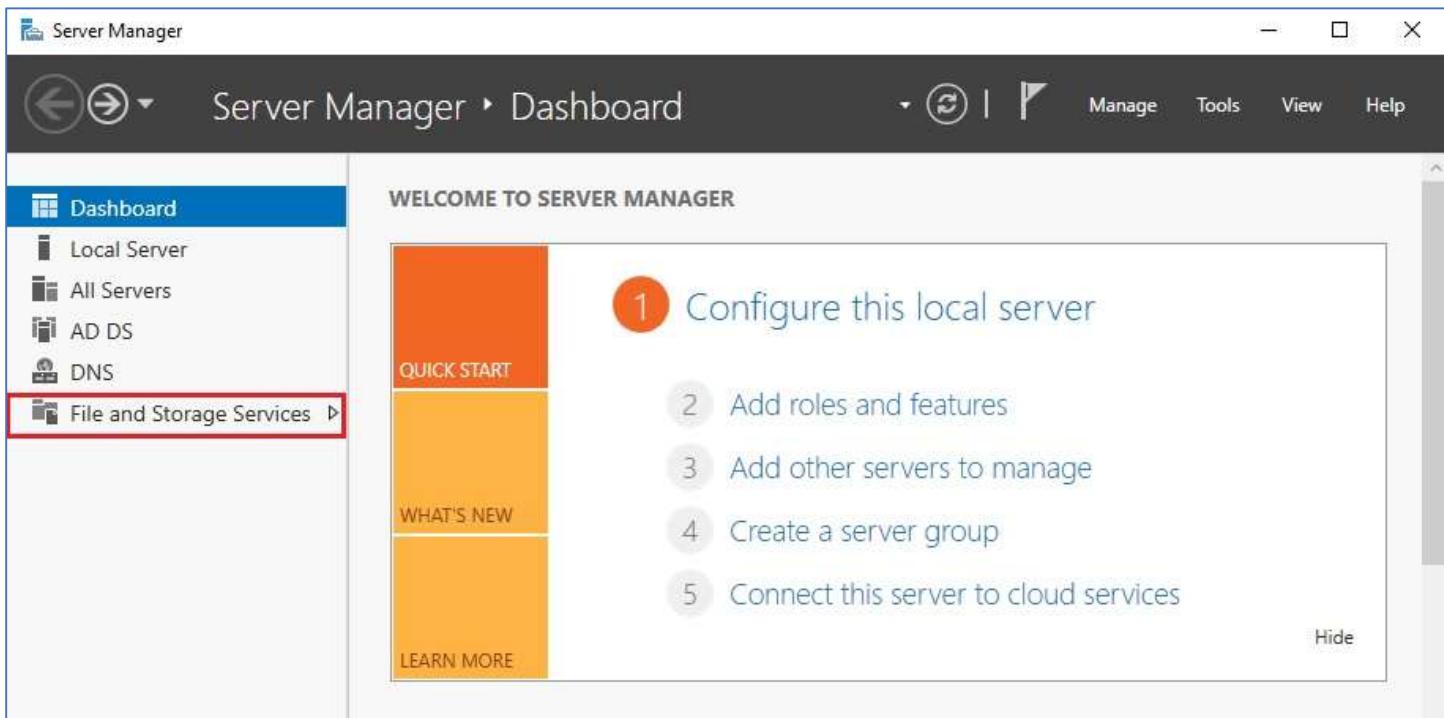


Step 18) Set up the iSCSI Target

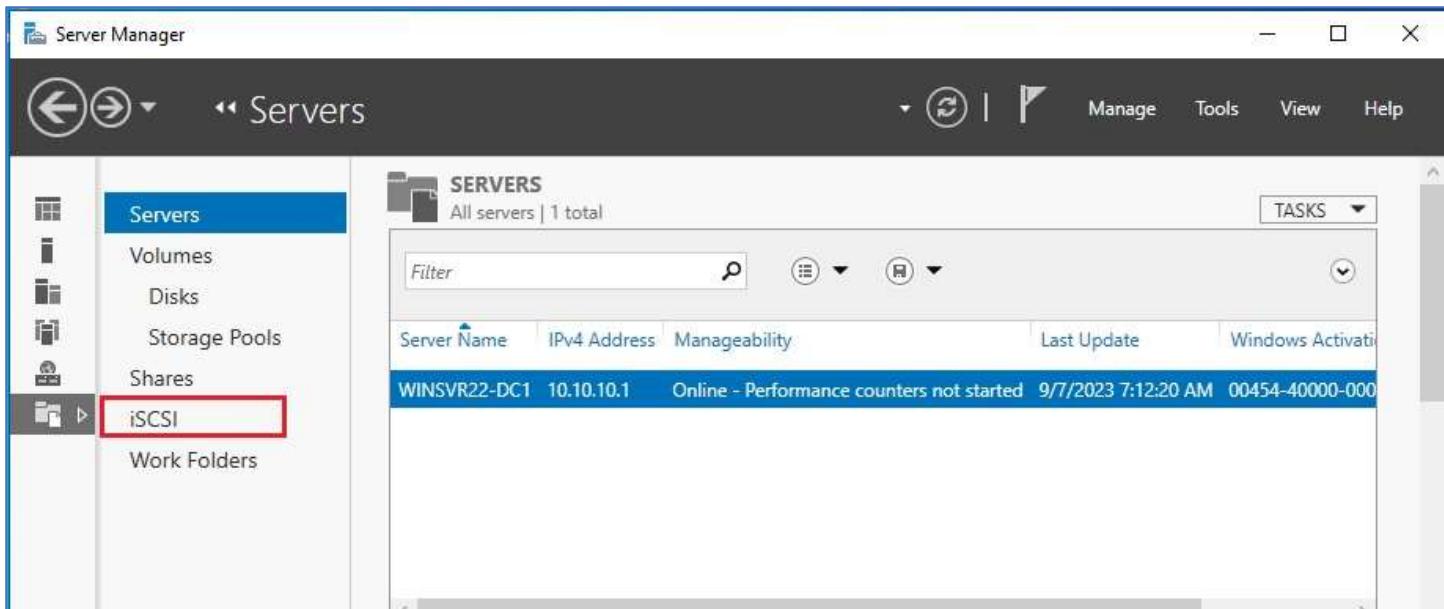
Now we need to make those two drives (Q: and S:) available as shared storage, visible to the SQL machines.

Log into WinSrv22-DC1 as **MIRKWOOD\Administrator** (**not the Fbaggins account? No..**)

Server Manager – Files and Storage Service – click the right arrow

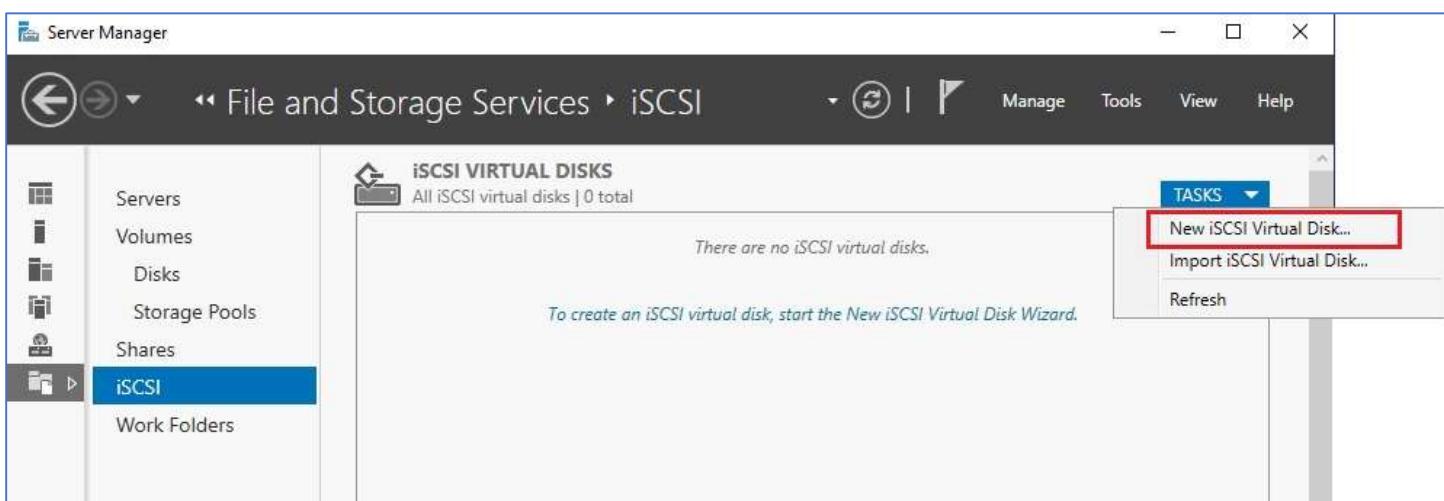


Choose iSCSI



Create a New iSCSI Virtual disk

Click Tasks – and choose New iSCSI Virtual Disk



Let's choose Q: first. We'll have to do all of this for S: afterward.

New iSCSI Virtual Disk Wizard

Select iSCSI virtual disk location

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

Server:

Server Name	Status	Cluster Role	Owner Node
WinSvr22-DC1	Online	Not Clustered	

i 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:	39.1 GB	49.5 GB	NTFS
Q:	904 MB	921 MB	NTFS
S:	200 GB	200 GB	NTFS

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

Type a custom path:

[< Previous](#) [Next >](#) [Create](#) [Cancel](#)

Choose Q: and click Next

Then provide a Name and Description

New iSCSI Virtual Disk Wizard

Specify iSCSI virtual disk name

ISCSI Virtual Disk Location

ISCSI Virtual Disk Name

ISCSI Virtual Disk Size

ISCSI Target

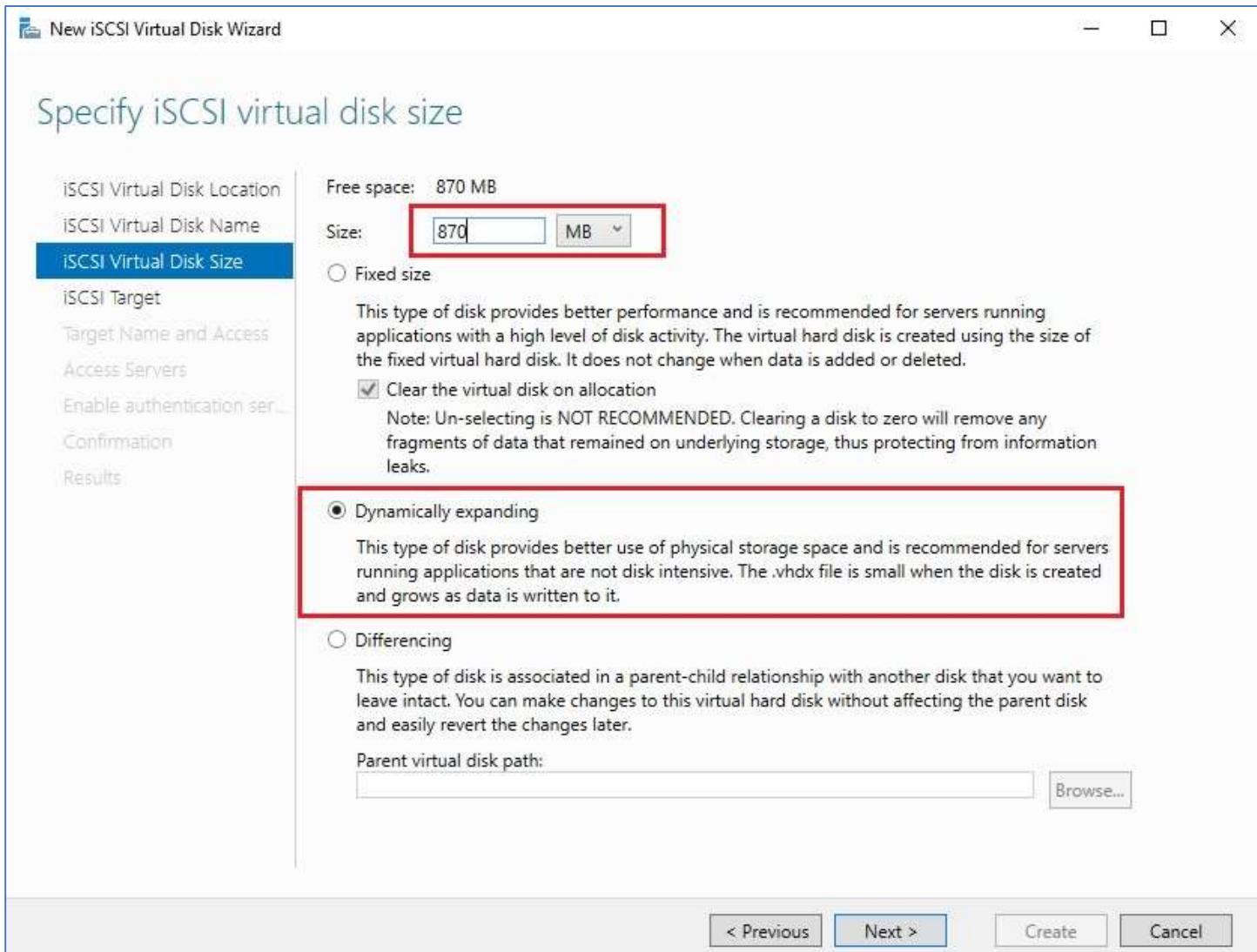
Name:

Description:

Path:

[< Previous](#) [Next >](#) [Create](#) [Cancel](#)

Specify to use all the available size, and make it Dynamically Expanding:



Terminology

The drive itself that is being used, is called the **iSCSI Target**.

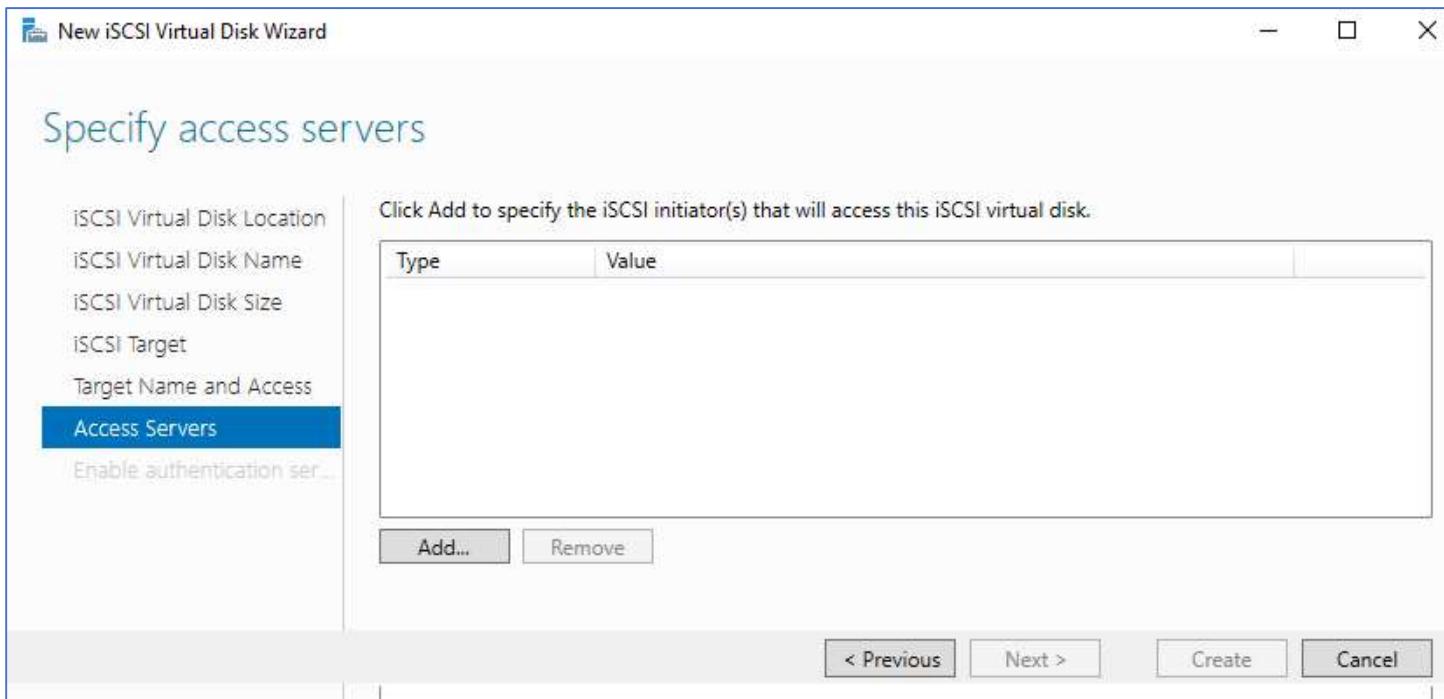
This is defined in the Domain Controller (but does not have to be. It could be on a totally separate server.)

The SQL Nodes which will use the drive, are called **iSCSI Initiators**.

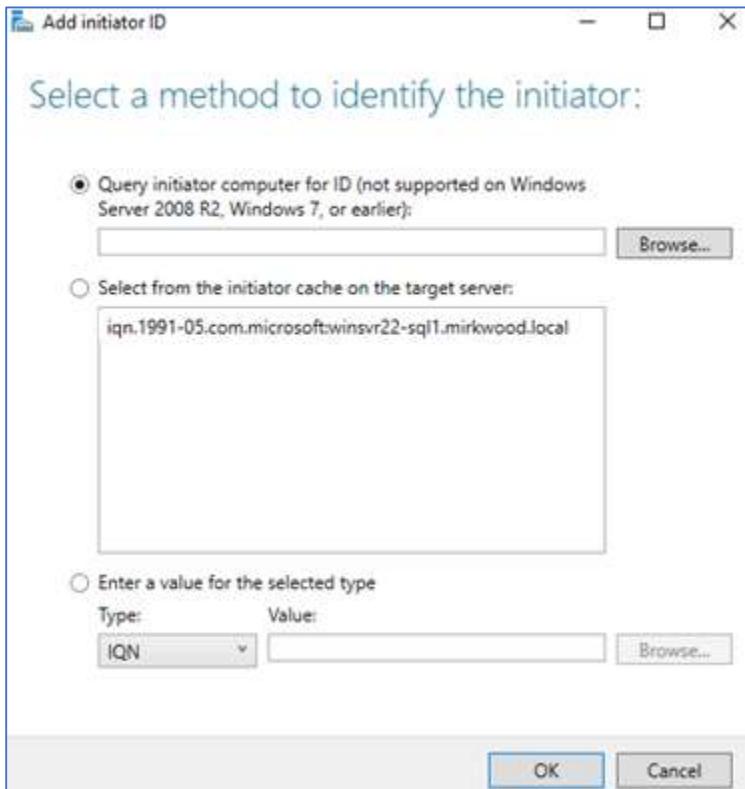
When you have set up the iSCSI Targets: Q: Quorum and S: Storage then we will be done with this for the moment.

This Virtual Machine (the Domain Controller) can use these drives now, however, this storage is not "for" it.

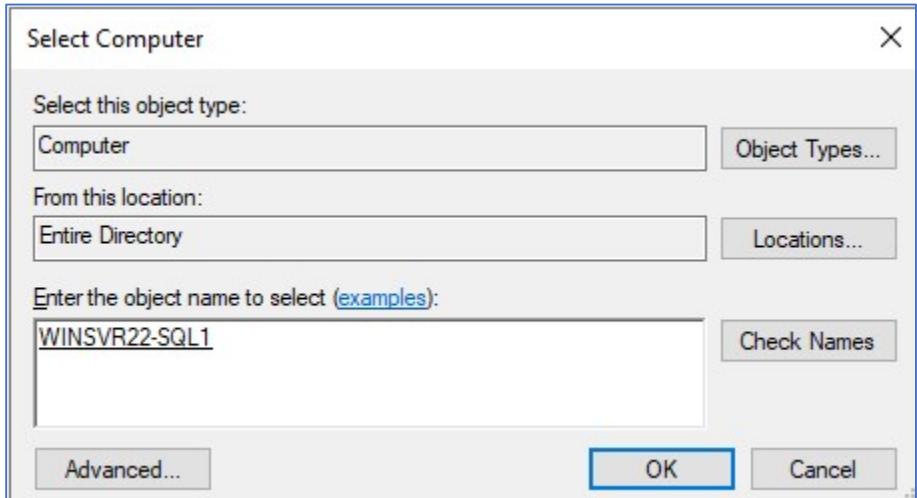
Step 19) Add each of the SQL nodes as Access Servers to the iSCSI devices



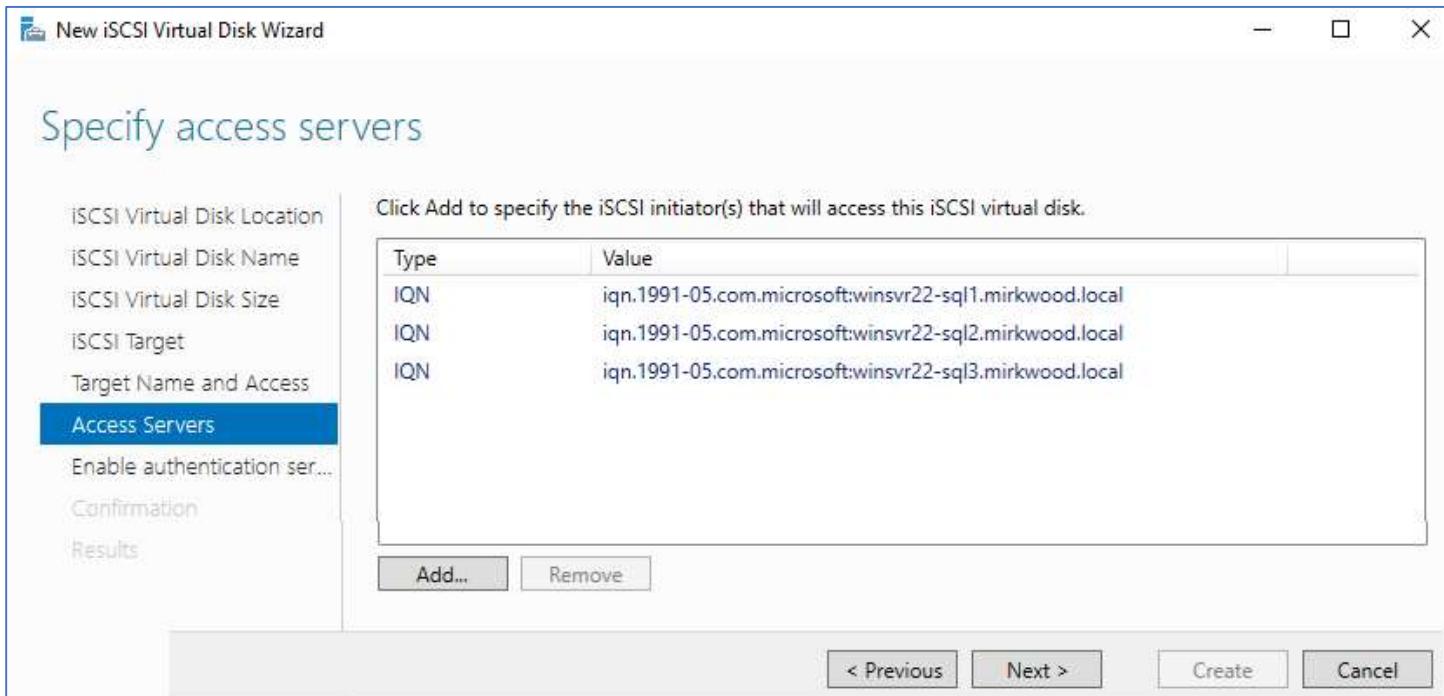
Click the "Add" button, and you will be brought to this dialog. Use the Browse button to get into a dialog that allows you to specify the Server Name and search for them. As you bring the 3 nodes in – it will show their server names. This is Adding the Initiators. The 3 SQL machines will be the Initiators.



Browse for the computer names

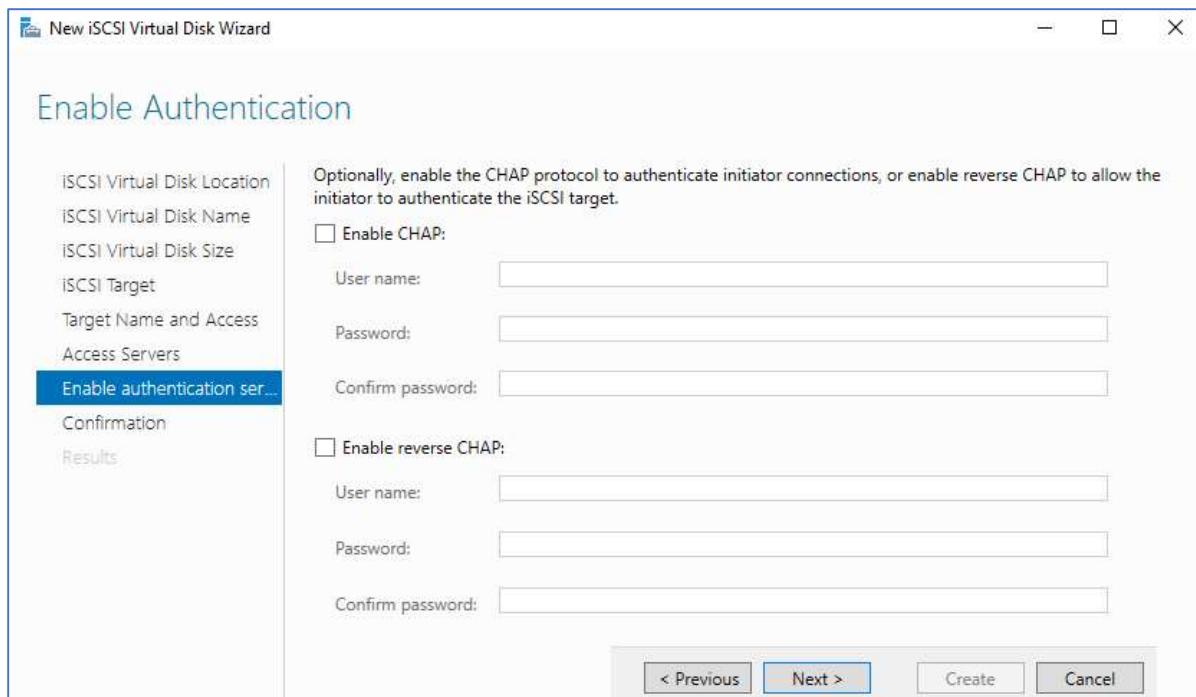


Get all 3 of them in there:

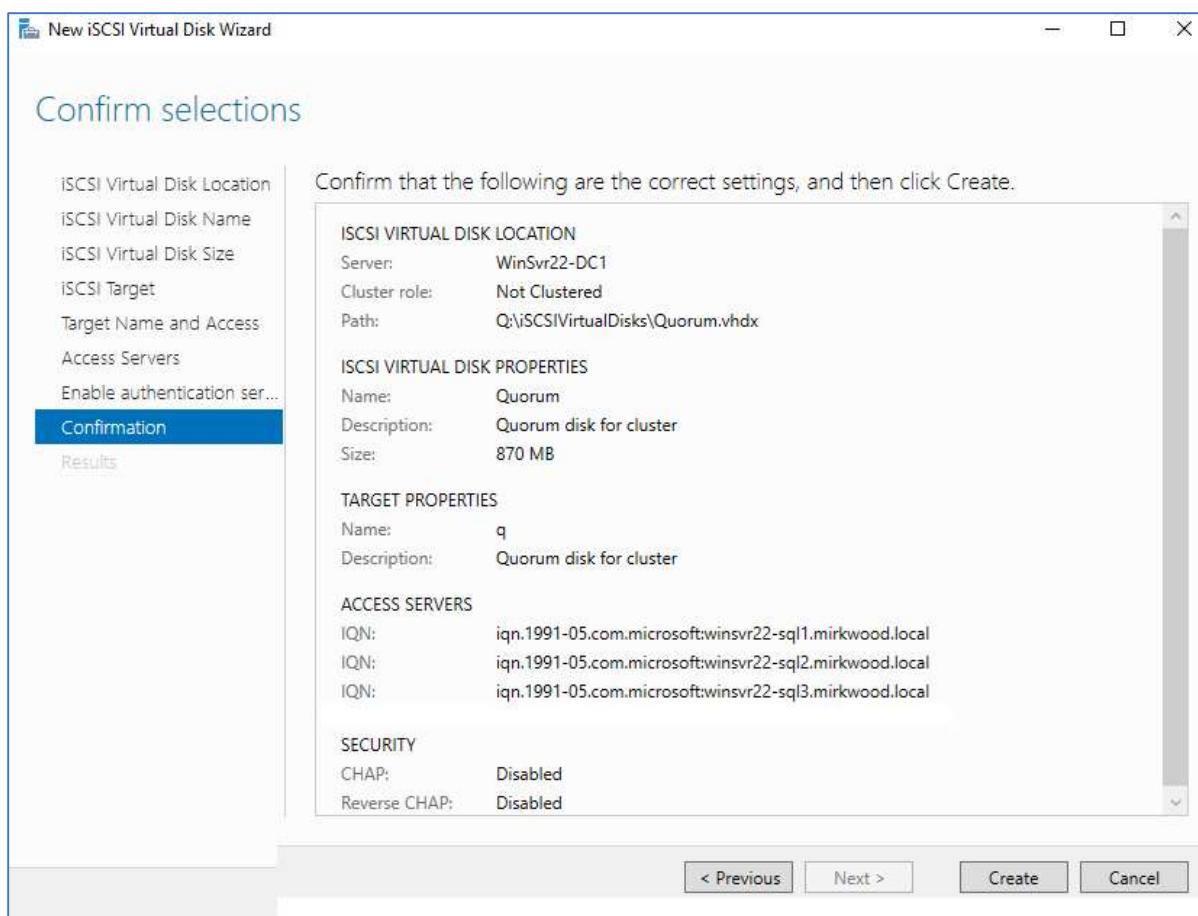


Click Next when you have all 3 of them in there.

You'll now be at a screen to enable authentication. We can skip this.



Don't check anything here, but just click Next



Click the "Create" button.

NOW repeat this entire Step over again for drive S: (Storage) – creating the Target, and identifying the SQL nodes as the Access Servers.

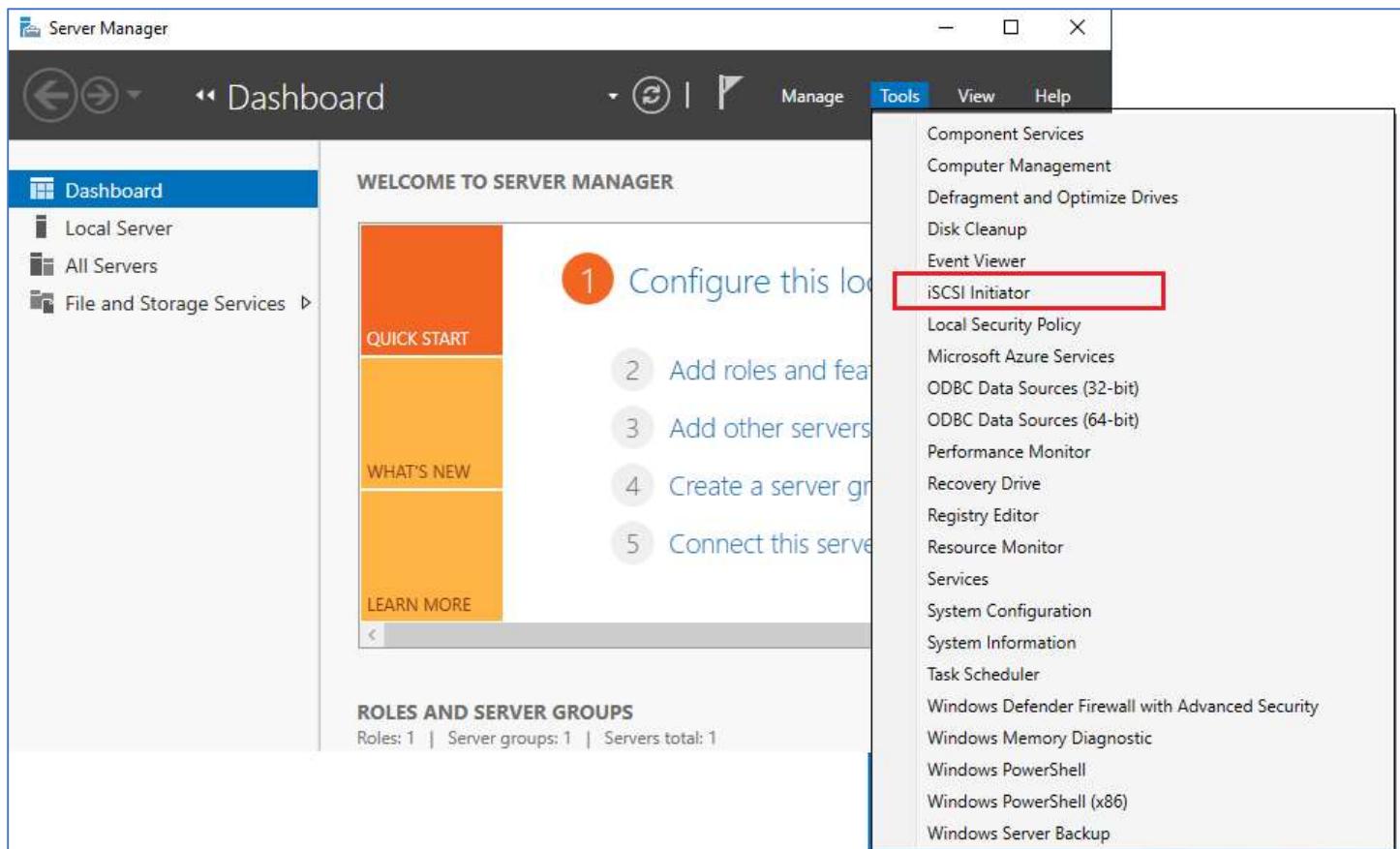
Step 20) Set up iSCSI Initiators on the 3 SQL machines

Now, we have to install the iSCSI Initiator feature on these 3 machines

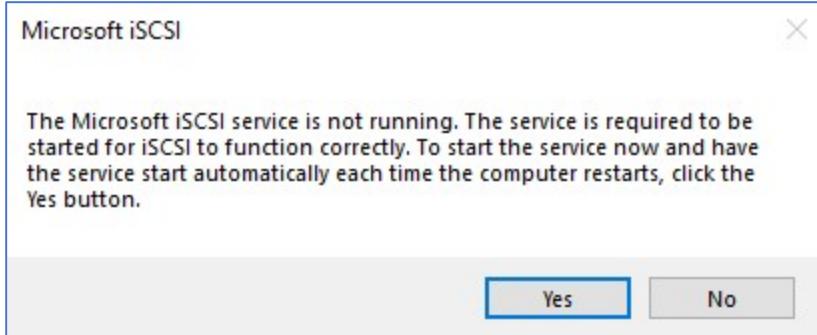
Log into each WinSvr22-SQL1, SQL2, and SQL2 – as the Domain Administrator
MIRKWOOD\Administrator

Then in each of the 3 SQL machines – Pull the Target.

Server Manager – Tools – iSCSI Initiator

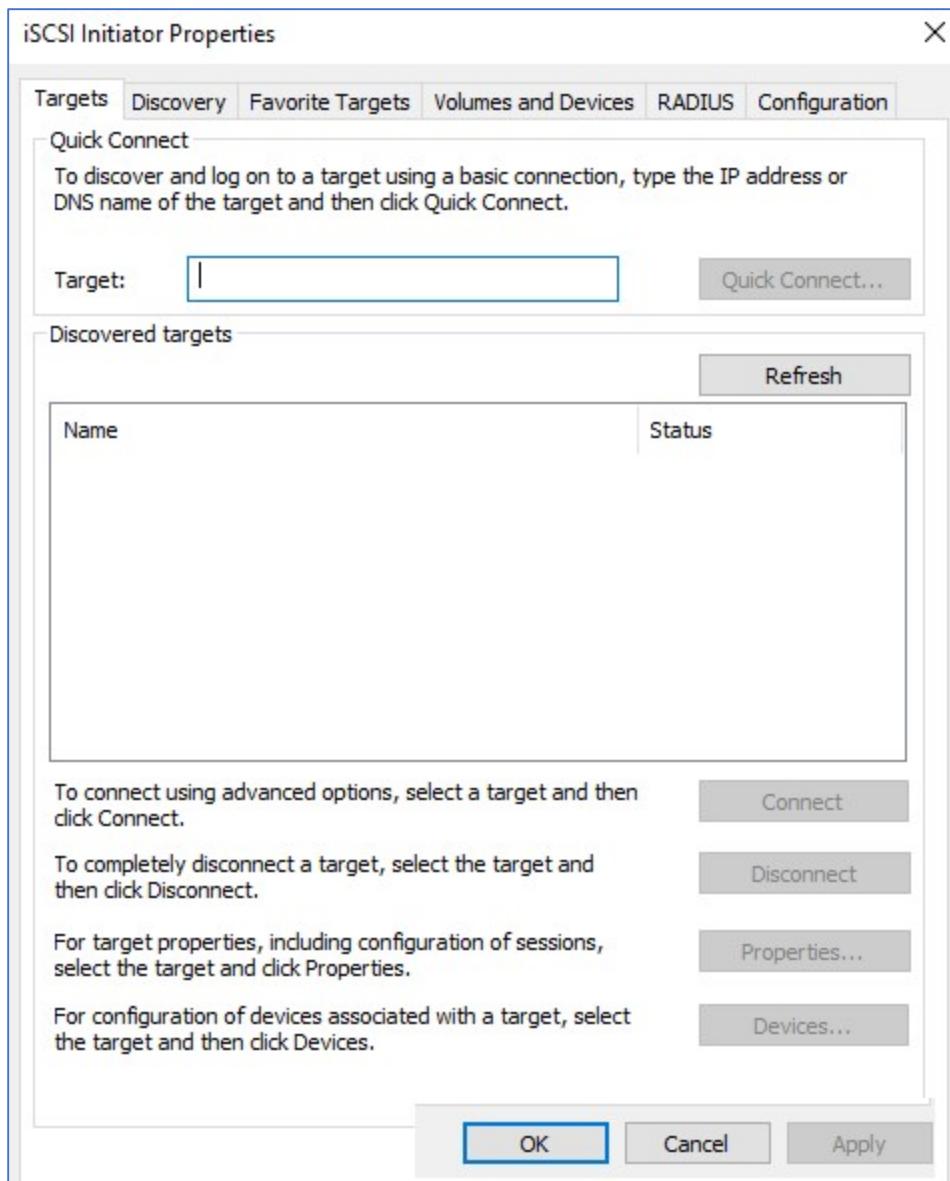


You will get a message that the iSCSI service is not started on this machine, and would you like to start it now, and at boot time. Click Yes

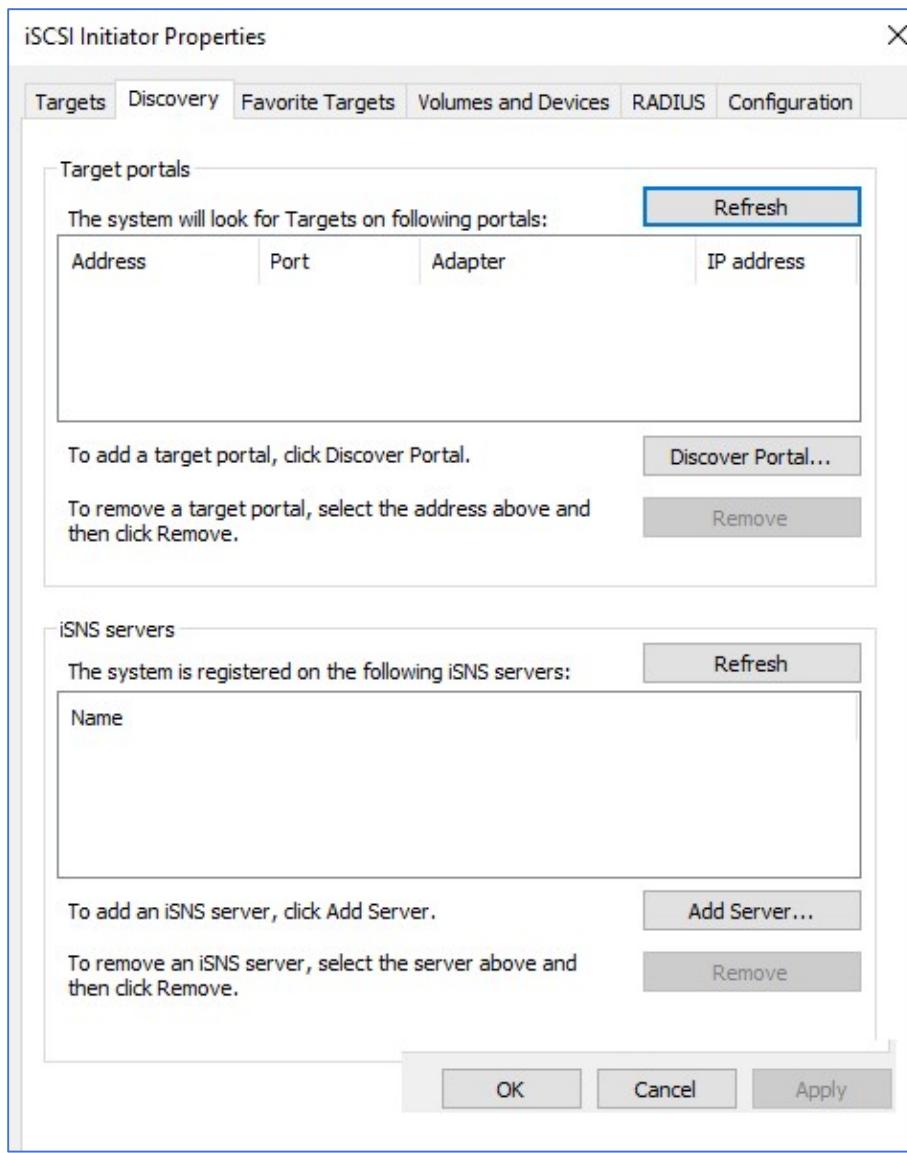


You will now be in a screen to help identify where the iSCSI Target drives are.

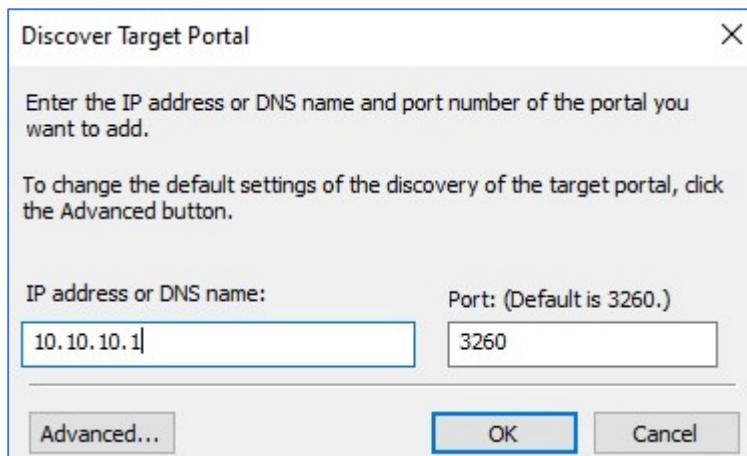
They are on the Domain Controller, at 10.10.10.1



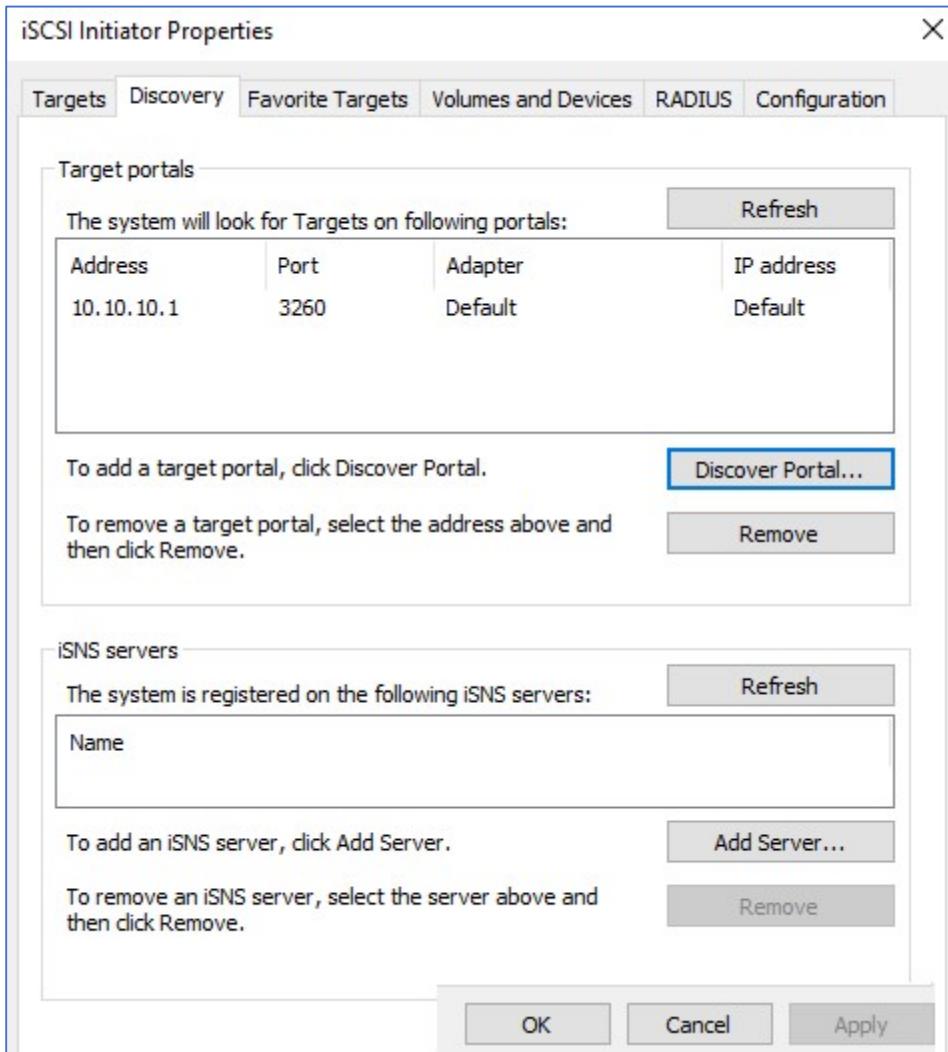
Click on the "Discovery" tab



Click the button "Discover Portal", and enter 10.10.10.1 (the Domain Controller's IP address) and accept the default port of 3260.



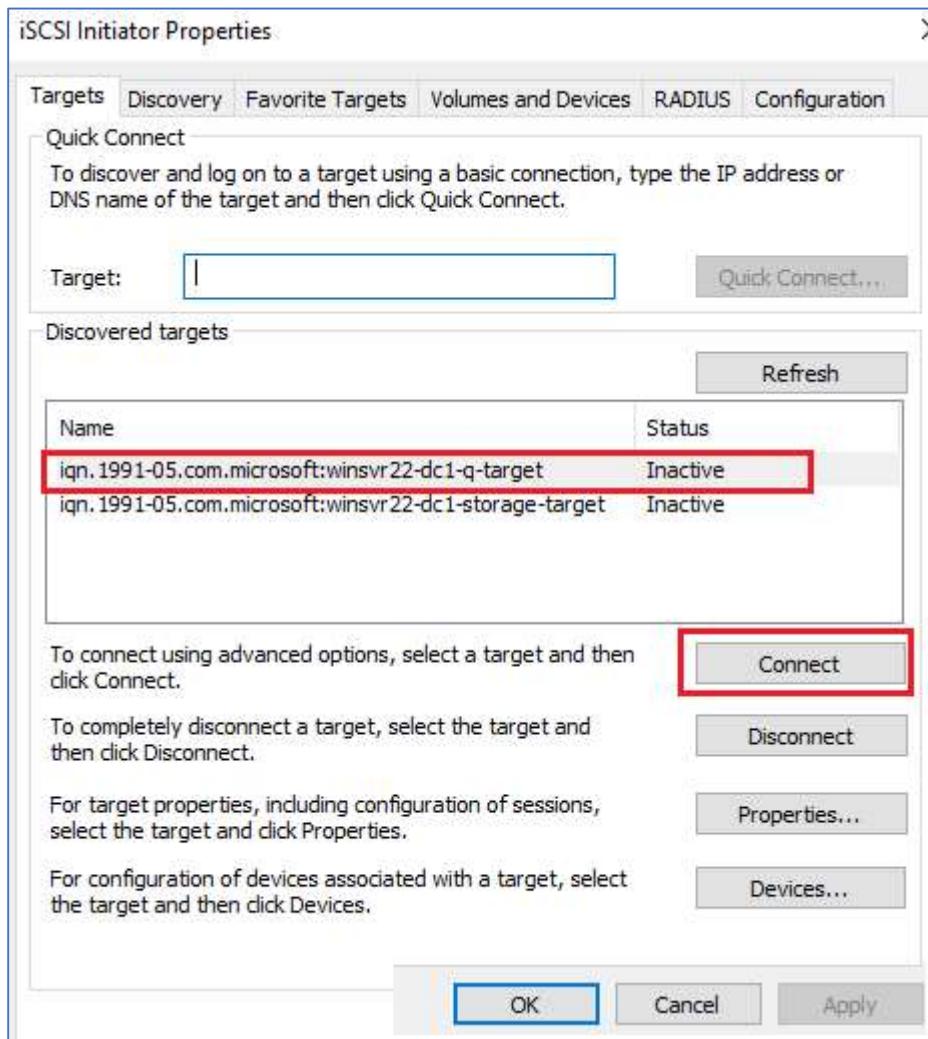
Now it knows the IP address of where the iSCSI Target is



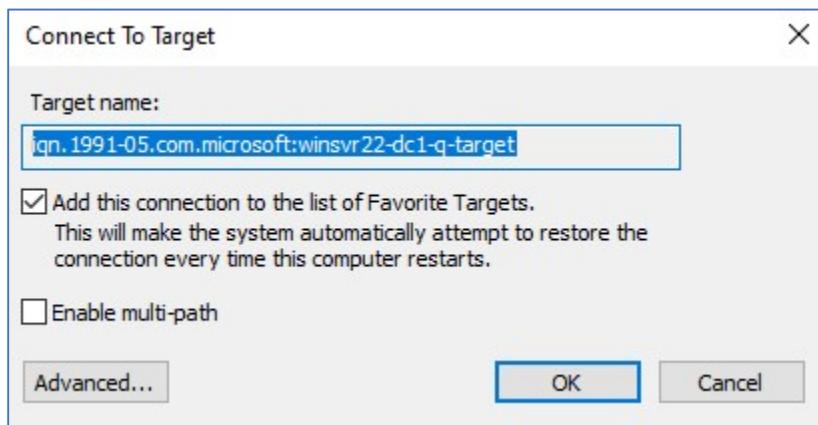
Click OK – and go to the Targets tab. Click Refresh, and you should see the entries for the Q: and S: drives:

Click OK, and back at the iSCSI Initiator Properties screen, it should show each of the Targets.

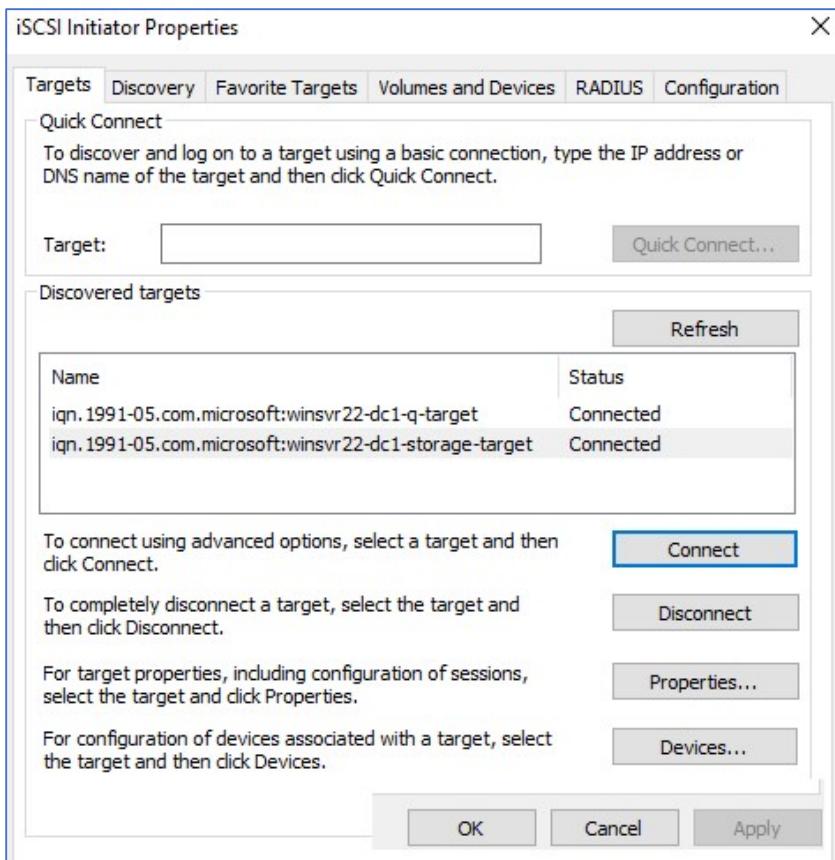
Click on the first one, and click Connect. Then the second one, and click Connect.



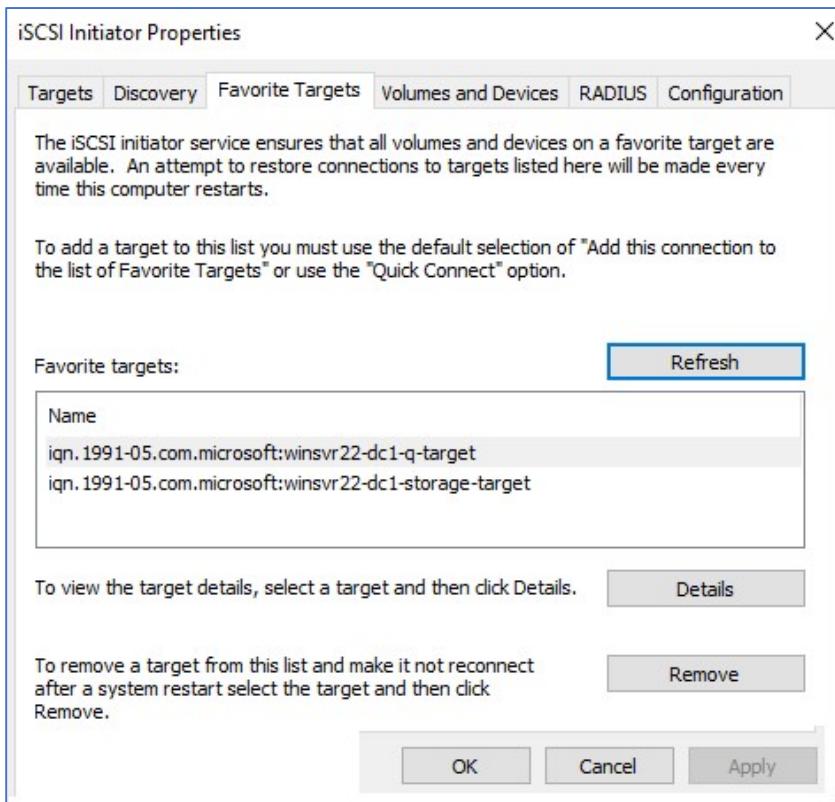
For each one, you will get this dialog:



Click OK



They should now show "Connected". Now click on the "Favorite Targets" tab, and see that they are both listed:



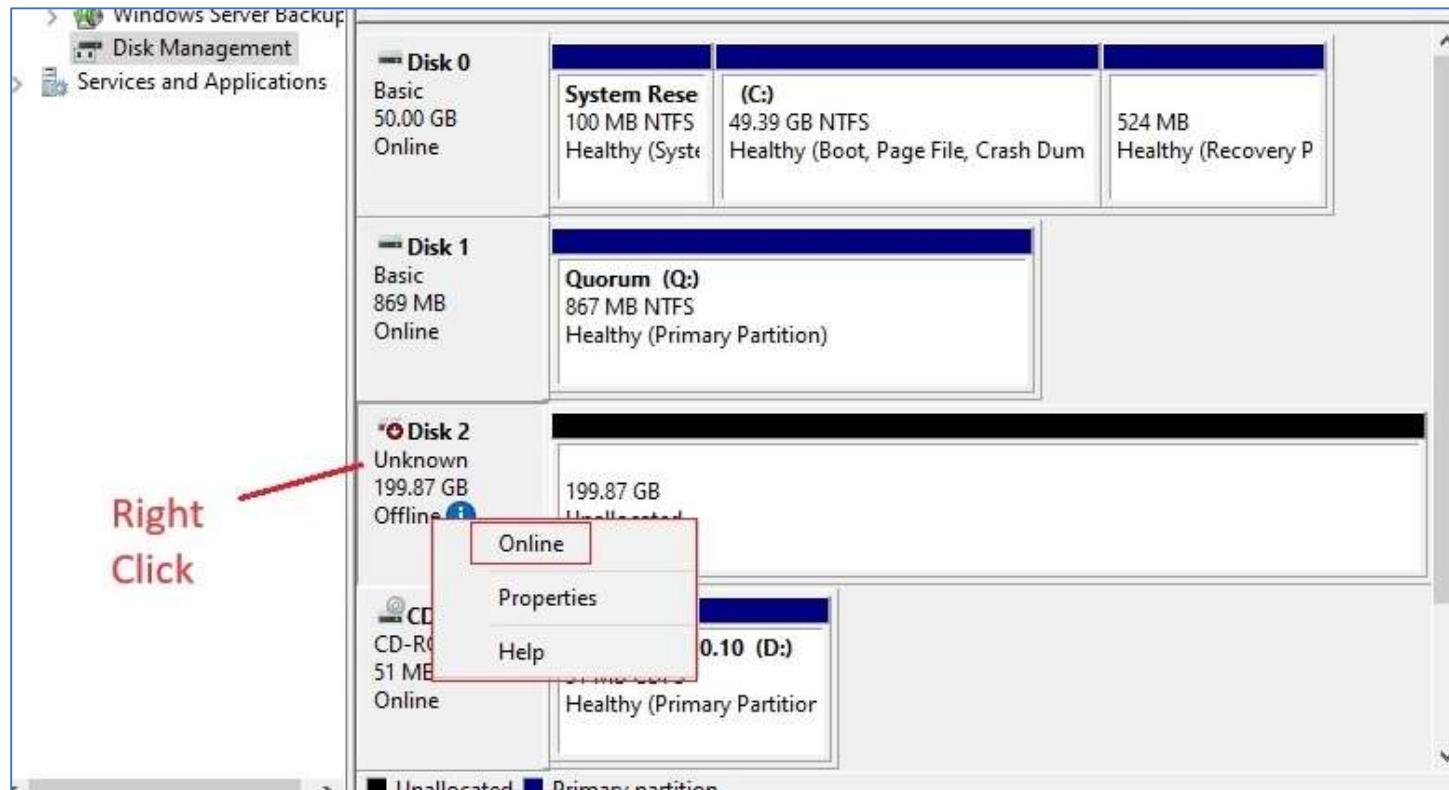
Click OK

This will close the iSCSI Targets pages.

Now we may to online the Quorum and Storage drives:

Server Manager – Tasks – Computer Management – Disk Management:

First, bring the disk Online



Initialize the disks. You should only have to do this from SQL1.

Then we will have to change the Drive letters to Q: and S:

Right click in the drive, and choose: Change Drive Letter and Paths.

So now, from this server WinSrv22-SQL1, the drives should be visible.

The screenshot shows the Windows Computer Management interface with the 'Disk Management' option selected under 'Storage'. The left pane lists system tools like Task Scheduler, Event Viewer, and Device Manager, along with Storage, Windows Server Backup, and Services and Applications. The right pane displays disk information in two tables.

Volume	Layout	Type	File System	Status
(C:)	Simple	Basic	NTFS	Healthy (Boot, Page File, Crash Dump, Primary Partition)
(Disk 0 partition 3)	Simple	Basic	NTFS	Healthy (Recovery Partition)
Quorum (Q:)	Simple	Basic	NTFS	Healthy (Primary Partition)
Storage (S:)	Simple	Basic	NTFS	Healthy (Primary Partition)
System Reserved	Simple	Basic	NTFS	Healthy (System, Active, Primary Partition)
VBox_GAs_7.0.10 (D:)	Simple	Basic	CDFS	Healthy (Primary Partition)

Disk	Volume	File System	Capacity	Status
Disk 0	System Rese 50.00 GB Online	100 MB NTFS Healthy (Syste	(C:) 49.39 GB NTFS Healthy (Boot, Page File, Crash Dum	524 MB Healthy (Recovery P
Disk 1	Quorum (Q:) 869 MB Online	867 MB NTFS Healthy (Primary Partition)		
Disk 2	Storage 199.87 GB Online	199.86 GB NTFS Healthy (Primary Partition)		
CD-ROM 0	VBox_GAs_7.0.10 (D:) 51 MB Online	51 MB CDFS Healthy (Primary Partitior		

Legend at the bottom: Unallocated (black square) and Primary partition (blue square).

Repeat this step for WinSrv22-SQL2 and WinSrv22-SQL3.

On each of the SQL machines, you will have to Online the disk.

Windows will have assigned them its own drive letters – but we want to change that. Just as we did before

Each SQL node should now be able to see the Q: and S: drives and that they are online and healthy.

Step 21) Install Failover Clustering on the first of the SQL Server 2022 machines.

Log in as mirkwood\fbaggins on WinSrv22-SQL1

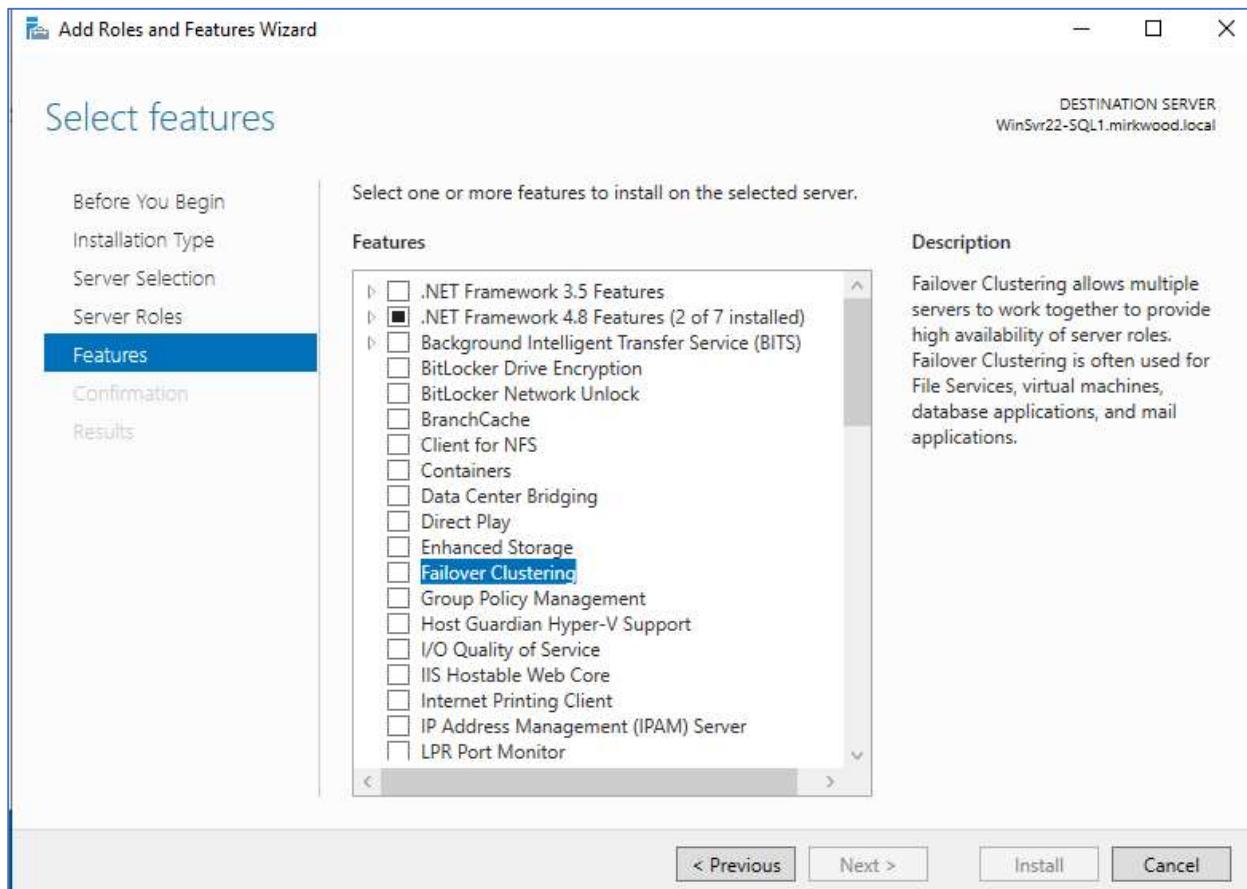
You set up Failover Clustering on each of the SQL nodes, not the Domain Controller, but you must be logged in as an Administrator level user on the domain. That is what the user FBaggins is for.

This is where we will set up the cluster, and SQL1 will be our primary replica.

But first, each of the SQL machines needs the Failover Clustering tools installed.

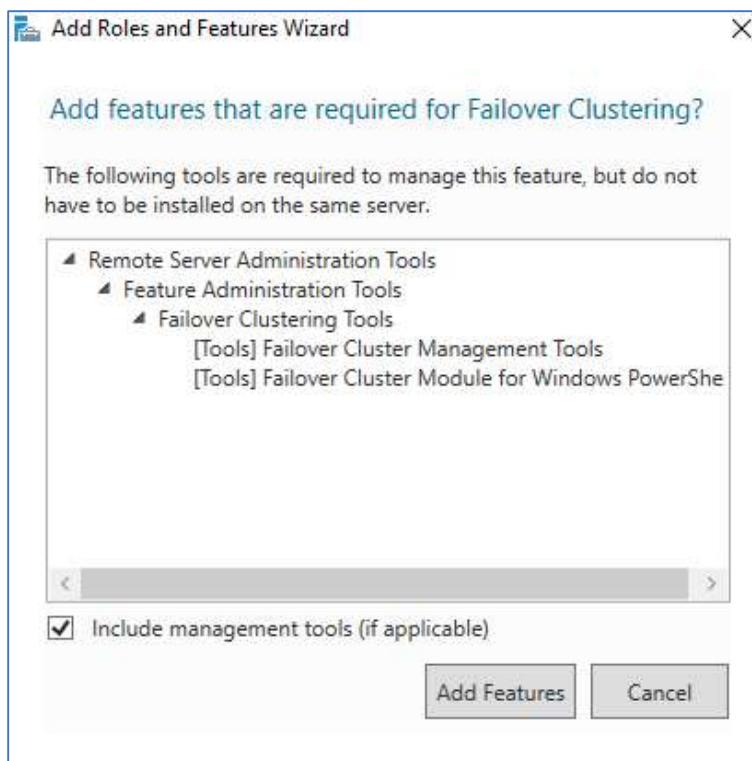
Server Manager - Manage/Add Roles and Features

Click "Next" and when you get "Select Features" - click the checkbox for "Failover Clustering"



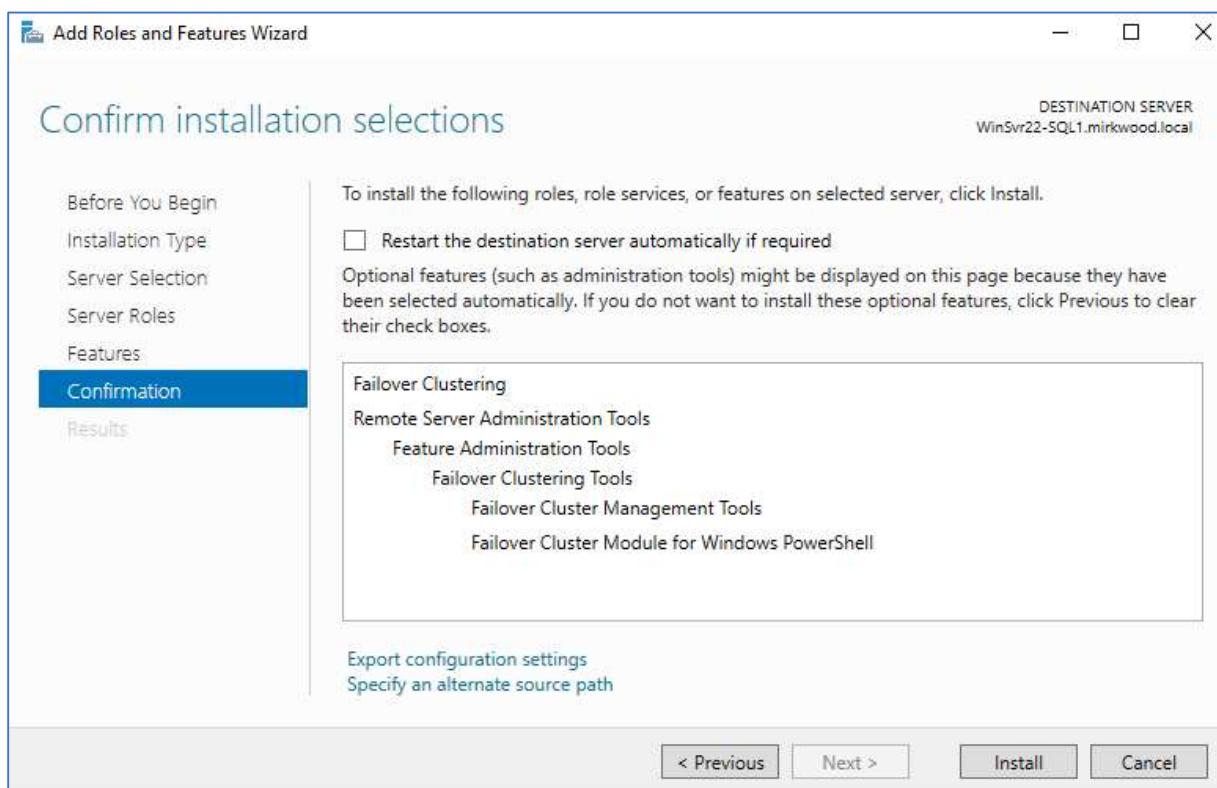
Add Roles and Features Wizard

Add Features that are required for Failover Clustering

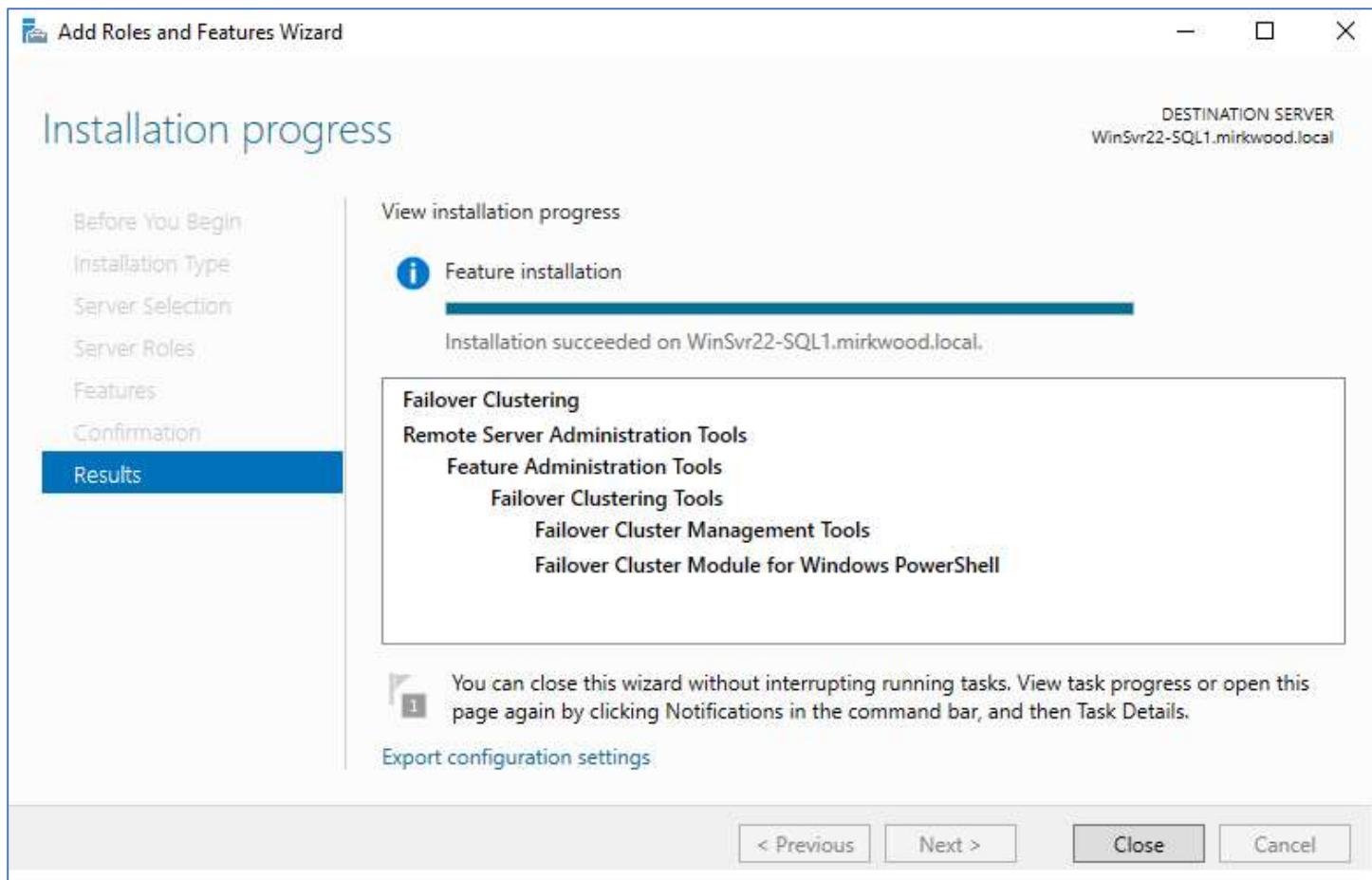


Check the "Include management tools" if applicable. - Add Features.

Confirm Installation selections



Click "Install"



We'll need this set up on each of the SQL Server machines.

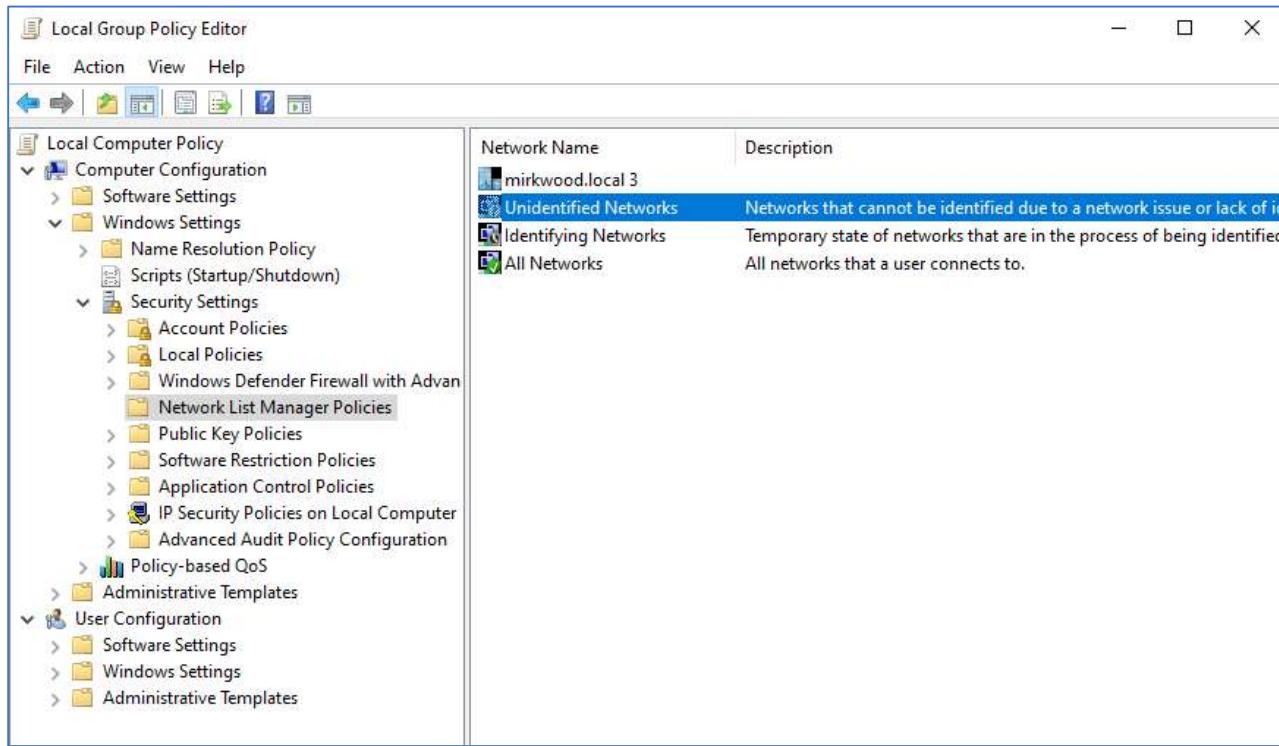
Let's rename Network Adapter 1 to be called "Domain"
and Network Adapter 2 to be called "Heartbeat"

ncpa.cpl ← fast access to the Network Interfaces

Rename the second adapter: "Unidentified Network" to "Heartbeat"

Step 22) Set Group Policy on Heartbeat network adapter on each SQL node

The way to get to this is from Windows, at Start > Run > gpedit.msc



Local Computer Policy

Computer Configuration

Windows Settings

Security Settings

Network List Manager Policies

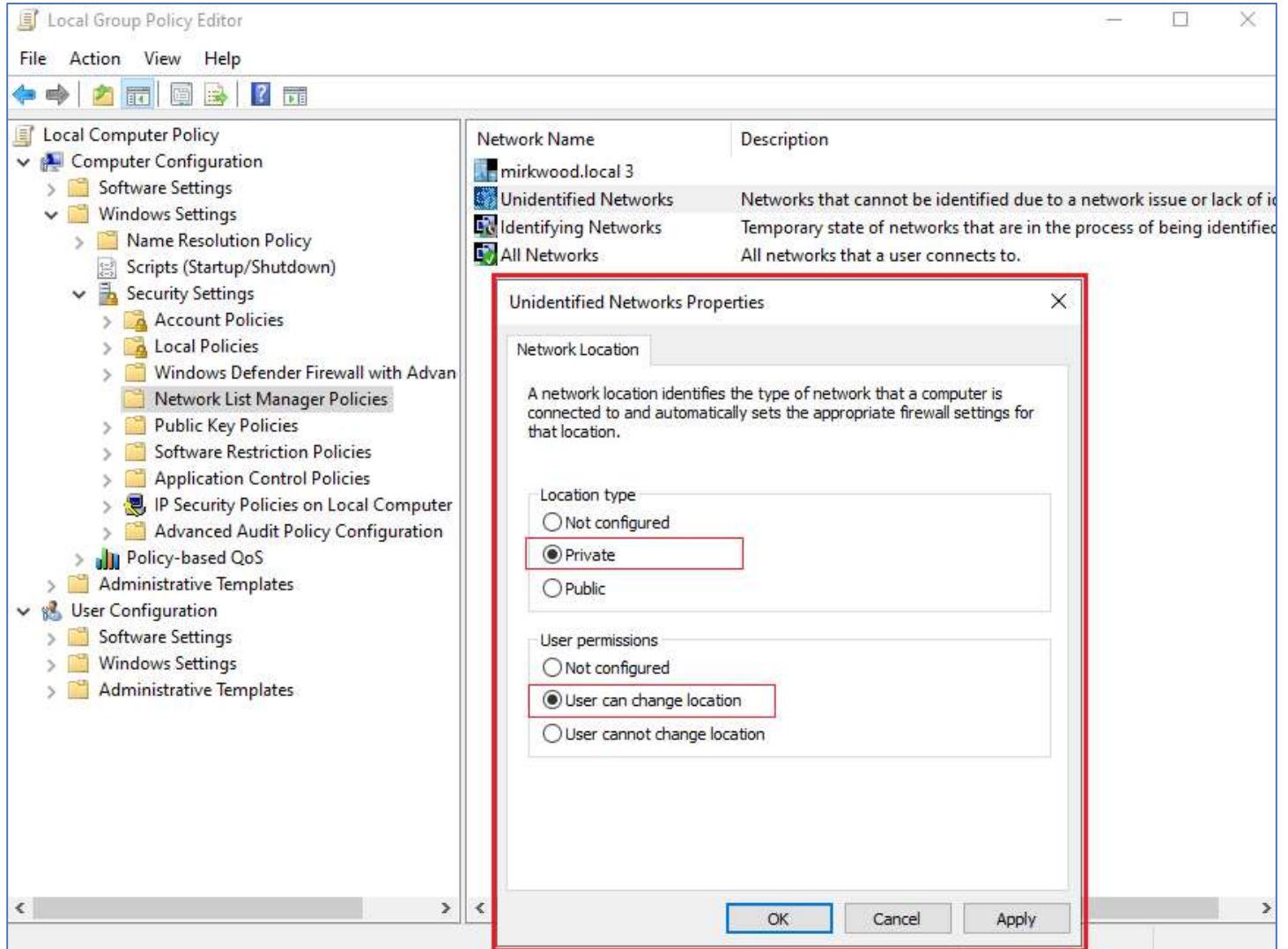
Do this on all the SQL machines.

On what is Network Adapter 2 – the one called "Heartbeat: (or maybe called "Unidentified Network")

Unidentified Network Properties

Change location type to private

User Permissions: User can change locations



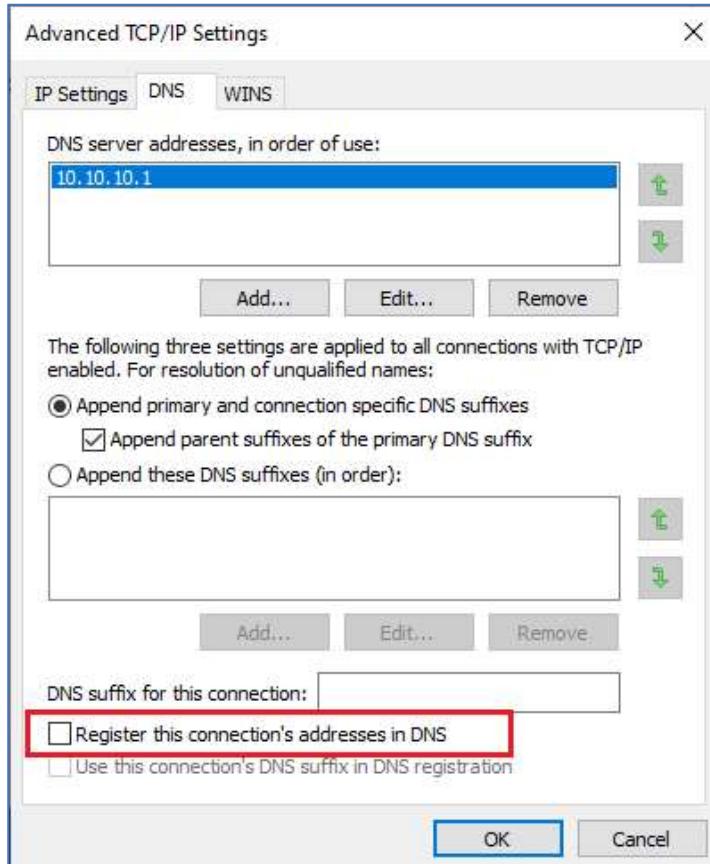
Do this on all the SQL machines.

Step 23) Set up the Heartbeat Network Adapters on the 3 SQL machines

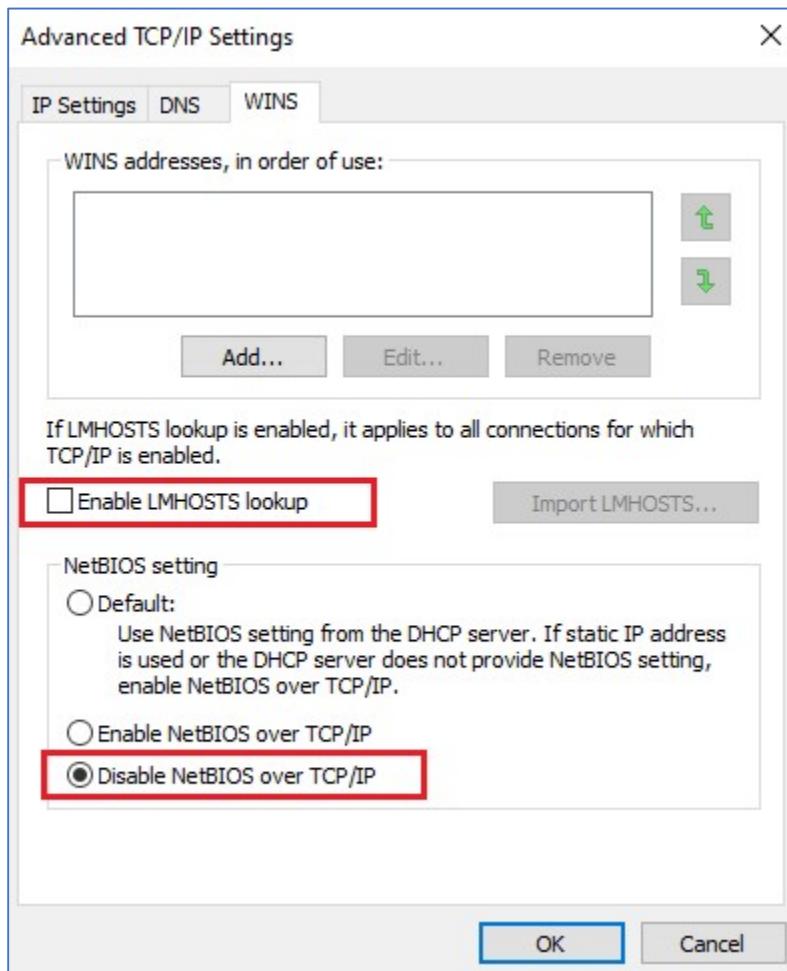
Open up the Heartbeat NIC ipv4 properties and change DNS and WINS settings from the advanced menu.

Windows – Run – ncpa.cpl

Uncheck ‘Register this connection’s addresses in DNS tab



In the WINS tab - Uncheck 'Enable LMHOSTS lookup' and disable NetBIOS over TCP/IP



Click OK and close the Network Adapter for Heartbeat. Do this on all the SQL machines.

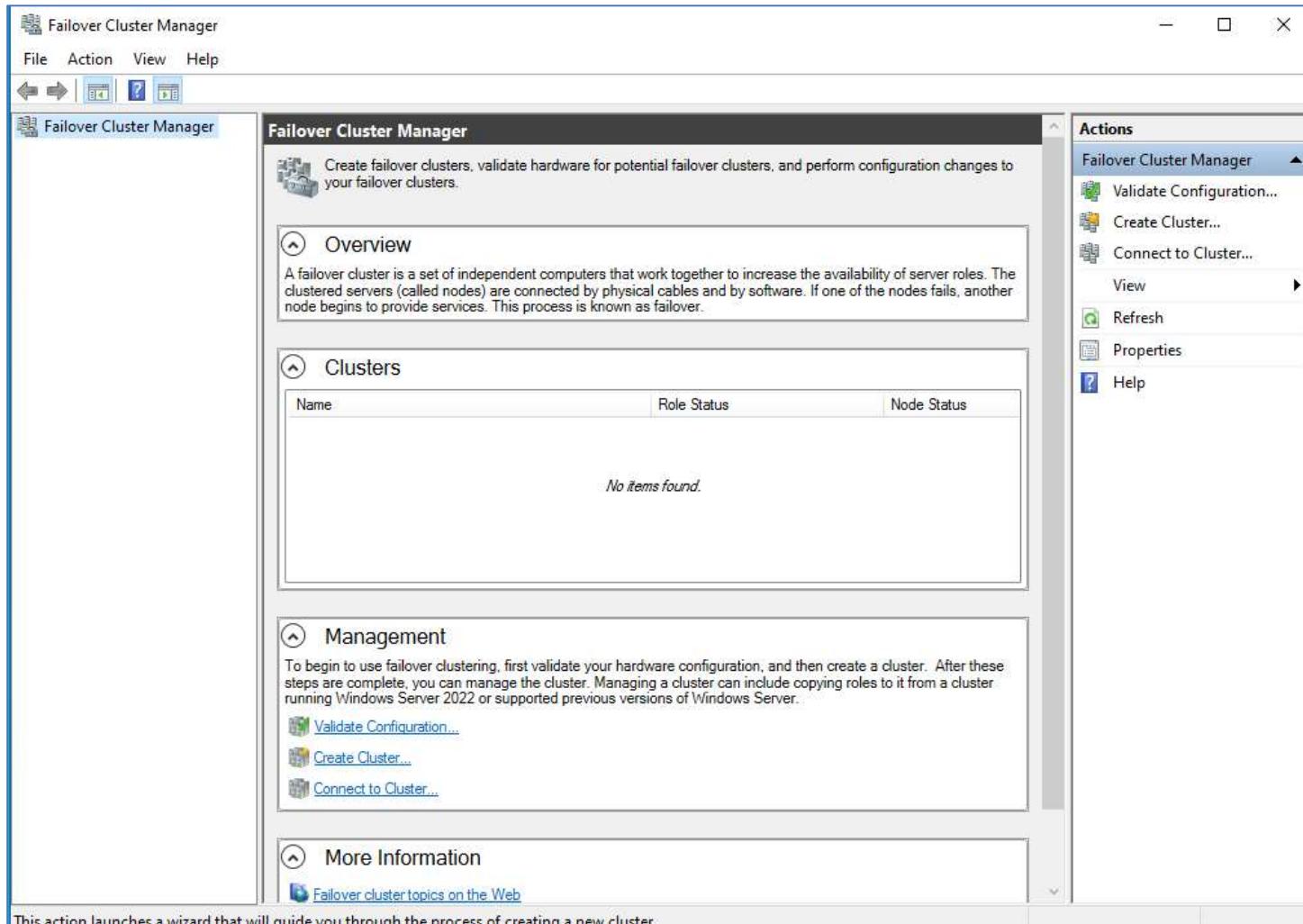
Step 24) On WinSrv22-SQL1, Create the Cluster.

All Nodes: Log out of local Admin, and log in as Domain Admin: Fbagins

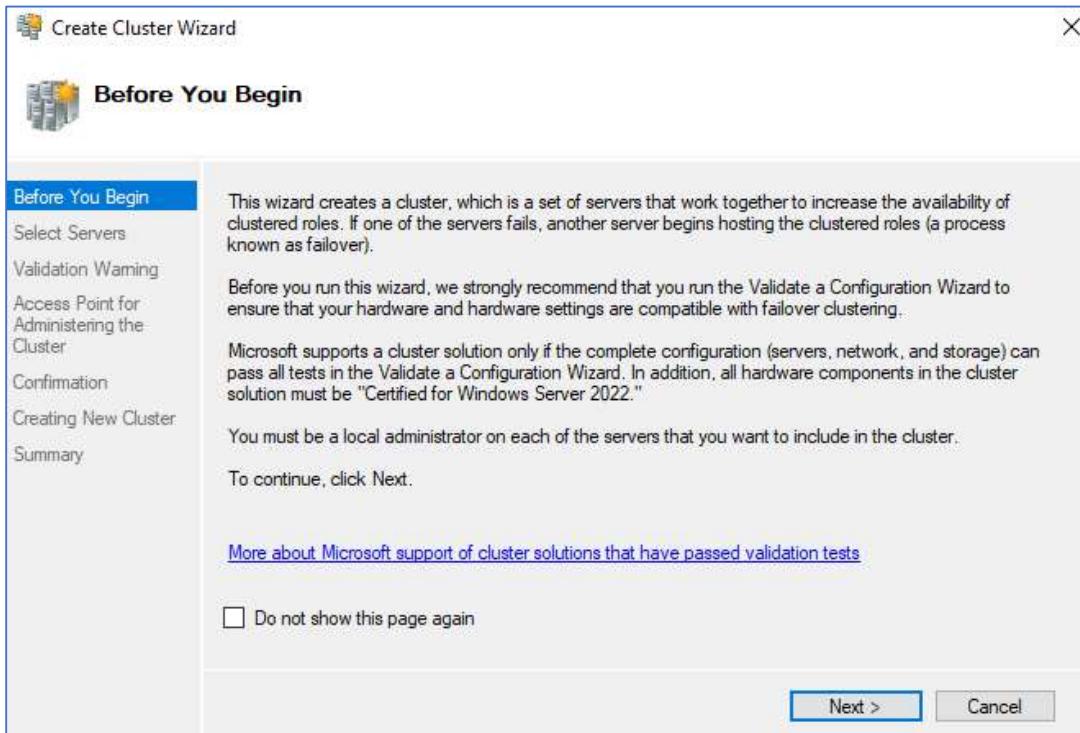
Go to the first SQL Server machine

Server Manager - Tools (dropdown) - choose: Failover Cluster Manager

Create Cluster (on right hand side)



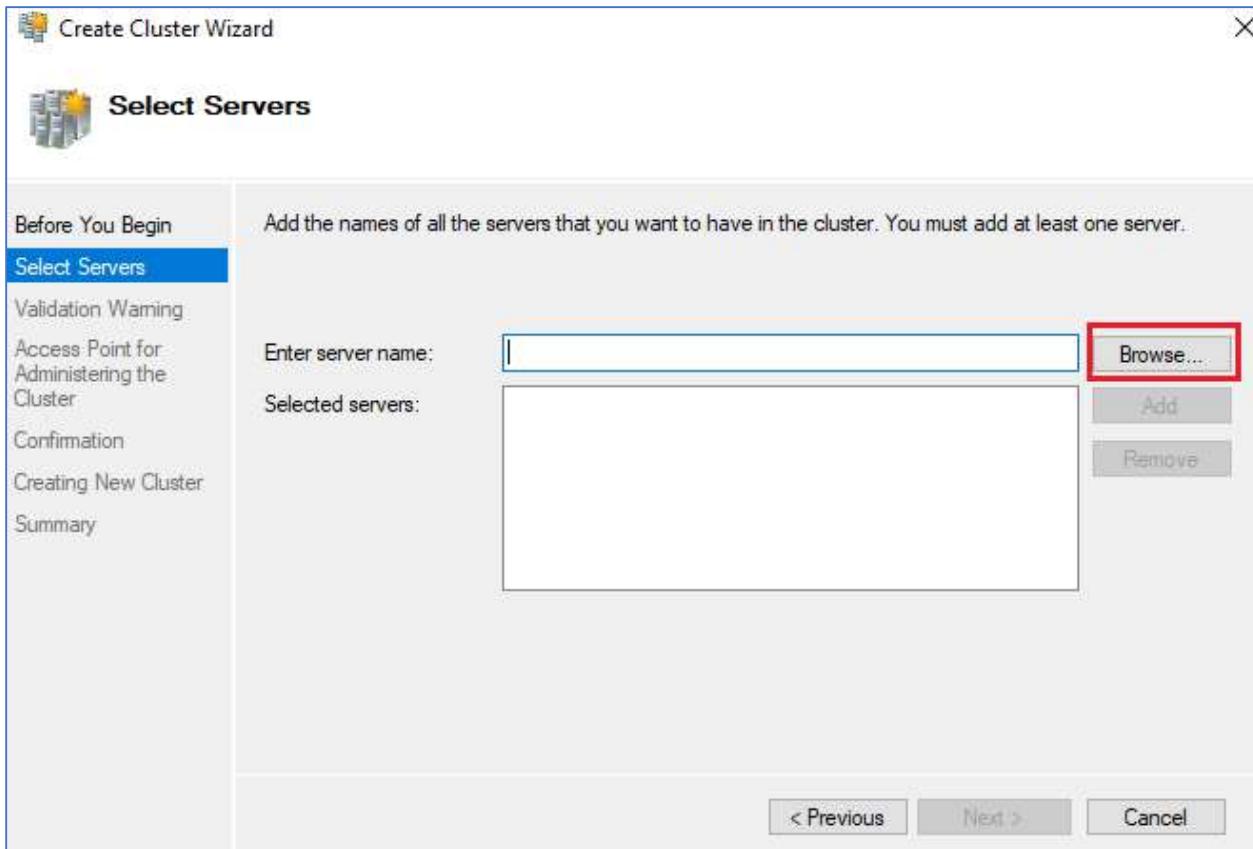
It will begin the "Create Cluster" Wizard:



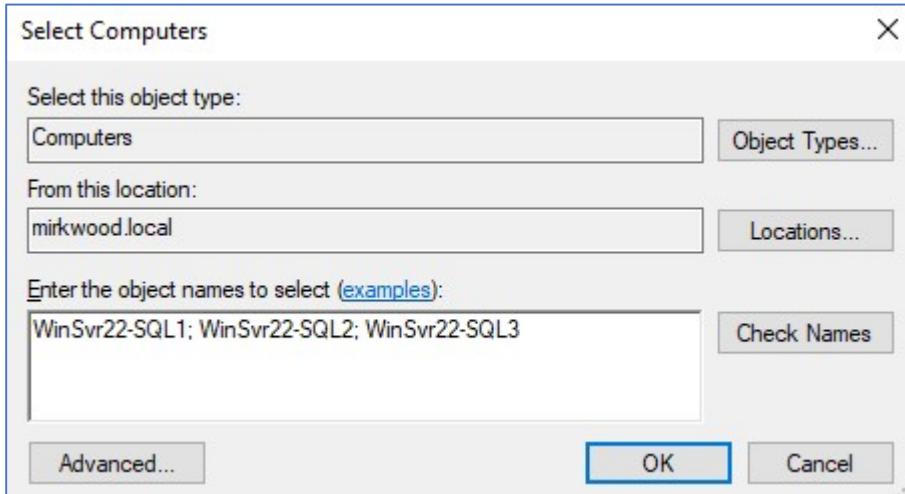
Click Next

You will now add the servers that are going to be part of the cluster.

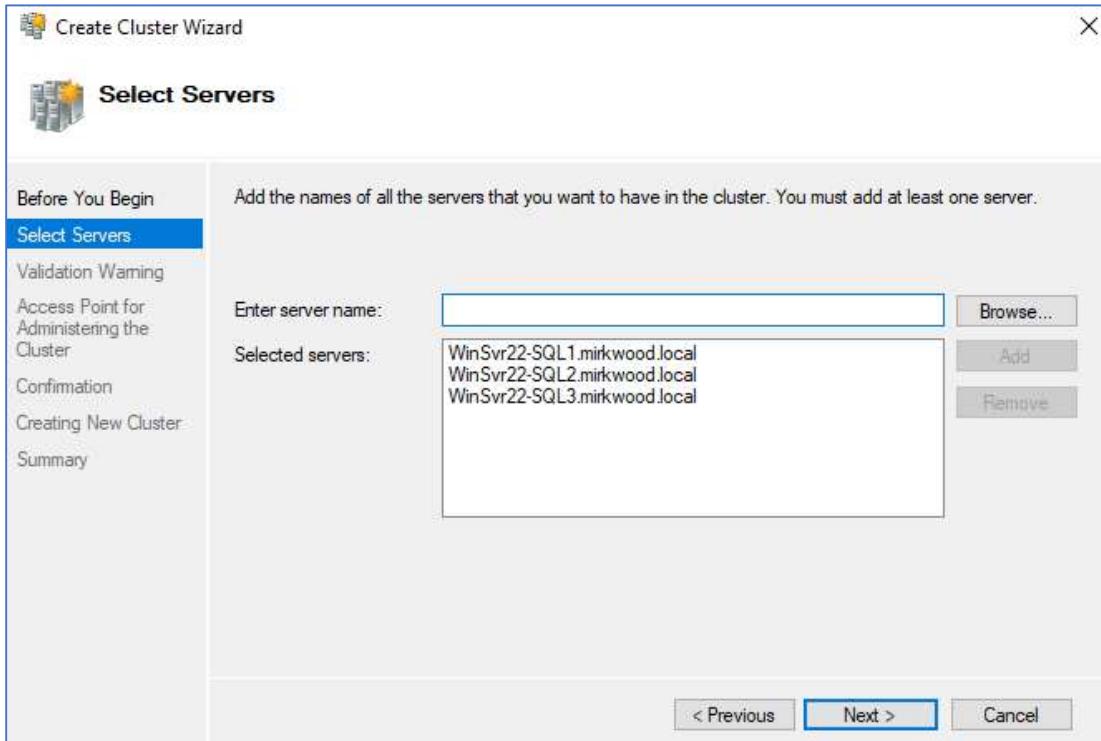
Instead of entering the server names, use the "Browse" button to locate the names of the servers.



You can specify them all at once, or one at a time.



If it finds them:

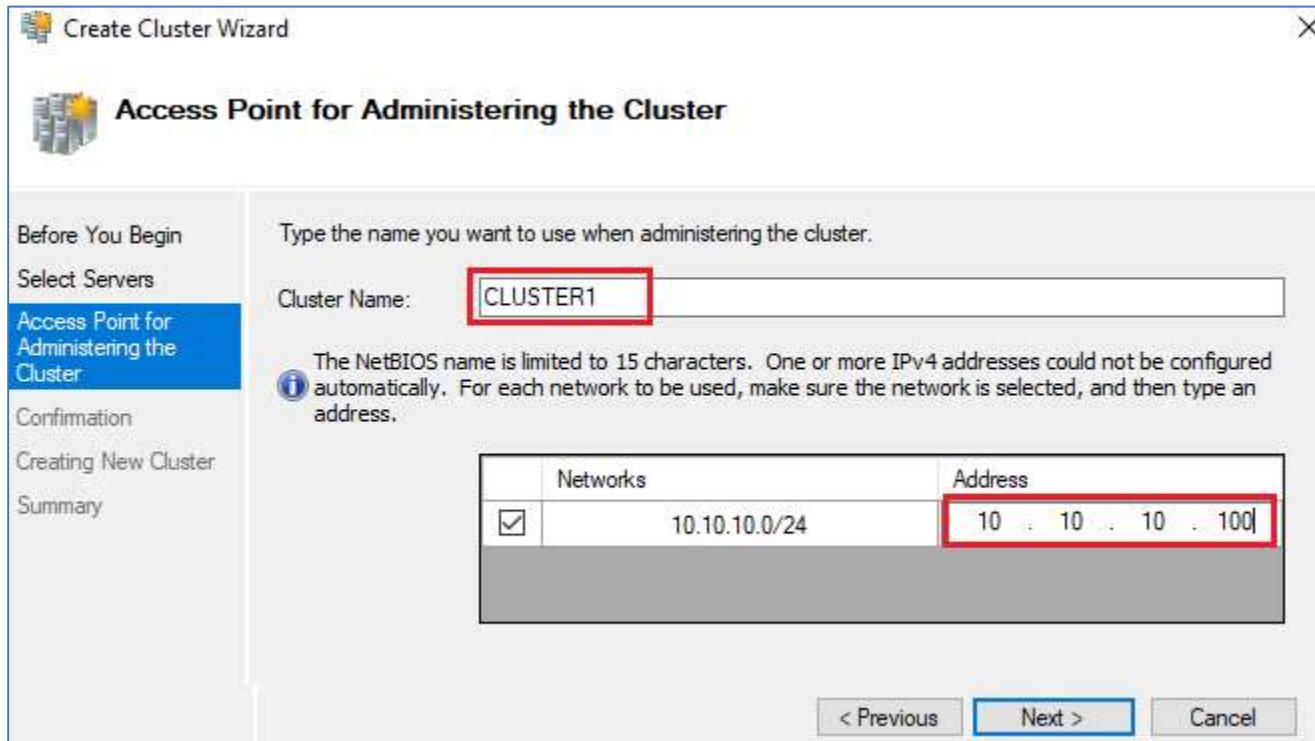


Click Next

Run through the Create Cluster Wizard. Observe the warnings. They should not be fatal.

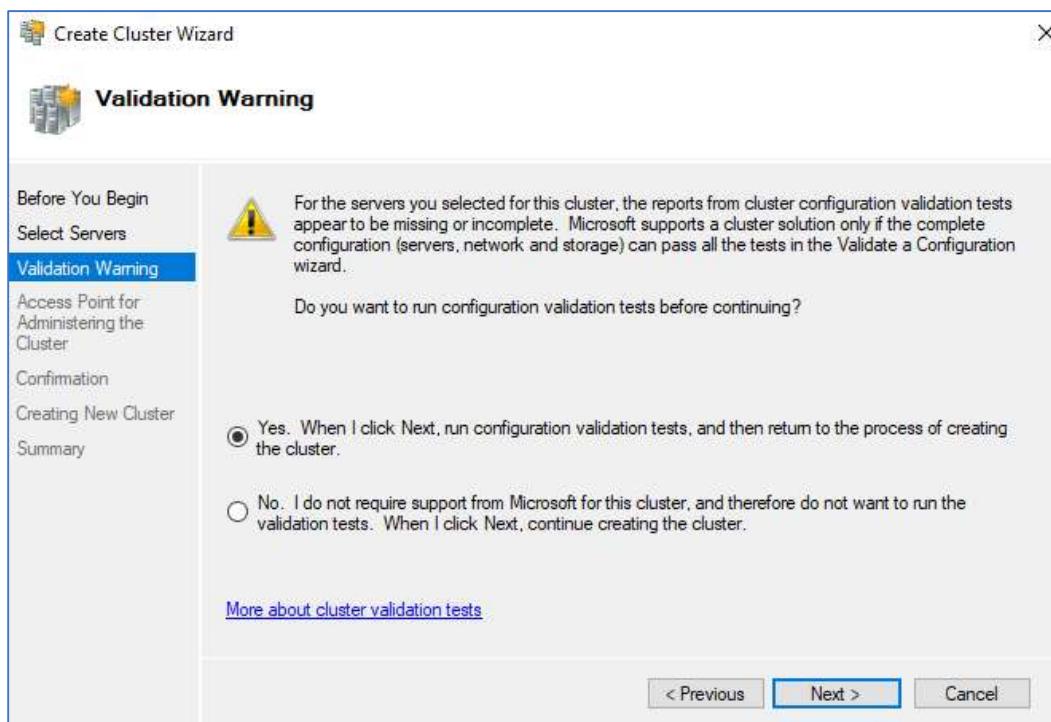
Choose (*) Yes - when I click Next, run configuration validation tests and then return to the process of creating the cluster.

Enter a name for the cluster, and an IP address to be the Access Point for Administering the Cluster.

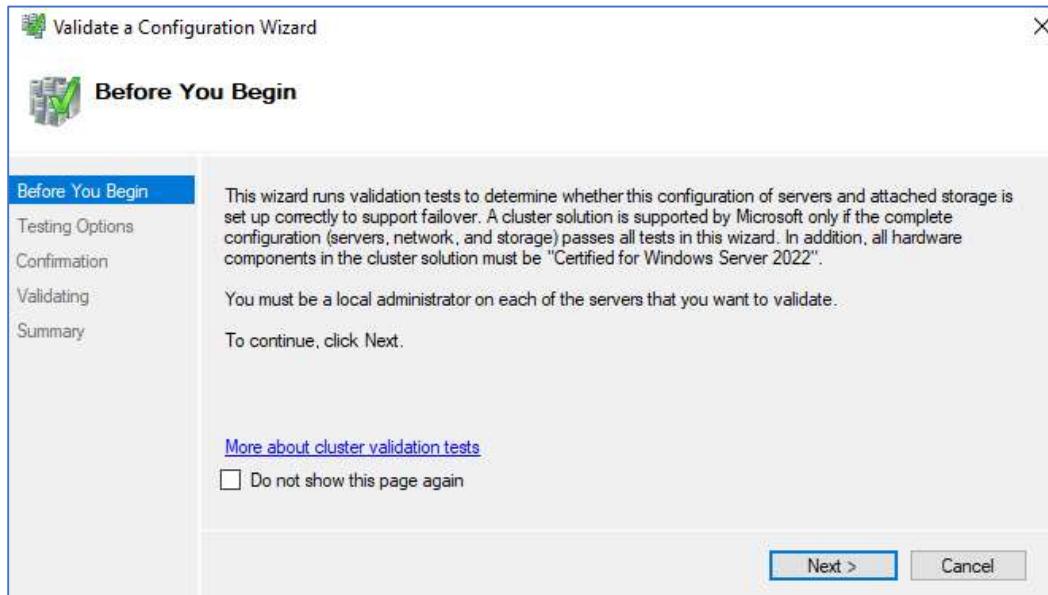


Note, this IP must be on the main network, not the network of the Heartbeat.

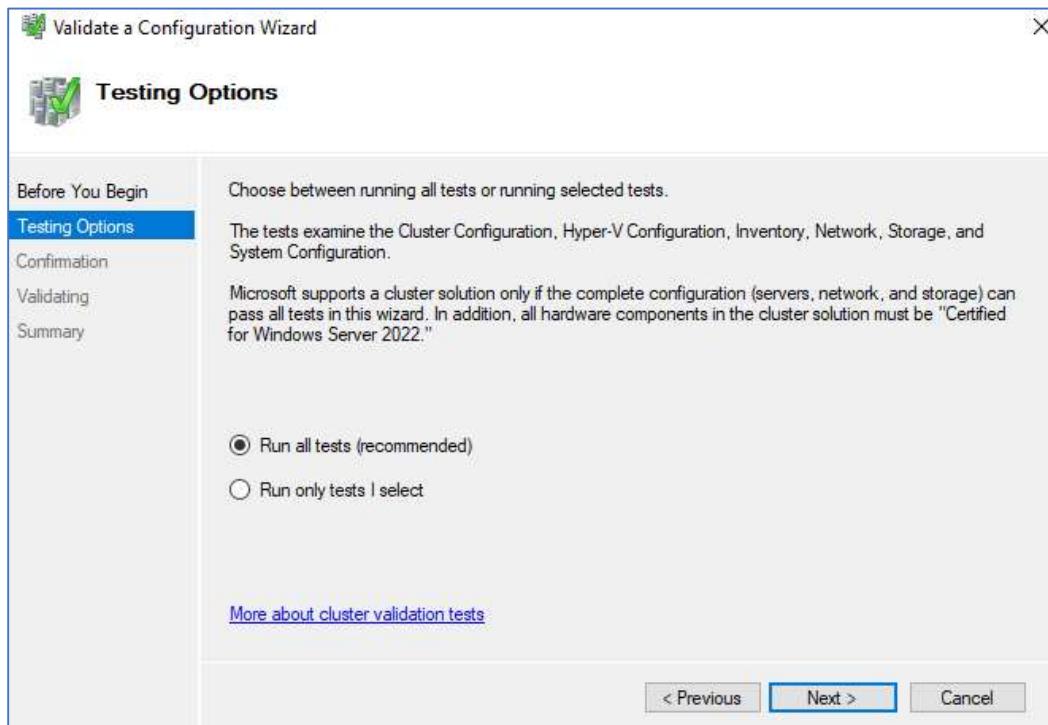
Now you must Test the Cluster Configuration:



Another advisory message. Check "Do not show this page again" if you want.

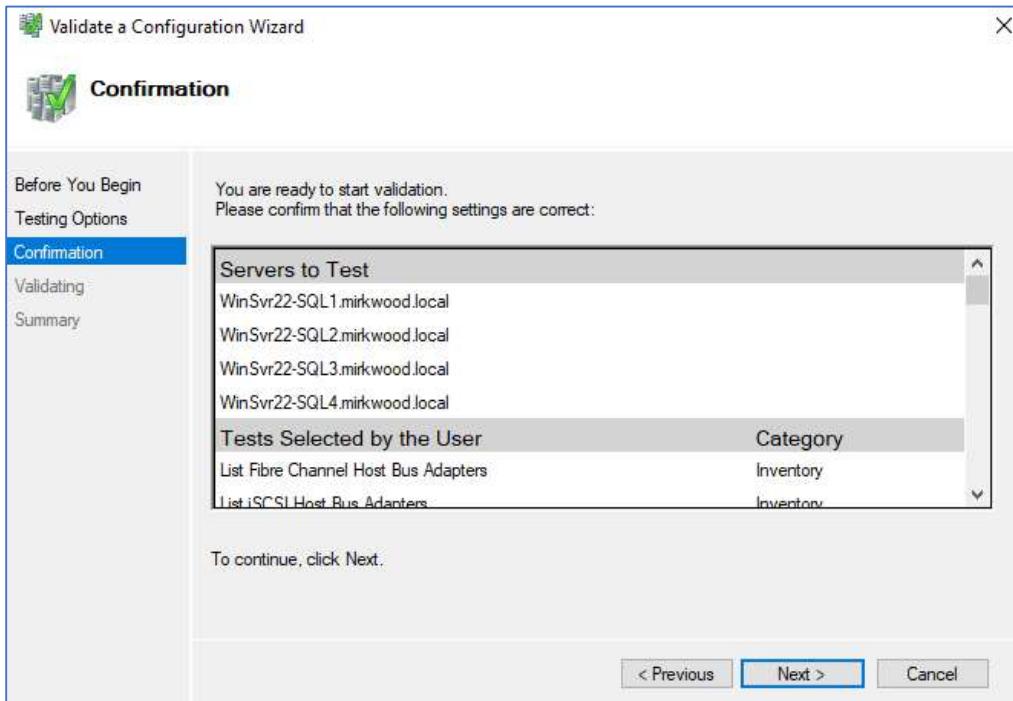


A confirmation. It's best to choose "Run all tests"...

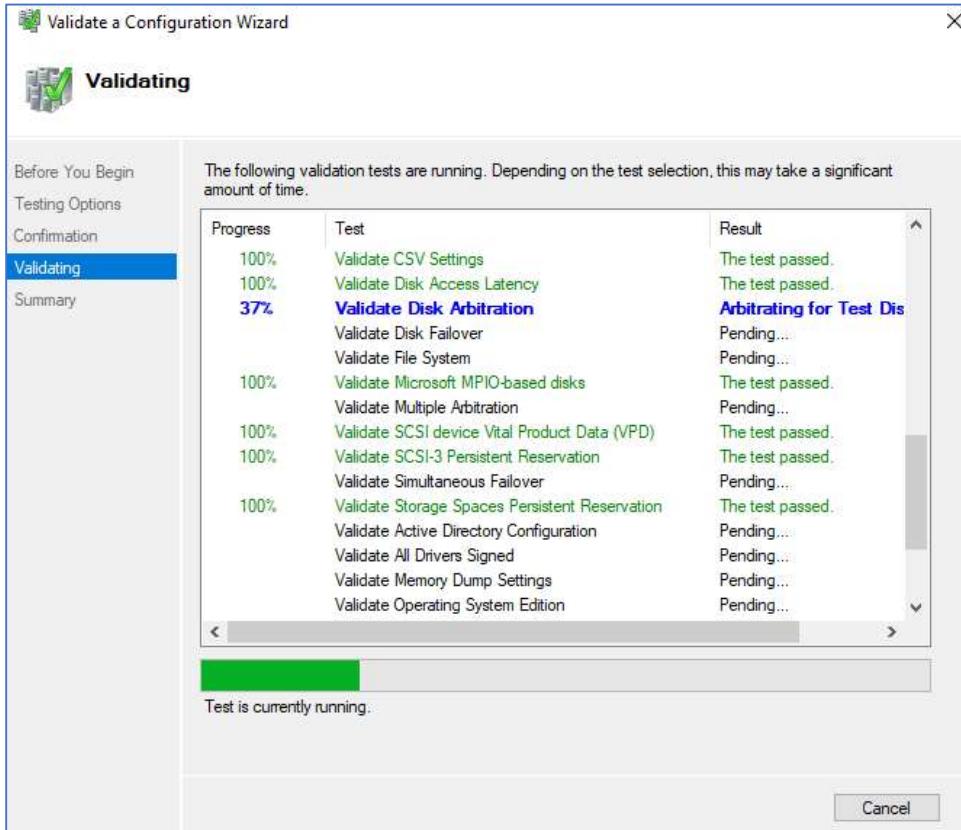


Click Next

Yet another confirmation page



Click Next. Now it will run all the tests on the Cluster. This can take about 10 minutes.



I had validation errors this time

Validate a Configuration Wizard

Summary

Before You Begin
Testing Options
Confirmation
Validating
Summary

 Testing has completed for the tests you selected. One or more tests indicate that the configuration is not suitable for clustering. A cluster solution is supported by Microsoft only if you run all cluster validation tests, and all tests succeed (with or without warnings).

Validate Microsoft MPIO-based disks	Success
Validate Multiple Arbitration	Success
Validate Network Communication	Failed
Validate Operating System Edition	Success
Validate Operating System Installation Option	Success
Validate Operating System Version	Success
Validate Required Services	Success
Validate Same Processor Architecture	Success
Validate SCSI device Vital Product Data (VPD)	Success
Validate SCSI-3 Persistent Reservation	Success
Validate Simultaneous Failover	Success
Validate Software Update Levels	Warning
Validate Storage Spaces Persistent Reservation	Success
Validate Switch Enabled Teaming Configurations	Success
Validate System Drive Variable	Success
Validate Windows Firewall Configuration	Success
Validate OOS Software Configuration	Success

To view the report created by the wizard, click View Report.
To close this wizard, click Finish.

View Report...

Finish

Click the View Validation Report button, and it will bring up a very long and detailed listing of what passed and what failed:

Failover Cluster Validation Report

Node	Validation Status
WinSvr22-SQL1.mirkwood.local	Validated
WinSvr22-SQL2.mirkwood.local	Validated
WinSvr22-SQL3.mirkwood.local	Validated
WinSvr22-SQL4.mirkwood.local	Validated

The Validate a Configuration Wizard must be run after any change is made to the configuration of the cluster or hardware. For more information, see <https://go.microsoft.com/fwlink/?LinkId=280145>.

Results by Category

Name	Result Summary	Description
Inventory		Success
Network		Failed
Storage		Success
System Configuration		Warning

Inventory

Name	Result	Description
List BIOS Information		Success

A sample of my Network errors at the bottom:

Description: Validate that servers can communicate, with acceptable latency, on all networks.

Start: 9/10/2023 5:04:00 AM.

Network interfaces WinSvr22-SQL1.mirkwood.local - Heartbeat and WinSvr22-SQL2.mirkwood.local - Heartbeat are on the same cluster network, yet address 10.10.10.120 is not reachable from 10.10.10.110 using UDP on port 3343.

Network interfaces WinSvr22-SQL1.mirkwood.local - Heartbeat and WinSvr22-SQL2.mirkwood.local - Ethernet are on the same cluster network, yet address 10.10.10.20 is not reachable from 10.10.10.110 using UDP on port 3343.

Network interfaces WinSvr22-SQL1.mirkwood.local - Ethernet and WinSvr22-SQL2.mirkwood.local - Heartbeat are on the same cluster network, yet address 10.10.10.120 is not reachable from 10.10.10.10 using UDP on port 3343.

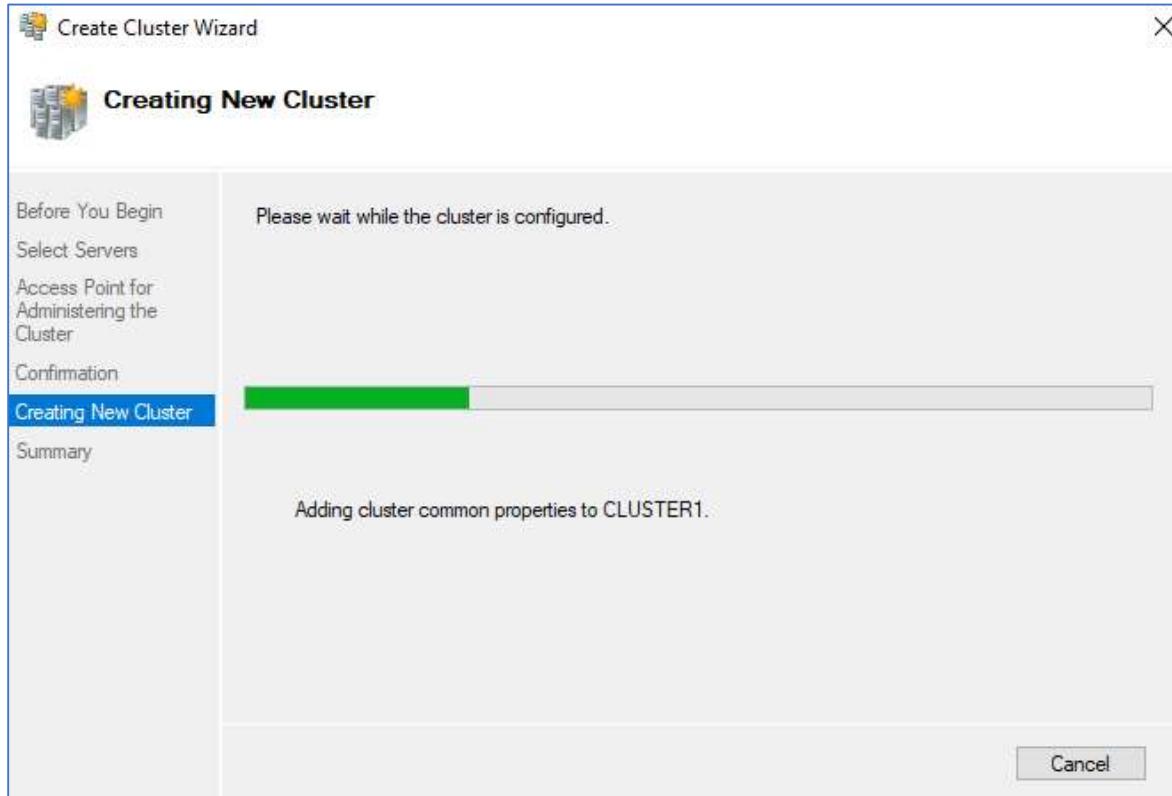
Network interfaces WinSvr22-SQL1.mirkwood.local - Ethernet and WinSvr22-SQL2.mirkwood.local - Ethernet are on the same cluster network, yet address 10.10.10.20 is not reachable from 10.10.10.10 using UDP on port 3343.

Network interfaces WinSvr22-SQL1.mirkwood.local - Heartbeat and WinSvr22-SQL3.mirkwood.local - Ethernet are on the same cluster network, yet address 10.10.10.30 is not reachable from 10.10.10.110 using UDP on port 3343.

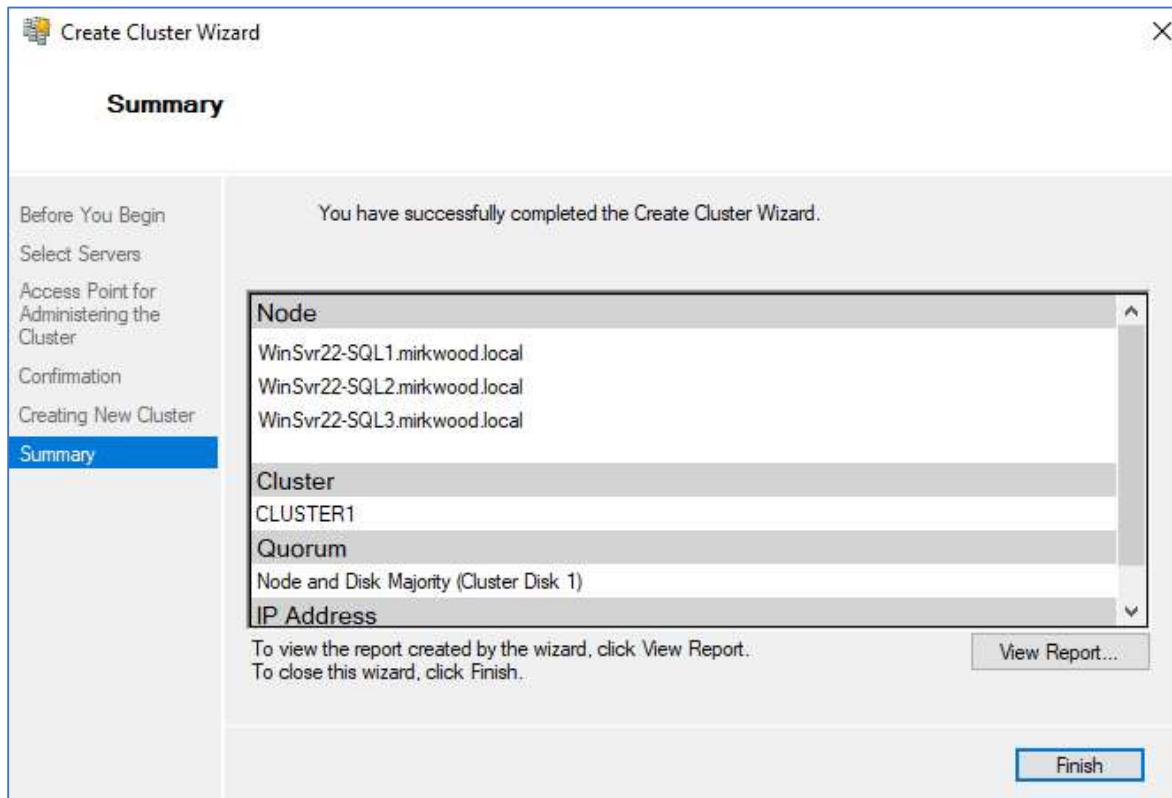
My problem on this first try was that my Heartbeat IPs were on the same network as the Domain network adapter. I fixed that by making them cite: 10.10.20.110 120, 130

With a Netmask of 255.255.255.0 - that makes them on a different network than 10.10.10.x

After fixing the errors, and passing another validation – it can create the cluster:

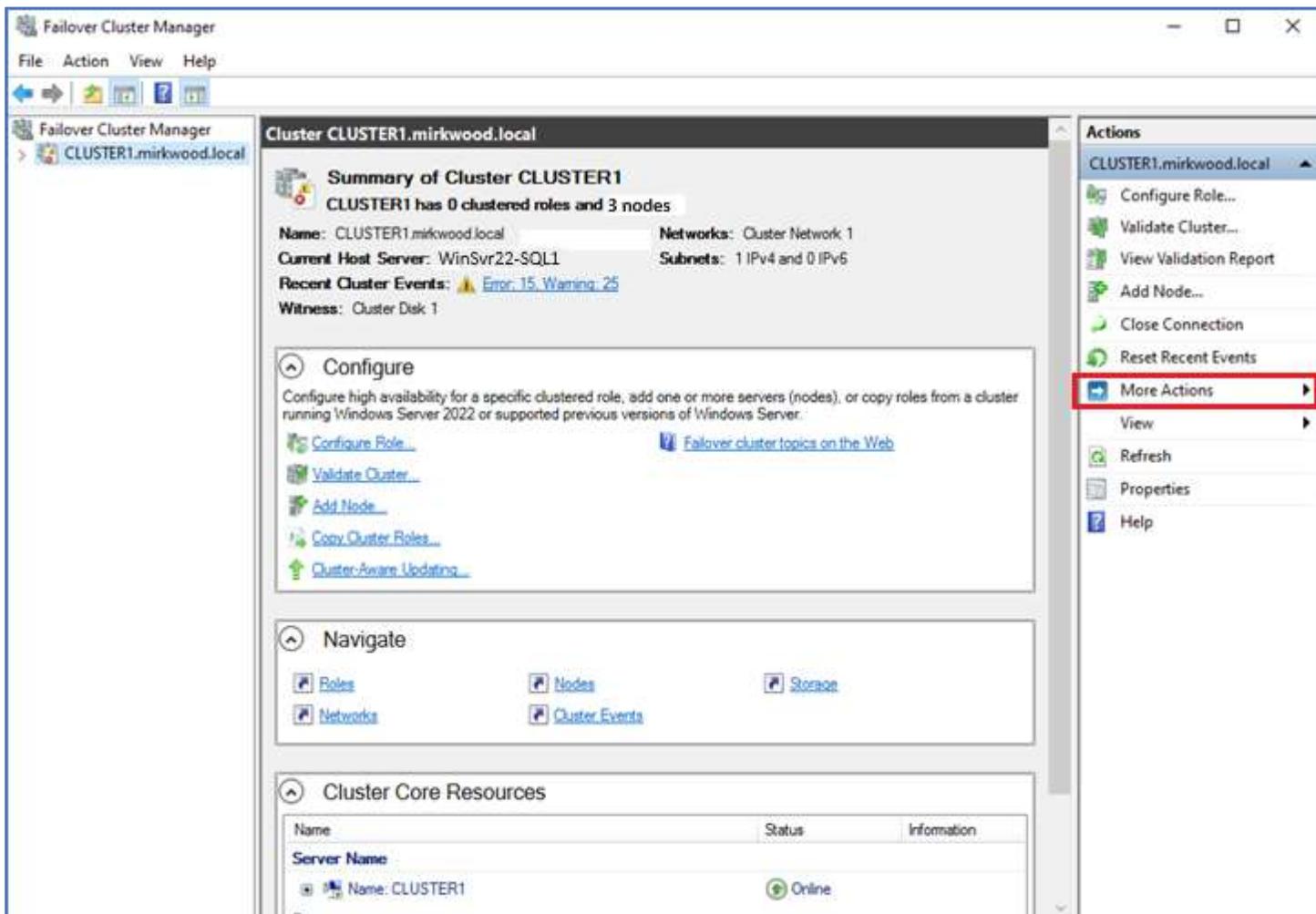


And success:



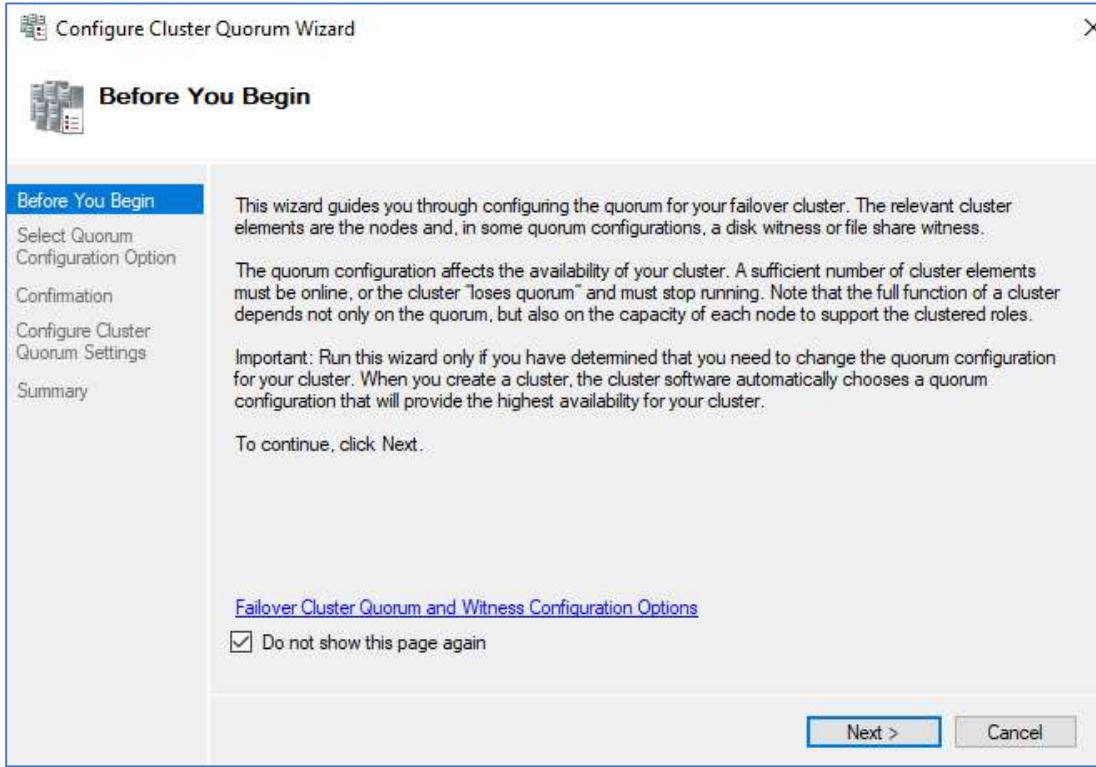
Click Finish

Now the Failover Cluster Manager shows CLUSTER1

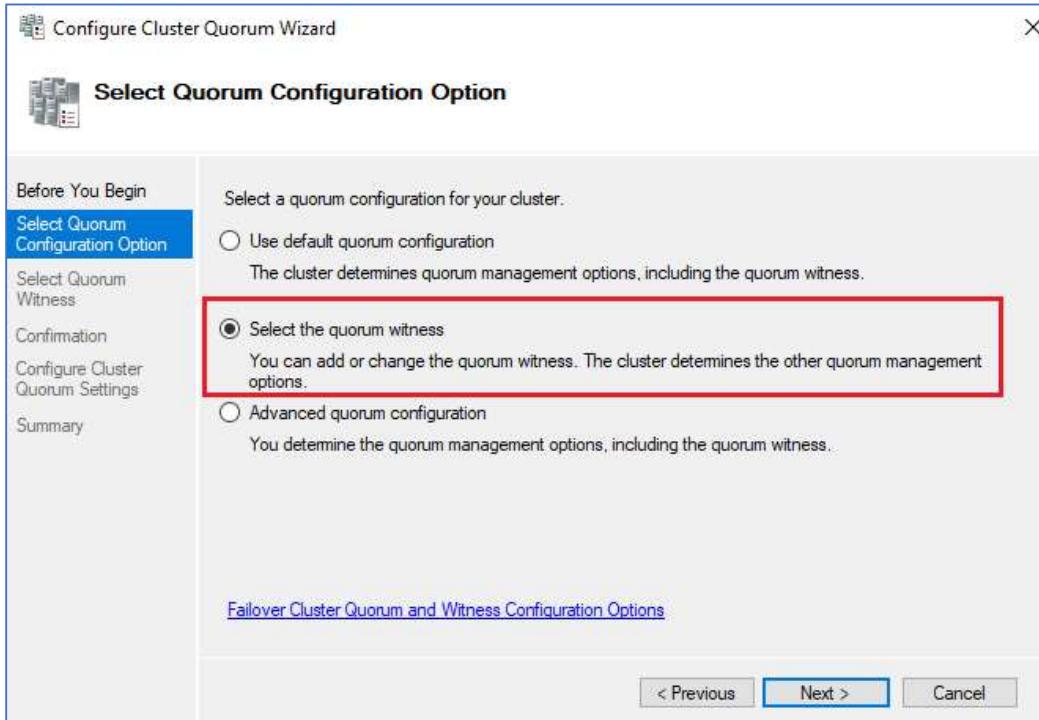


Step 25) Configuring a Quorum File Share Witness

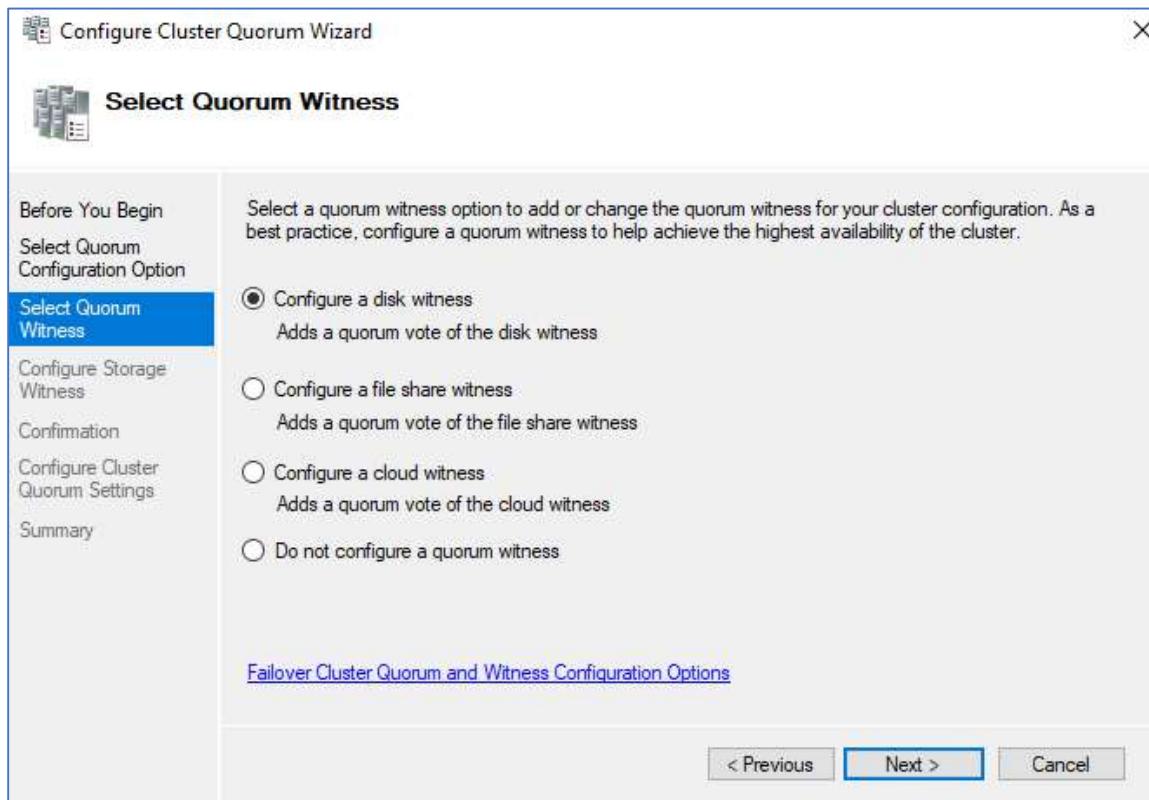
From Failover Cluster Manager, you should see the nodes as "Up". The screen above shows the "More Actions" Cluster Manager - More Actions - Configure Cluster Quorum Settings.



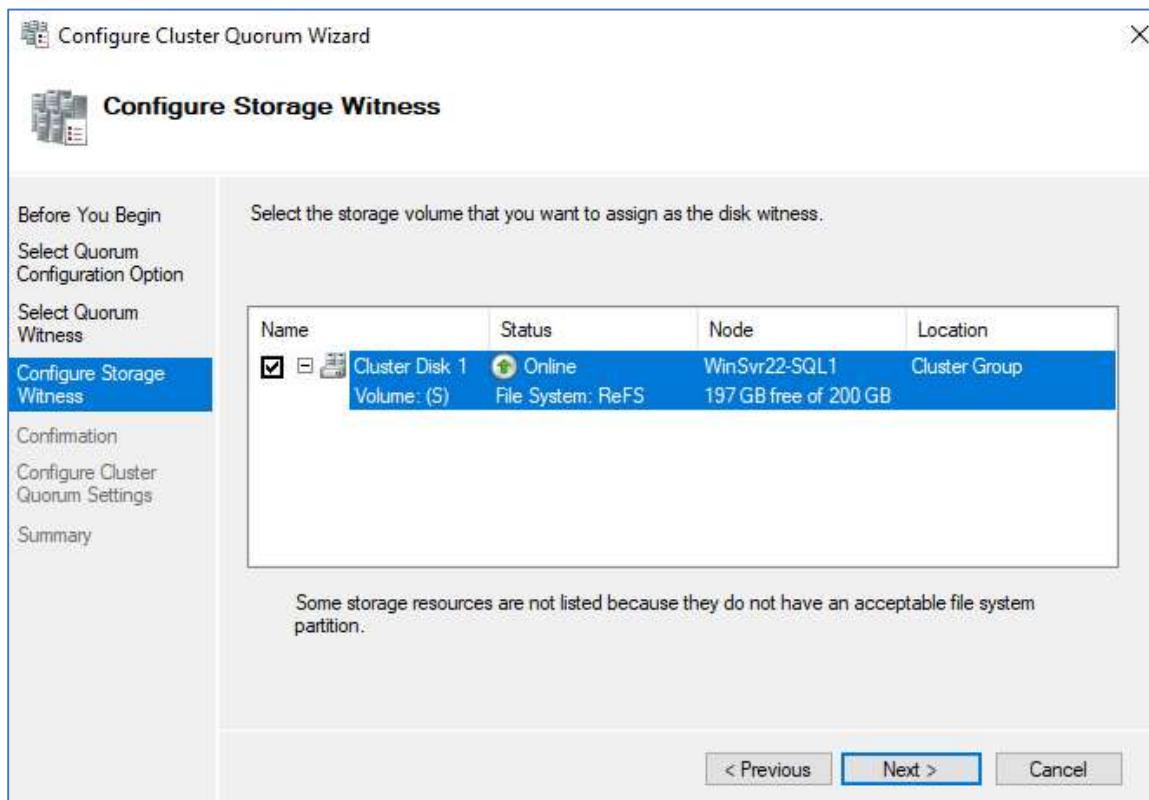
We will be setting up a Quorum Witness



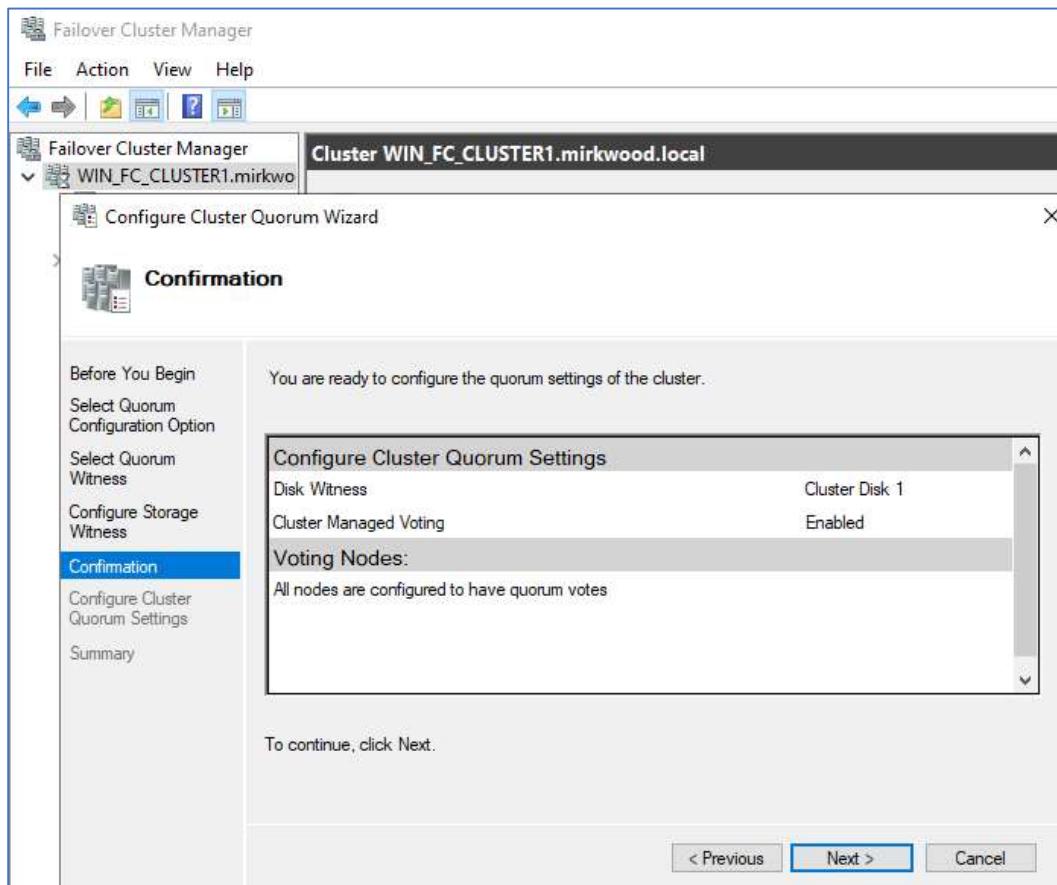
Next



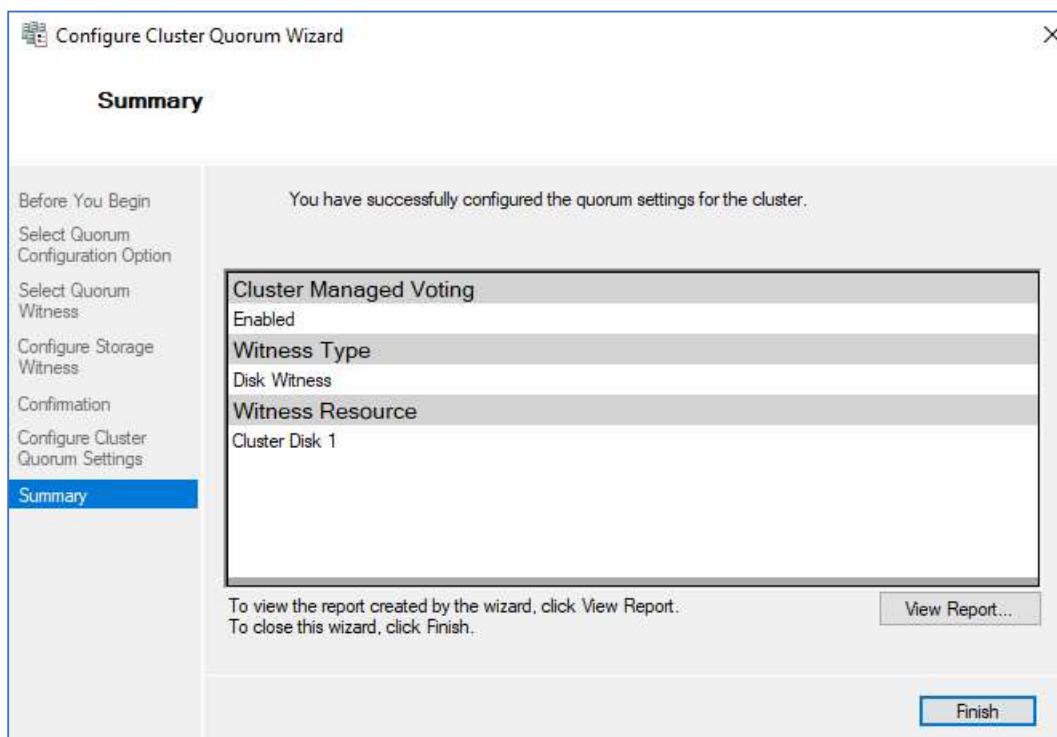
This is, in fact, our big Storage drive: **Why are we not using Q:** ?



Next

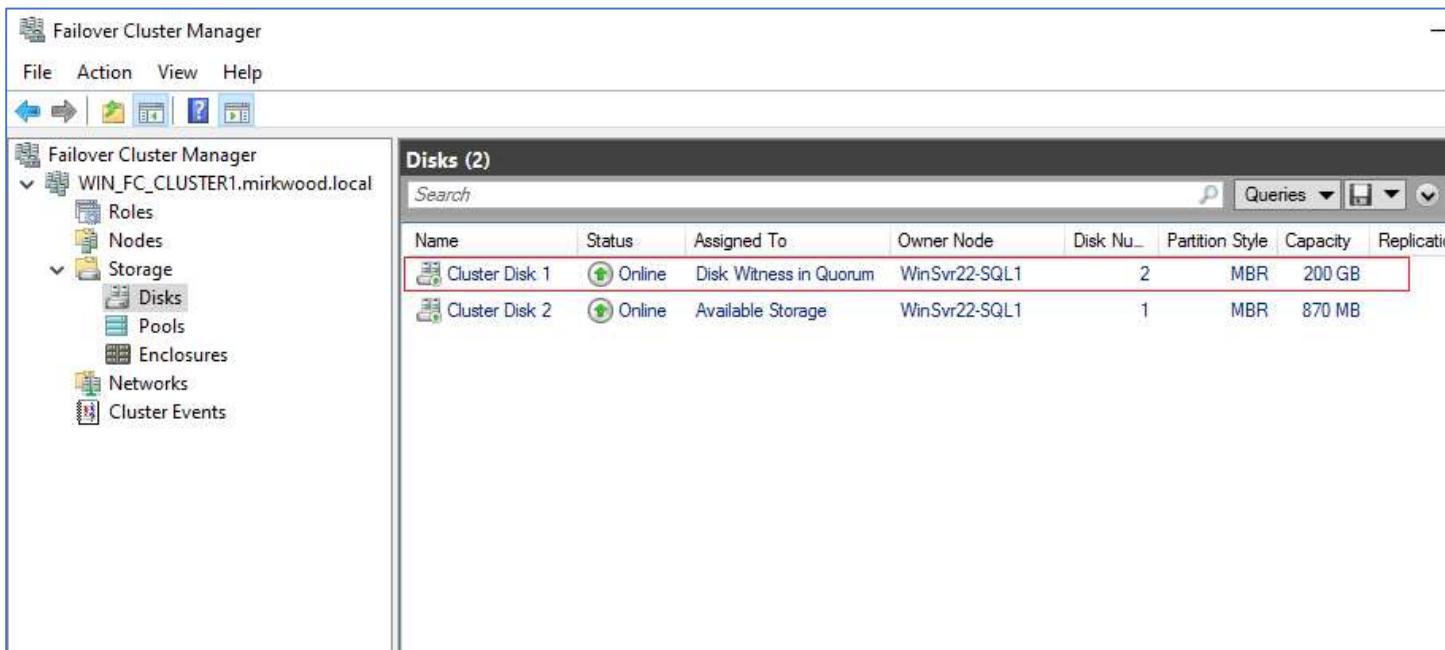


Next. Then the summary page that shows success.



Finish

Back in the Failover Cluster Manager, on the left hand side, we see Disks:



**Where it clearly shows that I have chosen the Storage drive to be the Quorum Witness.
That should have been done with the Quorum drive. Why did it not show up as one to choose from????**

Step 26) Confirm settings

Cluster Resources - should show Cluster Core Resources"

Server Name:

Name: cluster1 Online

File Share Witness:

File Share Witness (Q:\) Online

Step 27) Turn off the Firewall

We did this earlier

So on the SQL Servers - Server Management – Local server – there is an entry on the left to easily turn Windows Defender ON and OFF – for each of: Domain, Private, Public. We want all of the off, on all the SQL nodes.

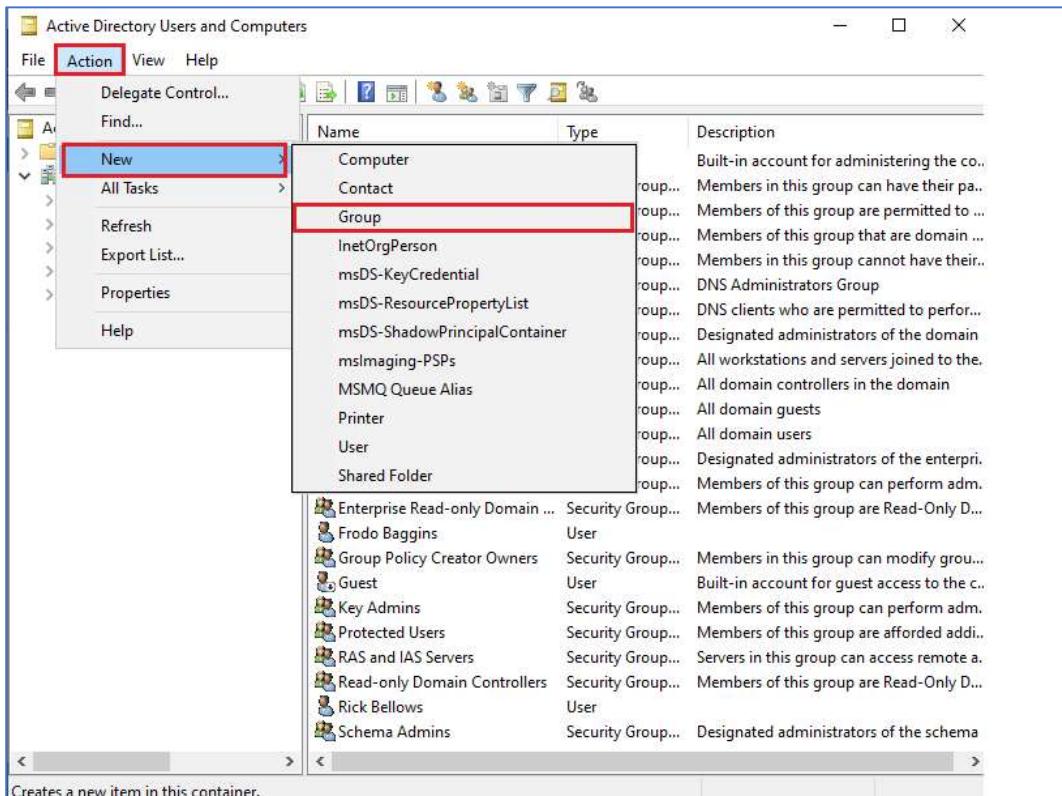
Step 28) Make the Domain Admin a Local Admin on the SQL VMs

What we need to do is make it so Frodo Baggins, while a domain administrator, will also be an Administrator on local machines logged into the domain. If we don't do this – we will get an Access Denied error when we install the SQL Failover Cluster Instance. Up to this point in the cluster, we've been logging access denied errors already because of this. To do this we will:

- Create a group called Local Admin, add Fbaggins to it.
- Use the Group Policy Editor to create a restricted policy Local Admin GPO
- Add the role of Administrator to the group.

On WinSrv22-DC1, either re-start and log back in, or issue the CTRL-ALT-DEL and chose Switch User. Log in as MIRKWOOD\Administrator.

Server Manager - Tools - Active Directory Users and Computers - Action - New – Group
(or Run > lusrmgr.msc)

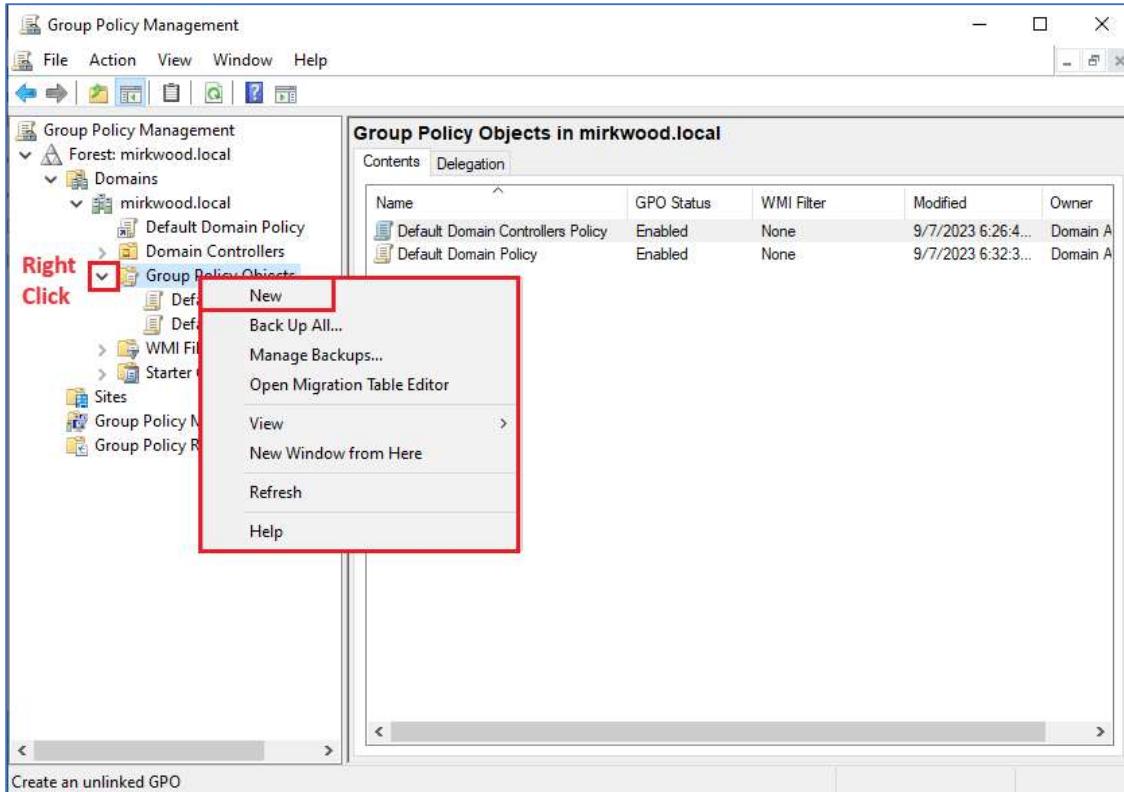


New Group Name: Local Admin

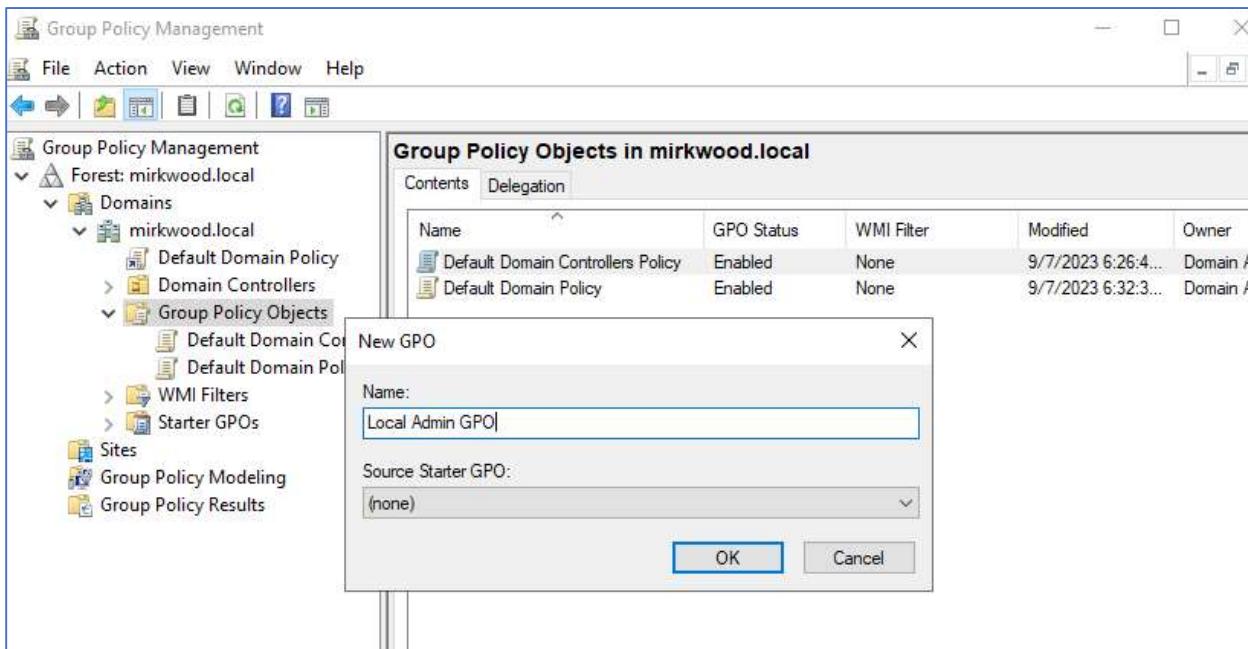
Add rbellows / fbaggins to the Local Admin group

Open Group Policy editor: Run - gpmc.msc

Right click on Group Policy Objects and select New

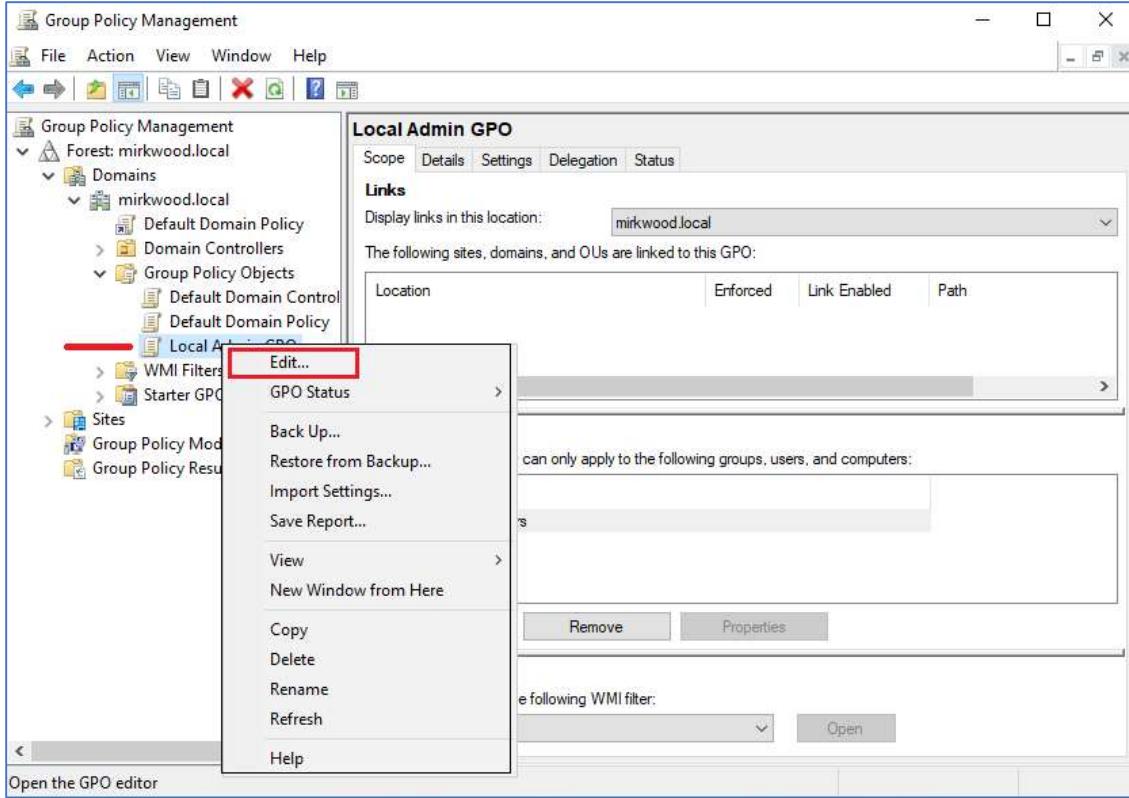


Type the name of the policy "Local Admin GPO"



Clik OK

After adding this Group Policy Object, edit it:



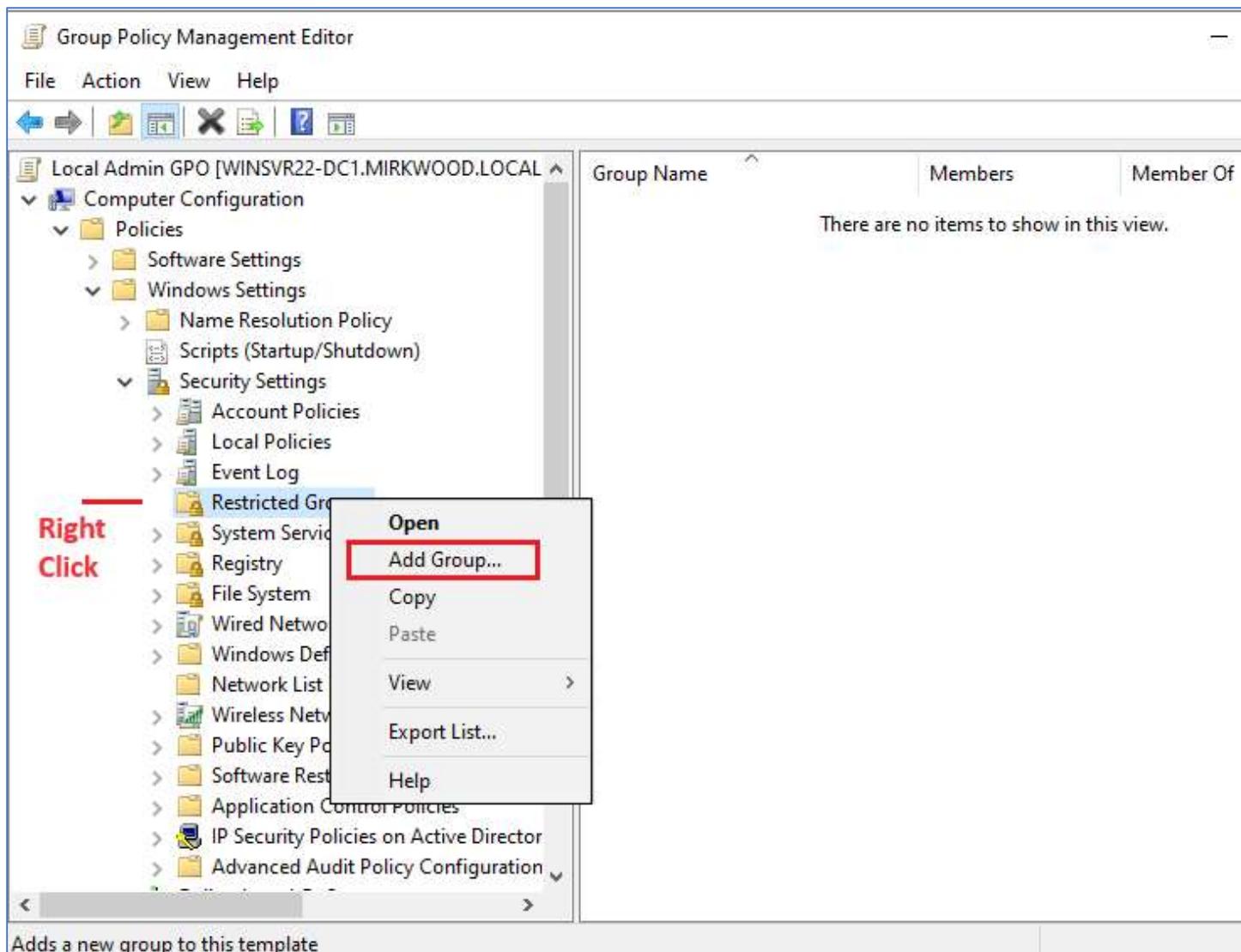
Configure the policy to add the “Local Admin” group as Administrators

Here you will add the Local Admin group to the Local Admin GPO policy and put them in the groups you wish them to use.

Right click “Local Admin GPO” Policy then select Edit.

Expand Computer configuration\Policies\Windows Settings\Security Settings\Restricted Groups

In the Left pane on Restricted Groups, Right Click and select “Add Group”



In the Add Group dialog box, select browse and type Local Admin and then click "Check Names"

Click OK twice to close the dialog box.

Click Add under "This group is a member of:"

Add the "Administrators" Group.

Add "Remote Desktop Users"

Click OK twice

NOTE# When adding groups, you can add whatever you want, the GPO will match the group on the system, if you type "Admins" it will match a local group called Admins if it exists and put "Local Admin" in that group.

Linking GPO

In Group policy management console, right click on the domain or the OU and select Link an Existing GPO

Select the Local Admin GPO

Testing GPOs

Log on to each of the SQL nodes as Fbaggins, and run

```
gpupdate /force
```

Then check the local administrators group. You should see Local Admin in that group now. Make sure all PCs you want to access should be move to an OU and properly link above GPO. The Mirkwood domain user Fbaggins should now be able to access all PCs remotely as a local administrator.

Step 29) Install SQL Server Failover Cluster Instance on WinSvr22-SQ1

First – as mentioned at the very beginning of this paper, you will need to un-install the Virtual Box Guest Additions program from WinSvr22-SQ1 before proceeding with the SQL Server Failover Cluster Instance install.

If you do not, you will get a "Network Name Invalid" about half way through.

Now, attach the optical CDROM drive to the SQL Server 2022 ISO file. Run Setup.exe from there.

Step 30) Install SQL Server as Cluster Nodes on WinSvr22-SQL2 and WinSvr22-SQL3

Never done this before. Take screenshots!

Step 31) Set up a SQL Server Availability Group

In each SQL Server Windows machine, go to SQL Server Configuration Manager

SQL Server Properties - go to tab "AlwaysOn High Availability" - click 'Enable AlwaysOn Availability Groups'

Also, while in SQL Server Configuration Manager - Network Configuration - we must enable Protocol: TCP/IP

Double click TCP/IP - go to its properties, and choose dropdown Enabled: Yes

Re-Start the SQL Service.

Step 32) Setting up fo Availability Groups

Create some databases.

(Should it be Full Recovery mode?)

Take an initial full backup of those databases.

You must have at least one full backup to set up the Availability Groups.

In SSMS (SQL Server Management Studio) -

Which we should have installed on each SQL machine by this point.

Object Explorer - Always On High Availability - Availability Groups - Right click: New Availability group Wizard.

Specify Availability Group Options:

Availability Group Name: AG1

Cluster Type: Windows Server Failover Cluster

Next

Step 33) Choose the databases to join the AG.

Specify Replicas.

Replicas:

SQL1 should be Primary

Others as Secondary

All set with Automatic Failover [x]

All with Synchronous Mode

Readable Secondary - No on all

BTW: If we were paying for all this, having Readable Secondaries would increase the number of core needing paid licenses.

Step 34) Set up the Listener

This will be the connection that applications will connect to, regardless of which replica is the primary.

Give this a name like:

Listener DNS Name: MainSqlAG1

Port: 1433

Ip Address: 10.10.50.1 Notice the 50 in the 3rd octet

Is this SUPPOSED to be on a separate network? Maybe 10.10.10.200 is more appropriate?

Verify this Listener is active:

In any one of the SQL Server machines, in SSMS - try to connect to: MainSqlAG1

This would be the location that any client should be able to reach, and should point to whatever is the Primary replica that is Up.

Step 35) Synch the databases

Remember how we had a central File Share out on Host OS? We're going to want a folder on that just for SQL Backups. It doesn't have to be off the DC.

How about we use S:\SQLBackups

So, off of that New Availability Group - we go to Select **Initial Data Synchronization**

(*) "Full Database and Log Backup"

Specify the file share path in Windows format:

S:\SQLBackups

The Validation will then happen on the new AG.

Hopefully everything is a Success.

Next - We get a summary

Click "Finish"

[Step 36\) Verify connectivity to the Listener](#)

Install SSMS on the Domain Controller

Make sure we can connect to MainSqlAG1. Try this as a final check.